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Responding to Intrusions in Obsessive-Compulsive Disorder:

The Roles of Neuropsychological Functioning and Beliefs about Thoughts

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Abstract

The aim of the current study was to examine cognitive and psychological factors hypothesized to affect responding to intrusions in obsessive-compulsive disorder (OCD). A group of individuals diagnosed with OCD was compared to a social phobia (SP) group and a nonclinical control group. Participants performed neuropsychological tasks, completed self-report measures, and engaged in a self-relevant thought suppression task. The OCD group demonstrated worse working memory and response inhibition and had increased intrusions during the suppression task relative to comparison groups. They also reported more distress during the task relative to the nonclinical group, but not the SP group. Regression analyses revealed that beliefs about thought control failures, but not working memory or response inhibition, was associated with increased frequency of intrusions and greater distress during suppression. Findings support cognitive-behavioural models of OCD that emphasize the role of meta-beliefs in explaining the struggle with obsessional thoughts.

Keywords: obsessive-compulsive disorder, thought suppression, working memory, response inhibition

1. Introduction

A defining feature of obsessive-compulsive disorder (OCD) is the presence of recurrent, disturbing obsessions that are difficult to inhibit or suppress. Individuals with this disorder employ various strategies to manage these obsessional thoughts. According to cognitive-behavioural models of OCD, these strategies not only fail to control unwanted thoughts (Purdon, 2004), they negatively impact on individuals' mood and interfere with their daily functioning (Purdon, Rowa, & Antony, 2007). Although research has demonstrated considerable heterogeneity within OCD (Mataix-Cols, Rosario-Campos, & Leckman, 2005), ineffective and psychologically costly attempts to suppress intrusive thoughts may be an important feature of the disorder that cuts across symptom dimensions.

Recently there has been a focus on integrating neuropsychological findings into cognitive-behavioural models of OCD in order to advance our understanding of the disorder (Kyrios, 2011). With respect to ineffective management of intrusions, it has been proposed that individuals with OCD may experience more failures suppressing intrusive thoughts due to certain neurological characteristics (Tolin, Abramowitz, Przeworski, & Foa, 2002). Brain abnormalities have been observed in OCD patients in the orbitofrontal cortex, parietal cortex, and striatum (Menzies et al., 2008). There is also mixed cross-sectional evidence of impaired executive functioning among adults and children with OCD (for reviews, see Greisberg & McKay, 2003; Simpson et al., 2006), as well as preliminary evidence of specific premorbid deficits in executive function (Grisham, Anderson, Poulton, Moffitt, & Andrews, 2009).

Chamberlain and colleagues (Chamberlain, Blackwell, Fineberg, Robbins, & Sahakian, 2005; Chamberlain, Fineberg, Blackwell, Robbins, & Sahakian, 2006) have proposed that response inhibition deficits in particular may be a useful endophenotype of brain dysfunction for OCD. Inefficient inhibition skills may be associated with an inability to keep out extraneous information from working memory (Bjorklund & Harnishfeger, 1990).

Thus poor inhibitory control and compromised working memory may lead to difficulties suppressing unwanted thoughts among OCD patients. Recent neuroimaging evidence provides a possible neural substrate for these thought suppression difficulties. OCD patients had difficulty activating the right frontoparietal networks, a key area for visuospatial ability, during tasks that required cognitive control (Koçak, Özpolat, Atbaşoğlu, & Çiçek, 2011).

Few studies, however, have directly examined the proposed link between impaired inhibitory control, the component of executive functioning designed to inhibit irrelevant information, and difficulty managing obsessional thoughts. An investigation in our lab found that OCD symptoms in a nonclinical sample were inversely associated with *perceived* thought control ability and greater spontaneous efforts to suppress an intrusive thought (Grisham & Williams, 2009). This study did not, however, directly assess the role of impaired inhibitory control. Working memory capacity tasks may be well suited to address this question, as they specifically assess control over proactive interference (e.g., intrusive thoughts). Performance on these tasks depends on one's ability to sustain goal-relevant information processing when simultaneously presented with alternative goals or distractions (Engle, 2001).

In a nonclinical student sample, Brewin and Smart (2005) found that better working memory on the Operational Span (OSPAN; Turner & Engle, 1989) was related to fewer intrusions in a suppression condition, suggesting a specific association between impaired working memory and ineffective attempts to inhibit unwanted thoughts. The current study is the first, however, to examine the association between indices of cognitive functioning and thought suppression difficulties in a clinical sample of individuals diagnosed with OCD. Following Brewin and Smart (2005), the current study employed the OSPAN (Turner & Engle, 1989), a working memory task that requires concurrent processing of dual tasks (encoding and recalling words while simultaneously solving math equations). Performance

on the OSPAN has been associated with emotion regulation (Schmeichel, Volokhov, & Demaree, 2008), making it a suitable measure of working memory in the context of OCD.

