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The Role Of Dysregulation in Pediatric Obsessive Compulsive Disorder: An Examination of Symptom Severity, Impairment and Treatment Outcome

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The Role of Dysregulation in Pediatric Obsessive Compulsive Disorder:

An Examination of Symptom Severity, Impairment and Treatment Outcome

By

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ABSTRACT

Pediatric OCD is frequently complicated by co-occurrences with ADHD, mood and anxiety disorders. Although each of these disorders is associated with impaired self-regulation, there has been little examination of impaired self-regulation (i.e., dysregulation) in youth with OCD. Dysregulation is characterized by affective, behavioral and cognitive problems, and can be assessed using the Child Behavior Checklist-Dysregulation Profile (CBCL-DP). Dysregulation may help account for the varied yet related findings identified for symptom severity, impairment and treatment outcome in pediatric OCD. This study examined the role of dysregulation on symptom severity, impairment and treatment outcome in a large sample of youth with OCD.

A total of 144 youth with primary OCD participated in this study. Clinicians administered the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS), Clinical Global Impression of Severity (CGI-S) and a 13-item scale of family accommodation. Children completed the Multidimensional Anxiety Scale for Children (MASC), and the Child Depression Inventory (CDI). Parents completed the CBCL, with both children and parents completing parallel versions of the Child OCD Impact Scale (COIS-C/P). Within this sample, 97 of these youth received exposure-based CBT and completed the same assessment battery along with the Clinical Global Impression of Improvement (CGI-I) after treatment.

Twenty-nine youth (20%) with OCD met categorical criteria for dysregulation. Dysregulated youth had greater obsessive-compulsive symptom severity, depressive mood, and exhibited greater rates of family accommodation and impairment than children without dysregulation. Hierarchical regressions revealed that the level of dysregulation predicted child-and-parent rated impairment, above and beyond obsessive-compulsive severity. Additionally, dysregulation predicted clinician-rated family accommodation above and beyond obsessive-compulsive severity. When examining treatment outcome to exposure-based CBT, a logistic regression indicated that baseline dysregulation did not predict treatment responder status. Although not predicting treatment response, it was found that youth who discontinued treatment (18%) had significantly higher dysregulation than youth who completed treatment ($p < .02$). For youth who completed exposure-based CBT, a significant decrease in obsessive-compulsive symptom severity and dysregulation was observed ($p < .01$).

Collectively, these findings suggest that youth with OCD and dysregulation experience more severe symptoms and have greater impairment than youth with more regulated functioning. As dysregulation was associated with treatment discontinuation, dysregulated youth with OCD may require more individualized interventions to treat dysregulated behavior prior to receiving exposure-based CBT. For youth who complete treatment, exposure-based CBT reduces obsessive-compulsive symptom severity and its benefits generalize to reductions in dysregulated behaviors as well.

INTRODUCTION

Over the past several decades, considerable advancements have been made in the conceptualization, assessment (Lewin & Piacentini, 2010), and treatment (Kircanski, Peris, & Piacentini, 2011; Mancuso, Faro, Joshi, & Geller, 2010) of pediatric obsessive-compulsive disorder (OCD). Despite this progress, many understudied factors remain that can influence clinical presentation and treatment outcomes. Among these factors, dysregulation may play an influential role in the clinical presentation and treatment outcome of youth with OCD. Dysregulation is a construct that is pertinent among youth with psychopathology (Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010). While dysregulation has been examined in clinical and non-clinical samples, there has been no study of its role in pediatric OCD. An examination of dysregulation in youth with OCD is essential as dysregulation may account for more severe psychopathology, elevated levels of impairment and attenuate treatment outcome to cognitive behavioral therapy (CBT).

The present study examines dysregulation in a large sample of youth with OCD through four primary objectives. First, this study will examine whether children with OCD who meet categorical criteria for dysregulation exhibit more severe psychopathology than children with OCD who do not meet dysregulation criteria. Second, this study will investigate the relationship between dysregulation, severity and impairment reported by clinicians, parents and children. Third, this study will examine whether baseline levels of dysregulation predict treatment outcome. Lastly, this study

will examine the change in dysregulation levels after CBT. In addition to providing the first known report of dysregulation in pediatric OCD, findings from an examination of dysregulation potential influence on treatment outcomes carries important implications for all youth presenting with dysregulation who would likely receive CBT.

Dysregulation

A key developmental process in childhood is the acquisition of adaptive self-regulation of emotions and behaviors (Cole, Martin, & Dennis, 2004). Self-adaptive regulation is integral to successful functioning across multiple situations and contexts. When successfully utilized, dynamic self-regulation facilitates numerous processes (e.g., focus attention, promote problem solving, supportive relationship). Indeed the ability to adjust internal processes (e.g., thoughts, emotions) to environmental contexts is central in early childhood mental health (Blair, 2002). Conversely, when lacking self-regulation, youth can experience detrimental effects (e.g., disrupted attention, interference with problem solving, troubled relationships) which may contribute to the later development of psychopathology.

Self-regulation is divided into affective, behavioral, and cognitive components (Fitzsimons & Bargh, 2004). When self-regulation is impaired in youth, dysregulation can be observed. Stated differently, dysregulation is a disorder of self-regulation across the multiple domains of affect, behavior and cognition. As dysregulation is the dysfunction of the components of self-regulation, rather than dysfunction of a single psychiatric domain, manifestations of dysregulated behaviors are heterogeneous in presentation. For example, affective components of dysregulation can manifest in youth

as severe anxiety or depressed moods. Behavioral components may be exhibited in youth as impulsivity, agitated behaviors, irritability, restlessness and aggressive actions. Cognitive components of dysregulation can be identified in youth as inattention. Dysregulation likely has multiple factors contributing to its development spanning genetic contributions, dysfunctional brain circuits, and environmental factors. While intriguing, the underlying development of dysregulation is beyond the scope of this current manuscript (see Cole & Deater-Deckard, 2009 or Cole et al., 2004 for a review).

Across clinically- and non-clinically referred youth, dysregulation varies in its frequency and severity, which presents diagnostic challenges for practitioners and researchers. For example, the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition-Text Revision (DSM-IV-TR) (American Psychiatric Association [APA], 2000) does not include dysregulation as a diagnostic category. This may stem from the heterogeneous presentation of dysregulation in youth. As there is a lack of formal recognition of dysregulation, youth with dysregulation are left to be described using a variety of terms like explosive, mood labile or highly-comorbid (Carlson, 2007). Indeed many of these youth were even classified as having a broad phenotype of pediatric bipolar disorder (Leibenluft, Charney, Towbin, Bhangoo, & Pine, 2003) or as experiencing severe mood dysregulation (Brotman et al., 2006). This variability in description can cause difficulties for researchers and clinicians in both consistent recognition and treatment of these youth. Without a formal approach to categorizing dysregulation, researchers rely on various methods to study and quantify dysregulation in youth. As methods (e.g., rating scales, structured interviews) differ across studies, results from one sample do not necessarily generalize to another. The inability to categorize

youth exhibiting dysregulated behaviors may result in inappropriate classification with other disorders that share related behaviors (e.g., ADHD, bipolar disorder), and in turn may lead to inappropriate treatment recommendations. For example, over the past decade there has been a noticeable increase in the diagnosis of pediatric bipolar disorder (Leibenluft, 2008; Moreno et al., 2007). As some clinicians and researchers believe that mania presents as persistent non-episodic severe irritability in youth (Biederman, 1998; Biederman et al., 2004), confusion between phenotypic symptoms of pediatric bipolar and severe irritability independent of pediatric bipolar may result in the misdiagnosis or over-diagnosis of the disorder. Consequently, children receiving this diagnostic classification may receive inappropriate treatment for their conditions (e.g., antipsychotic medication) that may have limited efficacy and/or safety risks (Correll et al., 2009).

The ambiguity in describing youth with dysregulation may be alleviated through the use of quantitative, behavioral rating scales. Specifically, the application of rating scales can provide a metric to quantify dysregulation severity, offer a dimensional approach beyond broad categorizations, and assist in generalizing findings across research samples. Moreover, rating scales can facilitate the accurate and consistent identification of dysregulation in youth. One such rating scale is the Child Behavior Checklist (CBCL) (Achenbach, 1991; Achenbach & Rescorla, 2001). The CBCL is a well-studied, empirically derived parent-rated scale that measures general child and adolescent psychopathology. The CBCL does not require clinician training, and thus is less likely to be affected by clinical experience or bias. Moreover, the CBCL has a profile, referred to as the CBCL-Dysregulation Profile (CBCL-DP), which is defined by

deviance on the CBCL syndrome scales of Anxious/Depressed (affective), Aggressive Behavior (behavioral) and Inattention (cognitive).

Using the CBCL-DP as an index, approximately 1.0-3.5% of youth in epidemiological studies (Althoff et al., 2010; Hudziak, Althoff, Derks, Faraone, & Boomsma, 2005), 6-7% of child psychiatric clinical samples (Holtmann, Becker, Banaschewski, Rothenberger, & Roessner, 2011; Holtmann, Goth, Wockel, Poustka, & Bolte, 2008), and 10-44% of children with ADHD, (Spencer et al., 2011; Volk & Todd, 2007) meet criteria for dysregulation. Although there is limited information on the development of dysregulation in these samples, available research suggests the involvement of additive genetic and environmental factors (Althoff, Rettew, Faraone, Boomsma, & Hudziak, 2006; Boomsma et al., 2006; Hudziak et al., 2005). The construct of dysregulation appears to be stable across time and age suggesting that children who meet criteria continue to exhibit these qualities throughout adulthood (Boomsma et al., 2006; Meyer et al., 2009). Thus, dysregulation does not appear to be a byproduct of a developmental stage (e.g., adolescence), but rather appears to be a relatively stable trait of impaired self-regulation. Indeed, higher levels of dysregulation in youth are associated with the later development of mental health problems such as substance abuse, personality disorders and suicidality (Meyer et al., 2009). In youth with ADHD, the presence of dysregulation predicts the emergence of personality disorders in late adolescence and early adulthood (Volk & Todd, 2007). Although some researchers purported that the CBCL-DP is indicative of a specific diagnosis (e.g., pediatric bipolar disorder; Biederman, Wozniak, Kiely, & Ablon, 1995), the CBCL-DP appears to be an indicator of disordered self-regulation and impaired functioning (Ayer et al., 2009; Meyer

et al., 2009). In addition to severe psychopathology, the CBCL-DP has consistently been associated with considerable psychosocial impairment on global assessments of functioning in both cross-sectional and longitudinal studies (Biederman et al., 2009; Meyer et al., 2009). Given its association with the later development of severe psychopathology and impairment, an examination of dysregulation may prove useful in clinical populations of youth. Specifically for youth with OCD, an examination of dysregulation may account for the variable findings observed across studies for symptom severity, functional impairment and attenuated treatment outcome.

Pediatric Obsessive Compulsive Disorder

Obsessive-compulsive disorder (OCD) is a heterogeneous condition characterized by the presence of obsessions and/or compulsions that are time-consuming and cause distress. Obsessions are recurrent thoughts, impulses, or images that are experienced as inappropriate, intrusive, and distressing. In response to obsessions, individuals with OCD perform repetitive behaviors, rituals or mental acts referred to as compulsions. Compulsions serve to neutralize fear associated with the obsession, thereby providing temporary relief. This impairing condition affects 1-2% of children (Douglass, Moffitt, Dar, & McGee, 1995; Flament et al., 1988) and often results in considerable impairment (Piacentini, Bergman, Keller, & McCracken, 2003; Piacentini, Peris, Bergman, Chang, & Jaffer, 2007) and a diminished quality of life (Lack et al., 2009). A definitive etiological account of OCD is not yet known; however, multiple determinants including neurobiology (Maia, Cooney, & Peterson, 2008), genetics (Pauls, 2010), immunobiology (Murphy, Kurlan, & Leckman, 2010), dysfunctional cognitions (Rachman, 1997) and

behavioral conditioning (Mowrer, 1960) are implicated in its development and maintenance. For children, symptoms usually develop in early school age years, with a marked increase in symptom severity in adolescence (Bloch et al., 2009; Geller et al., 2001). Symptoms developing in childhood are more frequently observed in boys than girls (Hanna, 1995) with the gender differential balancing into adulthood (Farrell, Barrett, & Piacentini, 2006; Ruscio, Stein, Chiu, & Kessler, 2010).

Obsessive-compulsive disorder frequently co-occurs with other mental health conditions, with up to 90% of cases having at least one comorbid disorder (Ruscio et al., 2010; Storch et al., 2008a). Children and adolescents with OCD frequently present with co-occurring non-OCD anxiety disorders such as separation anxiety disorder (16-56%), generalized anxiety disorder (39-48%), social phobia (14-38%); as well as externalizing disorders such as attention-deficit hyperactivity disorder (ADHD; 10-51%) and oppositional defiant disorder (ODD; 15-51%) (Farrell et al., 2006; Geller et al., 2001; Masi et al., 2010). Similarly, youth with OCD often present with mood disorders like major depressive disorder (27-62%) (Geller et al., 2001; Masi et al., 2010) and bipolar disorder (15-34%) (Joshi et al., 2010; Masi et al., 2010).

Impaired Self-Regulation in OCD

Traditionally conceptualized as an anxiety disorder, OCD is also inherently a disorder of self-regulation. Its hallmark symptoms (obsessions and compulsions) are defined by an inability to inhibit repetitive thoughts and behaviors. Moreover, many of the comorbid conditions associated with OCD are also disorders of self-regulation (e.g., ADHD, ODD, non-OCD anxiety disorders, depression). In line with this, a recent neurobiological study found that successful implementation of cognitive emotion

regulation strategies are associated with increased activation in the prefrontal brain regions (Levesque et al., 2004). In contrast, patients with OCD frequently exhibit deficits in the same brain regions, including the dorso-lateral prefrontal cortex (Menzies et al., 2008; van den Heuvel et al., 2005). Despite the indicators for a relationship between OCD and dysregulation, as well as the recognition of its role in other childhood conditions (e.g., depression; Kovacs, Joormann, & Gotlib, 2008), dysregulation in pediatric OCD remains uninvestigated.

Severity and Impairment in Pediatric OCD

Pediatric OCD is a heterogeneous condition with diverse symptomatic presentation. Consequently, symptom severity, interference and distress from obsessive-compulsive symptoms can vary by individual and functional domains. For example, contamination fears may lead some children to excessive washing and showering, and subsequently interfere in family functioning. For others, these same fears may differentially prompt social withdrawal and curbed participation in various normative activities. Despite varied presentation, children with OCD consistently endorse distress and impairment in academic, familial, and socialization domains (Piacentini et al., 2007; Valderhaug & Ivarsson, 2005). Additionally, comorbidity has been found to play a role in symptom severity and impairment. For example, children with OCD and non-OCD anxiety (e.g., social phobia) were found to have greater OCD symptom severity when compared to children with OCD alone (Storch et al., 2008a). For impairment, greater levels of anxiety, depression, and family accommodation were associated with elevated levels of impairment in pediatric OCD (Storch et al., 2010a). Counterbalancing these findings for internalizing disorders, children with OCD and a comorbid externalizing

disorder (e.g., ADHD) also reported greater OCD symptom severity, anxiety and impairment than children with OCD alone (Langley, Lewin, Bergman, Lee, & Piacentini, 2010; Storch, Lewin, Geffken, Morgan, & Murphy, 2010c; Sukhodolsky et al., 2005).

Given that dysregulation has been associated with the presence of severe psychopathology and impairment in non-clinical youth, youth with OCD and dysegulation may present with greater severity and impairment than youth with more regulated functioning. Dysregulation shares aspects with constructs associated with elevated symptom severity (e.g., anxiety disorders), as well as impairment (e.g., ADHD, depression, externalizing disorders). Specifically for impairment, the construct of dysregulation may help account for disparate comorbid conditions implicated in impairment in pediatric OCD. Thus, the examination of dysregulation may serve as a potentially unifying dimension for the diverse constructs associated with symptom severity and impairment in pediatric OCD.