An important objective of this study was to identify the specificity of thought suppression difficulties and related cognitive impairment relative to appropriate comparison groups. It has been suggested that the neurocognitive profiles in OCD may be better accounted for by the presence of comorbid disorders (Basso, Bornstein, Carona, & Morton, 2001; Moritz et al., 2001). Thus discrepancies in the OCD neuropsychological literature may be partially due to a general lack of appropriate clinical comparison groups (e.g., anxiety disorder controls; although see Cohen, Hollander, DeCaria, Stein, & et al., 1996). In addition, it is unclear how proposed cognitive deficits may interact with maladaptive beliefs to maintain the disorder. Consistent with cognitive models of OCD (e.g.,Purdon & Clark, 2001; Rachman, 1997), we propose that while neurological deficits associated with OCD may lead to slightly increased intrusions and thought suppression failures, beliefs about the meaning and consequences of these failures lead to increased distress, thereby playing a critical role in the maintenance of the disorder.

According to cognitive theories of OCD, individuals with OCD not only misinterpret their obsessions by making *primary* appraisals about the meaning of intrusions, but they also make s*econdary* appraisals about their mental control efforts and the consequences of failures in thought control (Clark, 2004). Clark (2004) noted that holding these beliefs leads to greater distress and more intrusions than thought suppression alone, as these beliefs can direct increased attention to intrusions. As a result of these secondary appraisals, an individual may employ ineffective strategies, such as thought suppression. These strategies result in failed thought control, the reoccurrence of unwanted cognitions, and heightened distress.

Thus, in the current study, we attempted to integrate two prominent lines of OCD theory and research by examining how both neuropsychological indices and specific beliefs about controlling intrusions predict responding to intrusions in a clinical OCD sample. We administered tests of several aspects of cognition proposed to influence thought suppression: working memory (OSPAN), response inhibition (Hayling), and set-shifting (Trail Making Test). We also included the Wechsler Abbreviated Scale of Intelligence (WASI), an abbreviated gold standard measure of intellectual functioning to control for overall intelligence. In order to clarify whether any deficits in these domains are specific to OCD or represent a shared feature of anxiety in general, we compared OCD participants to both a healthy nonclinical group and an anxious comparison group (primary social phobia diagnosis). Furthermore, we assessed for general psychopathology in order to rule out the potential confounding influence of anxiety and depression on cognitive functioning.

In addition to examining the cognitive strategies individuals use in their daily life, we employed a modified thought suppression paradigm with a naturalistic intrusive thought (Rassin, 2001) to investigate the influence of these neurocognitive functions on *in vivo* control efforts. We induced a self-relevant negative thought (imagining a loved one in a car accident) and instructed all participants to suppress the thought. Previous studies have employed a thought suppression paradigm with individuals with OCD (Janeck & Calamari, 1999; Tolin et al., 2002). A novel aspect of the current study, however, was the focus on identifying specific indices of cognitive dysfunction and OCD-related beliefs that predicted response to the thought suppression task.

In sum, the aim of the current study was to examine neuropsychological and cognitive-behavioural explanations for recurrent obsessional thoughts in OCD. In order to accomplish this aim, we determined whether cognitive impairments, such as decreased response inhibition, set-shifting, and working memory, had an impact on chronic and *in vivo*

responding to intrusions among individuals with OCD. We extended previous research on this question by including an anxiety disorder comparison group with equivalent depression and anxiety symptoms to evaluate the specificity of cognitive deficits. In addition, we investigated the contribution of beliefs about controlling unwanted thoughts to thought suppression difficulties. Our predictions were as follows:

1. The OCD group would demonstrate poorer performance on tests of working memory, response inhibition, and set-shifting than both comparison groups, despite comparable intelligence overall.

2. The OCD group would report increased chronic thought suppression and greater beliefs about the need to control thoughts relative to both comparison groups.

3. The OCD group would experience increased frequency of intrusions (thought suppression failures) and increased distress during a self-relevant thought suppression task relative to both comparison groups.

4. Worse performance on cognitive tasks and secondary appraisals about the need to control thoughts would predict increased frequency of intrusions and increased distress during thought suppression.

2. Materials and Method

2.1 Participants

Nonclinical Control Group. Twenty females and 4 males with a mean age of 33.95 ($SD = 9.56$) who did not endorse any current or lifetime mood, anxiety, substance-abuse, head injury, or psychotic disorder were included in this group.