Treatment of Pediatric OCD

For children with OCD seeking treatment, cognitive-behavioral therapy (CBT) is a first line treatment that demonstrates considerable efficacy and produces moderate to large effect sizes (Abramowitz, Whiteside, & Deacon, 2005; POTS, 2004; Storch et al., 2007). Components of CBT can include psycho-education, cognitive restructuring, parental involvement, with an emphasis on exposure with response-prevention. The exposure component requires children to repeatedly encounter situational and/or internal triggers to their anxiety that usually precipitate their compulsive behaviors. While confronting these exposures, patients must prevent from engaging in compulsions until habituation to the anxious state is achieved. Over repeated exposures, distress and its

associated desire to ritualize diminish. Recent conceptualizations of this behavioral model have suggested that emotional processing may play a role in fear reduction (Casado, Cobos, Godoy, Machado-Pinheiro, & Vila, 2011; Foa & Kozak, 1986). Emotion processing involves incorporation of new information into an existing structure that allows for either increased or decreased emotional responding (Foa & Kozak, 1986). The processing of pathological fear requires the activation of the fear structure and then the incorporation of corrective information.

During emotional processing, dysregulation may affect physiological activation and habituation to stimuli—two components that are related to treatment outcomes (Foa & Kozak, 1986). For example, dysregulation in patients with OCD may result in impaired reactivity (or over-reactivity) in physiological responses to stimuli. Similarly, patients with dysregulation have difficulty regulating thoughts and emotions. Thus, youth with dysregulation may experience difficulty habituating to anxiety-provoking situations and/or incorporating corrective information. Habituation deficits may result in patients requiring longer therapeutic duration to achieve desired symptom reduction, or if present in a time-sensitive trial, may limit therapeutic response. Indeed, certain comorbidities (e.g., depression, disruptive behavior disorders) have been suggested to attenuate response to psychotherapy (Keeley, Storch, Merlo, & Geffken, 2008; Storch et al., 2008b). Similar to findings for impairment, these comorbidity findings are inconsistent across treatment studies (Piacentini, Bergman, Jacobs, McCracken, & Kretchman, 2002); thus, these variable findings may indicate the presence of latent constructs (e.g., dysregulation) that influence treatment processes and therapeutic outcomes.

Beyond treatment outcomes, dysregulation may also play a role in two predominant issues confronting cognitive-behavioral therapies—patient attrition rates and homework compliance. Dysregulation levels may influence attrition rates as those patients with higher dysregulation may be more difficult to engage in treatment due to irritability or aggressive behaviors. These dysregulated patients may be more prone to discontinue treatment as opposed to their more regulated patients because of fluctuating moods and/or externalizing behaviors. Similarly, dysregulated youth may not engage in the therapeutic process, thereby limiting the overall benefit evidence-based treatment. Presently, there exists evidence of related constructs to dysregulation influencing existing attrition rates in treatment studies. For example, treatment studies of pediatric OCD (Franklin et al., 2011; POTS, 2004) have found attrition (between 13-16%) to be associated with high levels of OCD symptom severity, anxiety and depression (Aderka et al., 2011). Furthermore, research indicates that the presence of comorbid symptoms (e.g., oppositional behavior, attention difficulties, depression) commonly observed in OCD may also interfere with treatment by (Storch et al., 2008a). Aside from treatment attrition, dysregulation may also influence treatment outcomes though youth's homework compliance. Dysregulated youth may exhibit oppositional or non-complaint behaviors that make completion of assignments difficult. Furthermore, the inability to self-regulate anxious feelings may prohibit the completion of out-of-session practice exposures. The ability to self-regulate is an important aspect in therapeutic processes with specific implications for attrition and homework compliance.

Present Study

Dysregulation is a common problem affecting youth that is associated with deleterious outcomes. For youth with OCD, the presence of dysregulation may influence clinical presentation, impairment and treatment outcome. This study examines dysregulation in a large sample of youth with OCD with four primary objectives. First, this study examines whether children with OCD who meet categorical criteria for dysregulation, exhibit more severe psychopathology than children with OCD who do not meet dysregulation criteria. It was hypothesized that dysregulated youth with OCD would exhibit more severe psychopathology than youth with OCD who had more regulated functioning. Second, this study examines whether a patient's level of dysregulation predicts impairment rated by clinicians, parents and children above and beyond obsessive-compulsive severity. It was hypothesized that dysregulation would predict impairment rated by clinicians, parents and children above and beyond obsessive-compulsive disorder. Third, this study explores whether dysregulation scores at baseline predict CBT outcome. It was hypothesized that baseline dysregulation levels would predict obsessive-compulsive severity at post-treatment and treatment outcome to CBT. Finally, as dysregulation has been suggested by some but not all to be a heritable and stable construct, this study investigates possible changes in dysregulation after receiving CBT. It was hypothesized that dysregulation would significantly decrease after CBT. Until now, no treatment studies have examined the influence of CBT on dysregulation in youth. If CBT does influence dysregulation, it may indicate a direction for future research and could be a considerable contribution to the field of child mental health.

METHOD

Participants

Participants were 144 youth (82 boys; 56%) ranging between 6-17 years of age (*M* = 12.61 years, *SD* = 2.81 years) who met diagnostic criteria for OCD. Participants were collectively recruited from one of two university-based specialty clinics for OCD in the state of Florida. Youth involved in this study agreed to participate in one of five studies (see Merlo, Lehmkuhl, Geffken, & Storch, 2009; Merlo et al., 2010; Storch et al., 2011; Storch et al., 2008c; Storch et al., 2010d). Treatment outcome data after CBT was available for three of these studies (Merlo et al., 2009; Merlo et al., 2010; Storch et al., 2011). Written consent was obtained from parents of children interested to participate, with assent being obtained from children as well. Inclusion and exclusion criteria were comparable across all studies, requiring participants to: (1) meet diagnostic criteria for OCD; (2) be medication free and/or on a stable dose of psychiatric medication; and (3) not have another psychiatric condition necessitating immediate treatment (for treatment studies). Children were not invited to participate if they did not meet the above criteria. For the treatment studies, children received structured CBT. Youth received no financial compensation for their participation. Collectively, this sample provided baseline data on 144 participants with 97 of these participants receiving CBT (see Table 1). Further demographic information concerning socioeconomic class, education and other demographic characteristics were unavailable for these participants.

Measures

Anxiety Disorders Interview Schedule for DSM-IV– Child and Parent Version (ADIS-C/P): The ADIS-C/P (Silverman & Albano, 1996) is a structured clinical interview that assesses current episodes of Axis I disorders and provides differential diagnosis based on DSM-IV-TR criteria (APA, 2000). In youth between 7 and 17, the ADIS-C/P has consistently demonstrated strong psychometric properties, including test-retest reliability, inter-rater reliability, and concurrent validity (Silverman, Saavedra, & Pina, 2001; Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). Diagnostic categories of interest were OCD, ADHD, disruptive behavior disorders (e.g., oppositional defiant disorder, conduct disorder, intermittent explosive disorder), depressive disorders (e.g., major depression, dysthymia, depression-not otherwise specified), non-OCD anxiety disorders (e.g., generalized anxiety, social phobia, separation anxiety, specific phobia, panic disorder, agoraphobia), substance disorders (e.g., substance use, substance dependence), body disturbance disorders (e.g., body dysmorphic disorder, anorexia), chronic tic disorder (e.g., Tourette Syndrome, chronic tic disorder), pervasive developmental disorder and bipolar disorder. This measure was completed as part of the screening procedure.

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS): The CY-BOCS is a 10-item semi-structured clinician-administered measure of current obsession and compulsion severity (Scahill, Riddle, McSwiggin-Hardin, & Ort, 1997). The CY-BOCS has demonstrated strong psychometric properties (e.g. inter-rater reliability, internal consistency, test-retest reliability, discriminant validity, convergent validity) in

youth between 4 and 18 years of age, and is considered the gold-standard measure for OCD severity in youth (Scahill et al., 1997; Storch et al., 2004). Total scores on this measure can range from 0 to 40. This measure was completed at baseline and post-treatment assessment.

Clinical Global Impression – Severity (CGI-S): The CGI-S is a 7-point clinician rating of psychopathology severity, which ranges from 0 (no illness) to 6 (extremely severe) (Guy, 1970). The CGI-S has been widely used in treatment studies and has demonstrated sound psychometric properties including convergent validity with the CY-BOCS and treatment sensitivity (Storch et al., 2007; Storch, Lewin, De Nadai, & Murphy, 2010b). The CGI-S was completed at baseline and post-treatment assessments.

Clinical Global Impression of Improvement (CGI-I): The CGI-I is a clinician-rated measure of response to treatment on a 7-point Likert scale ranging from *very much worse* (0) to *very much improved* (6) (Guy, 1970). A rating of *very much improved* (6) and *much improved* (5) are typically considered positive responses to treatment. Ratings of significant improvement on the CGI-I have been found to correspond with 25% reductions on the CY-BOCS (Storch et al., 2010b). The CGI-I was completed at the post-treatment assessment.

13-Item Scale of Family Accommodation (FAS): The FAS is a 13-item clinician-rated questionnaire scored on a 5-point Likert-type scale that assesses the degree to which family members accommodate a child's symptoms over a month (Calvocoressi et al., 1995). This measure has been found to be a good indicator of the level of distress/impairment that family members and patients experience, as a result of their

child's obsessive-compulsive symptoms. The FAS was completed at baseline and post-treatment assessments.

Child Obsessive Compulsive Impact Scale– Parent/Child (COIS-P/C): The COIS-P is a 56-item parent-rated questionnaire that examines OCD-related impairment in specific areas of child psychosocial functioning (Piacentini et al., 2003). Each item is rated on a 4 point Likert-type scale: *not at all* (0), *just a little* (1), *pretty much* (2), and *very much* (3). The complimentary measure for children (COIS-C) uses the same items and rating scales, but is completed by the child. The COIS-C/P has good reliability and validity in children between 7 and 17 years of age. The parent-and-child rated COIS were administered at baseline and post-treatment assessments. Only one participant in the sample (age 6) was not within the validated age range for this measure.

Multidimensional Anxiety Scale for Children (MASC): The MASC is a psychometric 39-item self-report questionnaire that assesses symptoms of general, social, and separation anxiety in children and adolescents (March, Parker, Sullivan, Stallings, & Conners, 1997). Items are rated on a 4-point Likert-scale that ranges from *never true* (0) to *often very true about me* (3). A total score is computed by summing all items with higher scores corresponding to greater symptom severity. The MASC assesses child anxiety and has good reliability and validity in children between 8 and 17 years of age (March et al., 1997). The MASC was completed at both baseline and post-treatment assessments. Only six participants in the sample (ages 6 to 7) were not within the validated age range for this measure.

Children's Depression Inventory (CDI): The CDI is a 10-item, brief child-reported measure that assesses the presence/severity of depressive symptoms (Kovacs,

1992). It is rated on a 3-point scale with higher scores indicating greater severity. The extensive use of the CDI in clinical and experimental research has provided ample data to support its reliability and validity for children between 7 and 17 years of age (Kovacs, 1992). The CDI was completed at baseline and endpoint. Only one participant in the sample (age 6) was not within the validated age range for this measure.

Child Behavior Checklist (CBCL): The CBCL is a widely used parent-rated questionnaire consisting of 118-items assessing the frequency of behavioral and emotional problems exhibited by children (Achenbach, 1991). Each item is rated on a 3-point Likert scale: *not at all* (0), *sometimes* (1), *all the time* (2). The CBCL produces eight clinical syndrome scales: withdrawn, somatic complaints, anxious-depressed, social problems, thought problems, attention problems, delinquent behavior, and aggressive behavior. Additionally, the CBCL produces broad-band Internalizing and Externalizing scales that largely correspond to mood and anxiety disorders, and disruptive behavior disorders, respectively. The CBCL has demonstrated good reliability, internal consistency and discriminant validity in youth between 4 and 18 years of age (Achenbach, 1991). In the present sample, the internal consistency of the CBCL syndrome scales ranged from 0.59-0.90 (see Table 2). The Aggressive Behavior Syndrome Scale (20 items), Attention Problem Syndrome Scale (11 items) and Anxiety-Depression Syndrome Scales (14 items) are used in the calculation of the CBCL-Dysregulation Profile. The internal consistency of the CBCL-Dysregulation profile was .92. All participants completed the same version of the CBCL (1991 version) at baseline and post-treatment. Although completed on the 1991 version, the high correlations between the raw scores on the problems scales of the

1991 and 2001 versions (r = .87-.99) suggest that findings would likely generalize across versions (Achenbach & Rescorla, 2001).

Procedures

All independent evaluators underwent extensive training in the administration on clinician-rated measures (e.g., CY-BOCS, CGI-S and FAS). Training consisted of attending an instructional training meeting, observing multiple administrations of measures, and administering the measures multiple times with in vivo observation and supervision. All participants completed an initial assessment that included a structured interview to assess current diagnoses (ADIS-C/P). Subsequently, clinicians assessed youth's obsessive-compulsive symptom severity (CY-BOCS), level of family accommodation (FAS), and overall clinical severity (CGI-S). Parents completed forms evaluating their child's behavior (CBCL), level of OCD-related impairment (COIS-P), and general demographics (e.g., children's age, current medication, race, gender, etc). Children completed forms that assessed their level of anxiety (MASC), depression (CDI) and OCD-related impairment (COIS-C). For participants receiving treatment, the above measures (excluding the diagnostic interview and impairment questionnaires) were re-administered at a post-treatment assessment. In addition to these measures, a clinician completed a measure to evaluate global improvement of the participant (CGI-I). It is important to note that all evaluating clinicians were naive to the participant's treatment condition.

ANALYTIC PLAN

There have been various cut-off t-score on the CBCL used to indicate dysregulation. Initial studies relied on syndrome scale t-scores of 70 or greater on all three syndrome scales that correspond with clinical significance (Biederman et al., 1995), while others studies have relied upon t-scores of 60 or greater indicating borderline impairment (Meyer et al., 2009). Meanwhile, other studies have used the three syndrome scales to generate a composite score with dysregulation cut-offs varying between 180 and 210 (Biederman et al., 2009; Spencer et al., 2011). Given that t-scores of 60 or greater are predictive of clinically significant psychopathology (Chen, Faraone, Biederman, & Tsuang, 1994), this study utilized a t-score $\geq$ 65 on all three syndrome scales for the categorical comparison of dysregulation. T-score values $\geq$ 65 are indicative of clinically borderline symptoms indicate values 1.5 standard deviations above the mean, and falls in the range of scores previously used to indicate dysregulation. All power calculations were computed in G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007). As no precedent was available for effect sizes, a medium-sized effect was assumed (based on criteria established by Cohen, 1988 and Lipsey & Wilson, 2001).

In order to examine whether youth with OCD and dysregulation have more severe psychopathology than youth with OCD without dysregulation, an independent samples t-test was conducted on continuous clinical characteristics for the sample of 144 youth. As 20% of the sample was identified as meeting dysregulated criteria, a priori power analyses

identified a power of .85 to detect medium effects between groups. Categorical characteristics were examined using Fisher's exact tests statistic. As comorbid psychiatric conditions are often common in youth with OCD, Cohen's κ statistic was used to examine classification agreement between youth who met categorical criteria for dysregulation and youth who met diagnostic criteria for both an internalizing disorder and externalizing disorder on the ADIS. This comparison would discern whether categorical dysregulation was being accounted for by comorbid psychiatric conditions, or whether dysregulation itself was distinct. Internalizing disorders were considered to be generalized anxiety disorder, social phobia, separation anxiety, social phobia, panic disorder, agoraphobia, major depression, dysthymia, and depression not otherwise specified. Externalizing disorders were considered to be attention deficit hyperactivity disorder (ADHD), oppositional defiance disorder (ODD), conduct disorder, and intermittent explosive disorder.

In order to examine the relationship between dysregulation and impairment, a hierarchical linear regression was completed to assess the unique contribution of dysregulation in predicting impairment scores, after accounting for the variance explained by obsessive-compulsive symptom severity. An a priori power analyses demonstrated that each hierarchical regression would have a power of .99 to detect a medium-sized effect. For these analyses, dysregulation was examined continuously rather than categorically using a revised CBCL-DP total score. For statistical analyses of these syndrome scales, the CBCL manual recommends the use of raw scale scores rather than t-scores to take into account the full range of variability (Achenbach, 1991). As each CBCL syndrome scale used a different number of items to contribute to the revised

CBCL-DP total score, syndrome scales were divided by the number of items used in its calculation. For example, the total syndrome score for attention problems consists of 11 items, so that syndrome scale total score was divided by 11.These revised syndrome scores were summed to comprise a revised total score of the CBCL-DP, with values that ranged from 0 (no dysregulation) to 3 (extreme dysregulation). The revised CBCL-DP total score were used in three separate hierarchical linear regressions to examine whether dysregulation predicted clinician-rated illness severity (CGI-S), child-rated impairment (COIS-C) and parent-rated (COIS-P) impairment after accounting for variance explained by obsessive-compulsive severity (CY-BOCS). An exploratory hierarchical linear regression was conducted to examine whether dysregulation predicted family accommodation above and beyond obsessive-compulsive symptom severity. The variance inflation factor (VIF) was reported for all regression models to ensure the independent variables were not multi-collinear.