Obsessive Compulsive Disorder Group. Thirteen females and 9 males with a mean age of 29.13 ($SD = 10.04$), all meeting DSM-IV criteria for OCD were included in this group. Current diagnostic information obtained from the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, Di Nardo, & Barlow, 1994) is presented in Table 1.

Social Phobia Group. Seventeen females and 8 males with a mean age of 29.44 (*SD* =

13.77), all meeting DSM-IV criteria for social phobia (SP) were included in this group.

Current and lifetime diagnostic information for this group is also presented in Table 1.

Insert Table 1 about here

2.2 Diagnostic assessment

Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, Di Nardo, &

Barlow, 1994). The ADIS-IV is a semi-structured interview to diagnose anxiety, mood,

somatoform, and substance use disorders and to screen for the presence of other conditions,

such as psychosis. The ADIS has demonstrated good to excellent reliability for the majority

of anxiety and mood disorders (Brown, Di Nardo, Lehman, & Campbell, 2001).

Structured Clinical Interview for DSM Disorders- Screening Module (SCID-I/NP;

First, Spitzer, Gibbon, & Williams, 2002). The SCID screening module was used to screen

participants recruited from the community and to rule out any history of Axis I disorders in

the nonclinical control group.

2.3 Questionnaires

Concern About Failures in Thought Control Questionnaire (CFTCQ; Purdon, 2001)**.**

The CFTCQ is self-report measure of appraisals of intrusive thoughts with two subscales; the

6-item Control scale that provides an index of the perception that thoughts and mental

capacities are out of control and the 8-item Fusion/Dystonicity scale that provides a measure

of the implications of the thought for the individual's personality, mental state, and likelihood

of the thought coming true. The CFTCQ demonstrates good psychometric properties (Purdon,

2001). In the current sample Cronbach's alpha was .87and .67 for the Control and

Fusion/Dystonicity subscales, respectively. A total score was calculated by summing the two subscales.

Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995). The DASS is a 21-item self-report measure which requires participants to rate on a scale from 0 (does not apply to me at all) to 4 (applies to me very much) the extent to which each item applies to them. The items on the DASS tap into depression, anxiety and stress, with subscale scores ranging from 0 to 42. Depression scores 13 and lower, anxiety scores 9 and lower, and stress scores 18 and lower indicate symptoms in the mild to normal range (Lovibond & Lovibond, 1995). This measure demonstrates good reliability and internal consistency (Henry & Crawford, 2005). Cronbach's alpha was .95 in the current sample.

White Bear Suppression Inventory (WBSI; Wegner & Zanakos, 1994) is a 15-item self-report questionnaire that measures chronic thought suppression tendencies, or the deliberate attempt to avoid thinking about unpleasant thoughts. Scores on the Total scale range from 15–75 with higher score indicating a stronger tendency to engage in thought suppression. The authors report good internal consistency and test-retest reliability (alpha .89 and .80, respectively). Following the suggestion of Höping and de Jong-Meyer (2003), Intrusion and Suppression subscale scores were also calculated with Cronbach's alpha of .87 and 73, respectively.

Target Thought Ratings. Participants were asked to rate on a scale of 0 = 'not at all' to 100 = 'Extremely' the degree to which they actively attempted to suppress the target thought and the level of distress and guilt associated with the target thought.

Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) assesses the vividness of visual imagery by asking participants to mentally form a series of 16 images (e.g., a friend or relative's face, the rising sun). Ratings of image vividness are made on a

five-point scale, ranging from 1 = 'Perfectly clear and vivid as normal vision' to 5 = No image at all, you only "know" you are thinking of the object'. Lower total scores indicate more vivid imagery. Cronbach's alpha was estimated to be .88 in a meta-analytical review (McKelvie, 1995).

2.4 Neuropsychological Tests

Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). The WASI Vocabulary and Matrix Reasoning subtests were summed to provide an index of overall intelligence. The WASI Vocabulary subtest is a 42-item task similar to the Vocabulary subtest of the Wechsler Adult Intelligence Scale-III (WAIS-III; Wechsler, 1997). The reliability coefficients for the Vocabulary subtest range from .90 to .98 (Psychological Corporation, 1999). The WASI Matrix Reasoning subtest is comprised of 35 incomplete visual patterns that are used to assess nonverbal fluid reasoning and general intellectually ability. The reliability quotient for Matrix Reasoning ranges from .88 to .96 (Psychological Corporation, 1999).

The Trail Making Test (TMT; Reitan & Wolfson, 1993) was administered as a measure of motor speed, visual scanning, and visual-motor integration. Trails-B has good reliability was administered as a measure of attention and cognitive flexibility (Fals-Stewart, 1992).