The intent-to-treat principle was applied to participants who received CBT, whereby all treatment receiving participants were included in analyses. To examine the role of dysregulation in treatment, a bivariate regression was completed to determine whether the dysregulation total score (revised CBCL-DP total score) predicted the obsessive-compulsive severity (CY-BOCS total score) after treatment. A prior power analyses indicate a power of .92 to detect a medium-sized effect. Additionally, a logistic regression was conducted to examine whether baseline CBCL-DP total scores predicted the clinician's rating treatment responder status using the CGI-I. A prior power analysis identified a power of .94 to detect a medium-sized effect. Additional exploratory logistic

regressions were completed to examine previously noted predictors of response (e.g., anxiety, depression, obsessive-compulsive symptom severity).

In order to examine changes in dysregulation levels after CBT, a paired sample t-test was used to compare participants' baseline and post-treatment revised CBCL-DP total score. A priori power analysis indicated a power of .99 to detect a medium-sized effect with a paired sample t-test. Following up on the significance of this test, a residualized change regression was used to determine if this change in dysregulation from baseline to endpoint was related to change in obsessive-compulsive symptom severity (CY-BOCS total score). Similar a priori power calculations indicated a power of .86 to detect a medium-sized effect.

RESULTS

Sample Characteristics

Demographic and clinical characteristics of the sample are provided in Table 1. Briefly, the sample was a relatively balanced mix of boys (57%) and girls (43%) who ranged in age from 6-17 years (M = 12.62 years, SD = 2.81 years). Participants were predominantly Caucasian (81%) and all met diagnostic criteria for OCD (see Table 1). Sixty-six percent of participants were taking one or more serotonin reuptake inhibitor (SRI) medications. Comorbidity was common among participants, with the most frequent conditions consisting of non-OCD anxiety disorders (e.g., generalized anxiety disorder, social phobia, separation anxiety, social phobia, panic disorder, agoraphobia; 40%), ADHD (28%) and depressive disorders (e.g., major depression, dysthymia, depression not otherwise specified; 22%). Forty-seven percent of participants reported at least one co-occurring internalizing or externalizing disorder, with 22% of the sample presenting with both internalizing and externalizing disorders. Participants' exhibited moderate obsessive-compulsive severity on the CY-BOCS (M = 26.24, SD = 4.65). There was a moderate relationship observed between obsessive-compulsive symptom severity and dysregulation at baseline, r = .43 p < .01. No differences for gender were identified at baseline for obsessive-compulsive symptom severity, family accommodation, depressive symptoms, child-rated and parent-rated impairment. Gender differences were apparent for self-reported anxiety, with girls (M = 42.48 SD = 17.06) reporting themselves to be

more anxious than boys (M = 34.24, SD = 15.63), $t(137) = 2.96$, $p < .01$. Table 2 describes the relationship among the variables assessed in the sample using Pearson's correlations.

Table 1. *Clinical and Demographic Characteristics of the Sample (N=144)*

	N (%)
Male	82 (57%)
Female	62 (43%)
Race	
White/Caucasian	118 (81%)
Black/African American	6 (4%)
Asian/Asian American	5 (4%)
Hispanic/Latino	8 (6%)
Biracial/ Other	7 (5%)
Comorbid Psychiatric Conditions	
ADHD	40 (28%)
Disruptive Behavior Disorder	25 (17%)
Depressive Disorder	32 (22%)
Non-OCD Anxiety Disorder	58 (40%)
Body Dysmorphia or Eating Disorder	2 (1%)
Tic Disorder	10 (7%)
Pervasive Developmental Disorder	2 (1%)
Bipolar Disorder	1 (< 1%)
Comorbidity Groupings	
OCD + Internalizing Disorder	26 (18%)
OCD + Externalizing Disorder	42 (29%)
OCD + Internalizing + Externalizing Disorder	31 (22%)
Medication Status	
On a SSRI and/or SRI	95 (66%)

	N	**Mean (SD)**
Age	144	12.62 (2.81)
CY-BOCS Total Score	144	26.24 (4.65)
MASC Total Score	136	7.45 (3.96)
CDI Total Score	139	37.74 (16.70)
COIS-C Total Score	132	40.96 (29.28)
COIS-P Total Score	122	48.34 (30.54)

Table 2. *Pearson Correlations on Measures of Psychological Functioning*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	CY-BOCS Total Score	.82																
2.	FAS Total Score	.47**	.90															
3.	CDI Total Score	.23**	.25**	.73														
4.	MASC Total Score	.28**	.01	.13	.90													
5.	COIS-C Total Score	.47**	.40**	.27**	.38**	.96												
6.	COIS-P Total Score	.52**	.55**	.30**	.20*	.67**	.96											
7.	CBCL Withdrawn	.43**	.30**	.29**	.24**	.39**	.63**	.77										
8.	CBCL Somatic Complaints	.21*	.26**	.08	.28**	.37**	.33**	.36**	.72									
9.	CBCL Anxious Depressed	.36**	.30**	.27**	.41**	.40**	.50**	.66**	.38**	.80								
10.	CBCL Social Problems	.28**	.25**	.21*	.19*	.33**	.41**	.46**	.30**	.37**	.69							
11.	CBCL Thought Problems	.37**	.27**	.00	.17*	.41**	.49**	.48**	.38**	.46**	.40**	.59						
12.	CBCL Attention Problems	.41**	.31**	.19*	.20*	.38**	.58**	.53**	.29**	.49****	.66**	.45**	.82					
13.	CBCL Delinquent Behavior	.25**	.46**	.26**	.18*	.33**	.38**	.37**	.25**	.41**	.40**	.30**	.46**	.67				
14.	CBCL Aggressive Behavior	.28**	.47**	.26**	.04	.27**	.45**	.38**	.20*	.47****	.48**	.30**	.50****	.69**	.90			
15.	CBCL Internalizing Scale	.26**	.41**	.30**	.30**	.39**	.53**	.67**	.55**	.79**	.46**	.48**	.51**	.48**	.57**	.87		
16.	CBCL Externalizing Scale	.40**	.43**	.26**	.18*	.36**	.49**	.52**	.32**	.58**	.47**	.35**	.54**	.76**	.86**	.45**	.91	
17.	CBCL-Dysreg Profile	.43**	.44**	.30**	.26**	.44**	.62**	.64**	.36**	.79**	.63**	.50**	.83**	.64**	.81**	.76**	.80**	.92

*$p < .05$; **$p < .01$ Note: Cronbach's Alpha is present for each measure along the diagonal.

CY-BOCS = Children's Yale-Brown Obsessive Compulsive Scale; FAS = 13 item scale of Family Accommodation; CDI = Child Depression Inventory; MASC = Multidimensional Anxiety Scale for Children; COIS-C = Child Obsessive-Compulsive Impact Scale- Child report; COIS-P = Child Obsessive-Compulsive Impact Scale- Parent report; CBCL = Child Behavior Checklist

Categorical Dysregulation and Clinical Severity

Twenty-nine youth (20%) with OCD met categorical criteria for dysregulation (see Table 3). It was hypothesized that dysregulated youth who have more severe psychopathology than youth without dysregulation. As hypothesized, dysregulated youth had greater obsessive-compulsive symptom severity ($p < .01$), and greater overall clinical severity on the CGI-S ($p < .01$) compared to youth with more regulated functioning. Additionally, both children ($p < .01$) and parents ($p < .01$) reported that dysregulated youth experienced greater levels of impairment (see Table 2). Compared to youth with more regulated functioning, dysregulated youth had higher scores on several of the CBCL syndrome scales including the Withdrawn scale ($p < .01$), Social Problem scale ($p < .01$), Thought Problem scale ($p < .02$) and Delinquent Behaviors scale ($p < .01$). Level of family accommodation was greater in dysregulated youth compared to families with children who had more regulated functioning ($p < .01$, see Table 2). Finally, youth with dysregulation exhibited greater levels of self-reported depressive symptoms ($p < .01$) but did not have higher levels of self-reported anxiety symptoms ($p > .15$). For those youth diagnosed with an internalizing and externalizing disorder (N = 31), 12 youth (39%) met categorical criteria for dysregulation. For youth who did not meet criteria for both an internalizing and externalizing disorder on the ADIS (N = 113), 17 youth (15%) met categorical criteria for dysregulation. The κ coefficient was .24 ($p < .01$) suggesting poor agreement between categorization as dysregulation and the presence of an internalizing and externalizing disorder (Fleiss, 1981). The minimal agreement suggests that dysregulation cannot be fully accounted for by these broad diagnostic categories.

Table 3. *Comparison of Dysregulated and non-Dysregulated Youth*

	Children without Dysregulation (*n* = 115)		**Children with Dysregulation (*n* = 29)**		χ^2	*p*
Male	69 (60%)		13 (45%)		2.18	.14
Comorbid Psychiatric Conditions						
ADHD	25 (22%)		15 (52%)		15.08	<.01
Disruptive Behavior Disorder	14 (12%)		11 (40%)		10.71	<.01
Depressive Disorder	19 (17%)		13 (45%)		10.74	<.01
Non-OCD Anxiety Disorder	45 (39%)		13 (45%)		.31	.67
Body Dysmorphia or Eating Disorder	2 (2%)		0 (0%)		Fisher's exact test	1.0
Tic Disorder	6 (5%)		4 (16%)		2.64	.10
Pervasive Developmental Disorder	2 (2%)		0 (%)		Fisher's exact test	1.0
Bipolar Disorder	1 (1%)		0 (0%)		Fisher's exact test	.60
Collective Comorbid Conditions						
OCD + Internalizing Disorder	35 (30%)		7 (24%)		.44	.51
OCD + Externalizing Disorder	17 (15%)		9 (31%)		4.13	.04
OCD + Internalizing +Externalizing Disorder	19 (17%)		12 (41%)		8.47	<.01
Medication Status						
On a SSRI and/or SRI	75 (65%)		20 (69%)		.15	.70
	N	**Mean (SD)**	**N**	**Mean (SD)**	***t***	***p***
Age	115	12.44 (2.84)	29	13.31 (2.58)	-1.49	.14
OC-Severity						
CY-BOCS Total Score	115	25.63 (4.42)	29	28.69 (4.79)	-3.28	<.01
CGI-Severity	112	3.85 (0.90)	28	4.43 (0.88)	3.06	<.01
Comorbidity Severity						
MASC Total Score	112	36.72 (15.54)	25	41.94 (20.64)	-1.46	.15
CDI Total Score	110	6.87 (3.85)	26	9.91 (3.47)	-3.69	<.01
Family Accommodation Total Score	111	24.04 (10.48)	29	32.62 (13.62)	-3.68	<.01
Impairment						
COIS-C Total Score	109	36.97 (27.60)	23	59.88 (30.21)	-3.56	<.01
COIS-P Total Score	98	40.76 (23.72)	24	79.28 (35.92)	-6.38	<.01
Child Behavior Checklist Raw Scores						
Withdrawn	113	3.38 (2.90)	29	6.10 (3.10)	-4.44	<.01
Somatic	114	2.82 (2.76)	29	3.56 (3.38)	-1.23	.22
Social Problems	115	3.43 (2.83)	29	6.31 (2.48)	-5.01	<.01
Thought Problems	112	4.77 (2.29)	28	5.95 (2.58)	-2.39	.02
Delinquent Behaviors	115	1.86 (2.20)	29	4.88 (2.76)	-6.26	<.01
Internalizing Scale	115	14.04 (7.64)	29	24.92 (9.60)	6.49	<.01
Externalizing Scale	112	10.78(8.67)	29	25.21 (7.15)	8.27	<.01

Dysregulation and Impairment

It was hypothesized that dysregulation would predict impairment rated by clinicians, parents and children above and beyond obsessive-compulsive disorder. Three separate hierarchical regressions were conducted to examine the role of dysregulation on obsessive-compulsive symptom severity and impairment. Excessive collinearity between the two independent variables used in these regression analyses was not observed (see Table 2) and variance inflation factors (VIF) for all regression analyses were low. For overall clinical severity, step 1 of the hierarchical linear regression revealed that obsessive-compulsive symptom severity predicted overall clinician-rated severity and explained 59% of the variance (see Table 4). The incorporation of dysregulation in step 2 of the model did not add significantly to the model and explained less than 1% of additional variance (p = .63; see Table 4).

Table 4. *Predictors of Clinician-rated Severity on the CGI-S*

Variable	***B***	***SE* B**	**β**	***t* value**	***p* value**	**VIF**
Step1						
CY-BOCS Total Score	.15	.01	.77	14.06	<.01	1.00
Step 2						
CY-BOCS Total Score	.15	.01	.76	12.46	<.01	1.23
CBCL-DP Total Score	.03	.06	.03	0.48	.63	1.23

Model fit statistics:
Step 1: R^2 = .59, p < .01
Step 2: R^2 = .59, ΔR^2 = < .01, p = .63

For child-rated impairment, step 1 of the hierarchical linear regression identified that obsessive-compulsive symptom severity predicted child-rated impairment and explained 22% of the variance (see Table 5). When dysregulation was added to the model in step 2, it significantly improved the model (p < .01) and accounted for an additional

7% of variance in child-rated impairment (see Table 5). Thus, these findings suggest that dysregulation predicts child-rated impairment beyond obsessive-compulsive symptom severity.

Table 5. *Predictors of child-rated Impairment on the COIS*

Variable	***B***	***SE* B**	**β**	***t* value**	***p* value**	**VIF**
Step1						
CY-BOCS Total Score	2.97	0.49	.47	6.08	<.01	1.00
Step 2						
CY-BOCS Total Score	2.20	0.52	0.35	4.25	<.01	1.22
CBCL-DP Total Score	8.82	2.52	0.29	3.50	<.01	1.22

Model fit statistics:
Step 1: $R^2 = .22$, $p < .01$
Step 2: $R^2 = .29$, $\Delta R^2 = .07$, $p < .01$

For the examination of parent-rated impairment, a similar pattern of findings emerged. Step 1 of the hierarchical linear regression identified that obsessive-compulsive symptom severity predicated parent-rated impairment and explained 27% of variance (see Table 6). When dysregulation was added to the parent-rated impairment model in step 2, it significantly improved the model ($p < .01$) and accounted for an additional 20% of variance. These findings suggest that dysregulation predicts parent-rated impairment beyond obsessive-compulsive symptom severity (see Table 6).

Table 6. *Predictors of parent-rated Impairment on the COIS*

Variable	***B***	***SE* B**	**β**	***t* value**	***p* value**	**VIF**
Step1						
CY-BOCS Total Score	3.46	.52	.52	6.62	<.01	1.00
Step 2						
CY-BOCS Total Score	2.09	.49	.31	4.28	<.01	1.21
CBCL-DP Total Score	15.52	2.30	.50	6.75	<.01	1.21

Model fit statistics:
Step 1: $R^2 = .26$, $p < .01$
Step 2: $R^2 = .47$, $\Delta R^2 = .20$, $p < .01$

Additionally, an exploratory hierarchical linear regression was completed to investigate the relationship between family accommodation and dysregulation. For this model of clinician-rated family accommodation, step 1 identified that obsessive-compulsive symptom severity predicted family accommodation and explained 22% of variance (see Table 7). When dysregulation was added to the model, it significantly improved the model ($p < .01$) and accounted for an additional 7% of variance. Thus, it appears that dysregulation predicts family accommodation beyond obsessive-compulsive symptom severity (see Table 7).

Table 7. *Predictors of Family Accommodation on a 13-item clinician-rated scale*

Variable	***B***	***SE* B**	**β**	***t* value**	***p* value**	**VIF**
Step1						
CY-BOCS Total Score	1.21	.19	.47	6.32	<.01	1.00
Step 2						
CY-BOCS Total Score	.89	.20	3.48	4.37	<.01	1.23
CBCL-DP Total Score	3.48	.96	.29	3.63	<.01	1.23

Model fit statistics:
Step 1: $R^2 = .22$, $p < .01$
Step 2: $R^2 = .29$, $\Delta R^2 = .07$, $p < .01$

Dysregulation and Attrition

Attrition for CBT was 18% ($n = 15$), which is comparable to other treatment studies for childhood OCD (Franklin et al., 2011; POTS, 2004). Youth who did not complete treatment and/or did not complete the post-treatment assessment exhibited significantly greater baseline dysregulation ($M = 2.43$, $SD = 0.97$) than treatment completers ($M = 1.83$, $SD = 0.90$), $t(95) = -2.33$, $p < .02$. Additionally, these youth also exhibited significantly greater scores on the CBCL Externalizing Scale ($p < .01$). No other significant differences on available measures were identified.

Baseline Dysregulation and Treatment Response

Using the intent-to-treat principle for those 97 participants who received CBT, a significant decrease in obsessive-compulsive symptom severity was observed from baseline (M = 26.09, SD = 5.04) to post-treatment (M = 13.78, SD = 9.41), $t(96) = 13.10$, $p < .01$. On average, CBT had a large effect size (Cohen's d = 1.33) with participants displaying a significant decrease in obsessive-compulsive symptom severity (M = 12.31, SD = 9.26). Overall, 67 (69%) participants exhibited a response to treatment on the CGI-I. It was hypothesized that baseline dysregulation levels would predict obsessive-compulsive severity at post-treatment and treatment outcome to CBT. Although approaching significance, a bivariate regression revealed that baseline dysregulation (B = 1.91, SE B = 1.01, β = .19, t = 1.89) did not account for obsessive-compulsive symptom severity at post-treatment ($R^2 = 0.04$, F (1, 96) = 3.56, p = .06). Further investigations into the association between treatment response on the CGI-I and baseline dysregulation were completed using a binary logistic regression. Participant response to treatment was the dependent variable and baseline dysregulation was entered as the independent variable. The dysregulation at baseline did not predict dichotomous treatment response on the CGI-I (odds ratio [OR] = 0.90, 95% CI = 0.57- 1.42, Wald = 0.21, p = .65). Furthermore, exploratory binary logistic regressions revealed that neither baseline anxiety symptoms (OR = 1.01, 95% CI = 0.98-1.04, Wald = 0.68, p = .41), depressive symptoms (OR = 1.10, 95% CI = 0.98-1.23, Wald = 2.48, p = .12) or obsessive-compulsive severity (OR = 0.99, 95% CI = 0.91-1.09, Wald = .02, p = .90) predicted dichotomous treatment response.

Influence of CBT on Dysregulation

It was hypothesized that dysregulation would significantly decrease after CBT. For those youth who completed treatment (n = 84), a paired samples t-test identified a significant decrease in youth's dysregulation from baseline (M = 1.86, SD = 0.94) to post treatment (M = 1.36, SD = 0.85), $t(71) = 6.58$, $p < .01$. Following up on this difference, a residualized change regression was conducted to examine the relationship between the change between dysregulation and obsessive-compulsive symptom severity after treatment. First, it was identified that baseline dysregulation significantly predicted post-treatment levels of dysregulation, $t(71) = 9.47$, $p < .01$ (see Table 8). Similarly, baseline obsessive-compulsive severity significantly predicted post-treatment levels of obsessive-compulsive symptom severity, $t(81) = 2.05$, $p < .04$ (see Table 8).

Table 8. *Residualized Change Regression for Dysregulation and CY-BOCS*

	B	***SE (B)***	**β**	**95% CI**
CBCL-DP				
Constant	0.10	0.15		
CBCL-DP Total Score *	0.68	0.07	0.75	0.54 - 0.82
CY-BOCS				
Constant	2.08	4.64		
CY-BOCS Total Score **	0.36	0.18	0.22	0.01- 0.71

*R^2= 0.56, SE= 0.57
** R^2= 0.50, SE= 7.71

When the residual change in dysregulation was correlated with the residual change in obsessive-compulsive symptom severity, a small to moderate significant relationship was observed, $r(72) = 0.36$, $p < .01$.

Table 9. *Predictors of residual change on the CBCL-DP*

	B	***SE (B)***	**β**	**T**	**p-value**	**95% CI**
Constant	-.59	.40				
FAS Total Score	.02	.01	2.28	2.27	.03	.003 - .05
CDI Total Score	.01	.03	.04	.34	.74	-.05 - .08
MASC Total Score	< .-01	. < .01	-.03	-.25	.80	-.02 - .01

F (3,64) = 2.00, p = .12
R^2 = 0.09, SE = 0.99

Neither baseline anxiety nor depression was identified as a significant predictor of the change observed in dysregulation and obsessive-compulsive symptom severity (see Table 9 & 10). Interestingly, baseline family accommodation predicted the level of change of dysregulation (see Table 9) but not change in obsessive-compulsive symptom severity (see Table 10).

Table 10. *Predictors of Residual Change on the CY-BOCS*

	B	***SE (B)***	**β**	**T**	**p-value**	**95% CI**
Constant	-.19	.39				
FAS Total Score	.01	.01	.16	1.35	.18	-.007 - .03
CDI Total Score	< .01	.03	. < .01	.01	.99	-.06 - .06
MASC Total Score	< -.01	< .01	-.07	-.62	.54	-.02 - .01

F (3,72) = .784, p = .50
R^2 = 0.03, SE = 0.98

DISCUSSION

The current study examined the role of dysregulation in the clinical presentation and treatment outcomes of pediatric OCD. Consistent with previous research in non-clinical populations (e.g., Meyer et al., 2008), dysregulated youth with OCD were found to have more severe symptomology and greater overall severity than non-dysregulated youth. More specifically, dysregulated youth had greater obsessive-compulsive severity, impairment, family accommodation, anxiety and depression. These data suggest that youth with dysregulation and OCD exhibit a more complex and severe symptom profile than youth without dysregulation. For youth with OCD, obsessional worries trigger distress, which motivates the performance of compulsive behaviors that serve to temporarily alleviate anxiety. When confronting these situations and/or prevented from completing anxiety-reducing compulsive behaviors, dysregulated youth may experience more frustration and exhibit disruptive behaviors and emotional outbursts in response to these encounters. As such disruptive behaviors and outbursts increase the burden experienced by parents, it is not surprising that parents may be more willing to accommodate obsessive-compulsive behaviors in lieu of confronting a situation that results in a disruptive outburst, resulting in the observed increased levels of family accommodation.

From a neurobiological perspective, youth with dysregulation may have deficits in brain functioning that result in impaired regulatory functioning and elevated sensitivity

to stimuli, beyond that present in youth with OCD alone. Additionally, dysregulated youth may be highly attuned to their surroundings and may experience dysregulated mood and behaviors even in the presence of minimal anxiety-provoking stimuli. While there are likely several different causes for the manifestation of dysregulated behaviors in youth with OCD, its presentation, regardless of the cause, results in a more severe symptom profile compared to those with OCD alone. As such, dysregulated youth are often more difficult to treat, and may require comprehensive treatment to address dysregulated behaviors as well as obsessive-compulsive symptoms.

Similar to previous examinations that reported impaired psychosocial functioning in clinical (Biederman et al., 2009) and non-clinical samples (Meyer et al., 2009), dysregulation predicted the level of impairment experienced by youth with OCD. Specific to pediatric populations with OCD, dysregulation predicted parent-and-child-rated impairment above and beyond obsessive-compulsive symptom severity. While obsessive-compulsive symptoms are impairing and likely serve as the primary reason for seeking treatment, dysregulation appears to account for additional functional impairment. It is important to note that these findings apply to all youth with OCD, and not just those exhibiting threshold levels of dysregulation. While dysregulation is associated with impaired psychosocial functioning and functional impairment, comprehensive interventions that target both dysregulation and obsessive-compulsive symptoms may reduce the elevated impairment experienced by children and families. Interestingly, dysregulation also predicted family accommodation beyond obsessive-compulsive severity. It may be that youth with higher dysregulation have more difficulty with day-to-day activities due to their inability to regulate emotions and/ or behaviors. As a result,

these youth may rely on family members to facilitate their functioning compared to youth with more regulated functioning. Alternatively, parents may be more likely to accommodate obsessive-compulsive behaviors in lieu of potential disruptive behavioral outbursts. As family accommodation is recognized as a critical factor in treatment for youth with OCD (Merlo et al., 2009), it is imperative to understand the complex relationship between dysregulation and family accommodation. Future research should examine the temporal order between dysregulation and family accommodation.

Exposure-based CBT had a large effect on participants' obsessive-compulsive symptom severity (Cohen's d = 1.33), with 69% of participants considered responders to treatment. Although approaching significance, baseline dysregulation did not predict post-treatment obsessive-compulsive severity. Furthermore, baseline dysregulation did not predict treatment response status, and baseline anxiety, depression and obsessive-compulsive severity were not identified as predictors of treatment response status. Consistently identifying predictors of treatment response in pediatric OCD is challenging, as examinations of predictive characteristics are often subject to methodological limitations and/or post-hoc approaches (Ginsburg, Kingery, Drake, & Grados, 2008). That being said, externalizing symptoms, disruptive behaviors (e.g., ADHD, ODD), major depression and OCD-related impairment have been noted to attenuate treatment response to CBT in previous studies (Garcia et al., 2010; Piacentini et al., 2002; Storch et al., 2008b). These constructs are all related to dysregulation, thereby suggesting that dysregulation may play a role in treatment response. Nevertheless, the findings from the present study suggest that a predictive relationship between dysregulation and treatment outcome is at best modest in strength. As dysregulation is a continuous measure, there

may be a threshold on this spectrum that results in attenuated response to CBT. Alternatively, it may be that the effect of dysregulation on treatment outcome was more modest than originally hypothesized (medium effect size), and thus the sample was underpowered.

While dysregulation does not appear to attenuate treatment outcome, it does appear to play an influential role in treatment attrition. For the 97 participants who received CBT, 18% dropped out of treatment. Although rationale for discontinuation was not elicited, several clinical factors were examined to discern differences between youth who completed treatment and those who discontinued early. Notably, baseline dysregulation and externalizing behaviors emerged as a predictor of treatment discontinuation. Careful screening and attention should be paid to youth prior to initiating treatment, as this may identify patients more likely to discontinue, and can guide clinicians in making more individualized treatment recommendations. For dysregulated youth, these individualized recommendations may include unique therapeutic delivery modalities (e.g., intensive daily CBT) that limit attrition. Alternatively, it may be more useful to treat dysregulated behaviors with targeted interventions prior to starting CBT for obsessive-compulsive symptoms. For example, parent training has demonstrated preliminary evidence in reducing disruptive behaviors present in youth with OCD (Ale & Krackow, 2011; Lehmkuhl et al., 2009). Indeed, the early utilization of these therapies may provide children and parents with the skills needed to manage the disruptive behaviors and emotional outbursts that impede exposure-based CBT.

Exposure-based CBT necessitates youth to confront their obsessional triggers and parents to engage in less accommodation of obsessive-compulsive symptoms. As accommodation decreases, youth have to face anxiety-provoking stimuli in the absence of mitigating compulsive behaviors. As these situations are often difficult for youth without dysregulation, they may be more likely to elicit emotional outbursts and disruptive behaviors in dysregulated youth. Youth and parents who learn to appropriately manage disruptive behaviors and emotional outburst prior to CBT, may be less likely to have these outbursts interfere with treatment. Without such outbursts impeding therapeutic progress, children and parents may be more likely to complete the full course of treatment and experience reduction in obsessive-compulsive symptom severity.

When assessing youth after treatment, a novel finding emerged. Despite previous findings that dysregulation is a stable construct over time (Boomsma et al., 2006; Meyer et al., 2009), it appeared that CBT produced a significant decrease in dysregulation. This finding suggests that cognitive-behavioral interventions can yield reductions in dysregulation, which may subsequently curtail the development of severe psychopathology observed in long-term follow-up studies (Althoff et al., 2010; Meyer et al., 2009). While dysregulation has historically been conceptualized as a trait, this research suggests that it is a malleable construct that is responsive to behavioral interventions. While these gains were observable post-treatment, future research should examine whether these positive gains persist over time, or whether this reduction in dysregulation reverts back to its pre-treatment levels over time.

Interestingly, a small to moderate relationship emerged between the change in dysregulation and the change in obsessive-compulsive symptom severity. It may be that as youth develop control over compulsive behaviors through CBT, the enhanced behavioral control is generalized to other dysregulated behaviors. From a neurobiological perspective, increasing an individual's regulatory abilities through CBT may produce improved functioning in regions associated with self-regulation. Findings from brain imaging studies in patients with OCD who receive CBT support this hypothesis. Studies measuring the effects of CBT for OCD on state glucose metabolism or blood flow showed decreases in activity of previously overly activated areas (Baxter, Schwartz, Bergman, & Szuba, 1992; Nakatani et al., 2003; Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996). Furthermore, correlations between activity in the caudate, orbitofrontal cortex and the thalamus identified prior to treatment were not observed after treatment (Baxter et al., 1992; Linden, 2006; Schwartz et al., 1996). Improvement in these areas may also generalize to related brain regions involved in emotional regulation (e.g., prefrontal cortex). Aside from these hypothesized neurobiological mechanisms of changes, these findings highlight that youth who completed treatment experienced improvement in both dysregulation and obsessive-compulsive symptoms.

Limitations and Implications

This study had several limitations. First, the study was limited in scope due to the combination of archival datasets. As there was limited availability of shared measures across datasets, some aspects of obsessive-compulsive phenomenology (e.g., symptom dimensions) remained unexamined. The present findings should be further investigated

and replicated in future prospective studies. Second, findings may have been hindered by the use of a single parent-reported measure of dysregulation. While prior studies have relied upon parent-reported ratings alone (e.g., Althoff et al., 2010; Biederman et al., 1995), future research may benefit from the collection of multiple measures of dysregulation (e.g., physiological measure, teacher reports, etc). Third, the sample was predominantly Caucasian, which may limit the extent to which findings generalize to the larger population of youth with OCD. Fourth, there was no control group in which to examine the change in dysregulation in the absence of treatment. While previous studies have shown dysregulation to be stable across time, it would prove more beneficial to examine the change in dysregulation in a parallel wait-list condition. While the changes in dysregulation likely resulted from the therapeutic intervention, it may also have resulted from a typical a waxing and waning of dysregulated symptoms. Finally, inherent limitations of available instruments to measure constructs of interest may have affected these findings. More specifically, while the CY-BOCS total score serves as a measure of symptom severity, these scores are based, in part, on the extent to which symptoms interfere with social activities and/or school performance. This may have resulted in an inadvertent inflation in the relationship between symptom severity and impairment, thereby decreasing the amount of variance explained by adding other variables to the regression models. Counterbalancing this concern was the finding that the relationship between dysregulation and impairment remained significant, with dysregulation predicting impairment beyond that of OCD severity.

Despite these noted limitations, the findings from this study have several important implications for both research and clinical practice. Youth identified with

dysregulation and OCD exhibit greater impairment and severity than youth with OCD and more regulated functioning. Additionally, dysregulation predicted child-and-parent-rated impairment beyond that of OCD severity. As dysregulation parallels obsessive-compulsive symptoms, it is important for clinicians to gauge dysregulation prior to initiating treatment. Even when not readily recognizable, dysregulation should be further queried as dysregulated symptoms may be mitigated by family accommodation. Overall, the timely recognition of dysregulation can serve to guide the treatment planning process. More specifically, the complex and impairing nature of dysregulation and OCD may require the initial treatment of dysregulated symptoms prior to addressing obsessive-compulsive problems. As dysregulation was associated with treatment dropout, the initially treatment of dysregulated behaviors would likely reduced treatment discontinuation. Indeed, addressing dysregulated behaviors prior to initiating CBT may not only help youth stay in treatment, but it can also lead to the achievement of meaningful symptom reduction.

For those youth who completed treatment, a substantial decrease in obsessive-compulsive severity was observed. Furthermore, a moderate and significant relationship emerged between the decrease in obsessive-compulsive severity and dysregulation. These findings indicate the utility of exposure-based CBT to treat dysregulation as well as obsessive-compulsive symptoms. Beyond reducing obsessive-compulsive symptoms, these findings demonstrate that dysregulation can be responsive to exposure-based CBT, which may be attributed to its strengthening of youth's self-regulatory abilities. In turn, this enhanced ability to self-regulate, reduces both dysregulated behaviors and obsessive-compulsive symptoms. As dysregulation was initially considered to possess a stable

trait-like quality associated with the later development of severe psychopathology, these findings suggest that the delivery of CBT and adjunctive therapies (e.g., parent training, anger-control training) may curb the development of later severe and impairing disorders for these youth.

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