The Operation-Span Task (OSPAN; Turner & Engle, 1989). The OSPAN task is a measure of working memory ability that requires participants to solve a series of math operations while trying to remember a set of unrelated words. Materials were adapted to be displayed via computer and presented using Powerpoint. Exposure and recording was controlled by the experimenter. An 85% accuracy criterion on the math operations was required for all the participants. The final score reflects the total number of correctly recalled

words in the correct position. The OSPAN has been shown to have good reliability and validity (Engle et al., 1999)

Hayling Sentence Completion Test (Hayling; Burgess & Shallice, 1997). The Hayling consists of two sets of 15 sentences, each having the last word missing. In set 1 respondents verbally complete the sentence as quickly as possible, providing an index of response initiation. In set 2 respondents are required to complete the sentence as quickly as possible with an unrelated word, providing an index of response inhibition. An overall scaled score taking into account response latencies and commission errors is calculated ranging from 1 (impaired) to 10 (very superior).

2.5 Procedure

Ethical approval was obtained by the Human Research Ethics Committee of the University of New South Wales. Participants were recruited via separate advertisements placed in the community either targeting individuals with no current or lifetime history of mental health concerns to participate in a study of how thoughts influence behaviour, or through advertisements placed on mental health websites seeking individuals with symptoms consistent with OCD or SP. All participants were initially screened over telephone by a PhD level psychologist (AW) using the screening module of the SCID-I/NP. Current substance abuse, history of head injury, and psychotic disorder were exclusion criteria for all participants. Eligible respondents were then invited to attend an individual research session. After obtaining informed consent, participants completed an electronic battery of the self-report questionnaires and the experimental protocol delivered via Medialab software.

The experimental protocol was based on the Sentence Completion Task (Rachman, Shafran, Mitchell, Trant, & Teachman, 1996) used as a TAF induction. Participants were first instructed to type the name of an important person who is currently in the participant's life in

the space provided. The subsequent screen embedded the loved-one's name in the following sentence 'Now imagine that (*loved-one's name*) has been in a car accident'. This information was presented on the computer screen for 30 s and then participants were informed that this would be their 'target thought'. Participants then completed the baseline Target Thought ratings. Participants were then presented with a cognitive load (a 6-digit number) and informed they would be asked to recall this number throughout the experiment. All participants engaged in an initial 2 min baseline monitoring period followed by a 2 min suppression phase and a final 2 min monitoring phase as outlined below.

Baseline and monitor phase instructions:

During the few minutes, you may think about anything you like. You may think about the accident target thought, but you do not have to. If at any time you think of the accident target thought please press the X key for each occurrence. It is important that you continue in the same way for the full duration.

Suppression phase instruction:

During the next few minutes, please record your thoughts as you did before. It is very important that you try as hard as you can to suppress the accident target thought, but be sure to press the X key if you do think of the accident target thought. It is important that you continue in the same way for the full duration.

Following each 2-min period participants were asked to enter the six-digit number and to complete the Target Thought ratings. Participants were then provided with the option of taking a 10-minute break before completing the battery of neuropsychological tasks (Trails, WASI, Hayling, OSPAN). Lastly, the ADIS-IV was administered. A small financial reimbursement was provided in exchange for participants' time.

3. Results

3.1 Preliminary data analyses

Outliers were identified and removed prior to conducting statistical procedures. Outliers were defined as cases with standardised scores in excess of 3.29 (p<.001, two-tailed test), as recommended by Tabachnick and Fidell (2007).

3.2 Group characteristics

The three groups were tested together using ANOVA. Follow-up tests were conducted using Student-Newman-Keuls (SNK) *post hoc* testing. Table 2 summarizes the results from the self-report questionnaires. There were no significant between-group differences with respect to age, $F(2,68) = 1.34$, $p < .27$ or gender, $\chi^2 (3.35,2) = .19$. In addition, due to the imagery-based nature of the thought suppression task, we verified that there was no between-group difference in ability to use visual imagery, either with eyes open, $F(2,37) = .26$, $p = .77$, or eyes closed, $F(2,37) = 1.12$, $p = .34$.

3.3 Questionnaires

With respect to self-report questionnaires, ANOVA revealed a significant main effect of groups on the symptom measures (DASS subscales), as well as measures of tendency to suppress thoughts (WBSI) and beliefs about failures of thought control (CFTCQ) (see Table 3). *Post hoc* tests indicated that the OCD and SP groups did not differ with respect to either depression, anxiety, or stress symptoms, beliefs about thought control failures, or the tendency to thought-suppress. Both clinical groups, however, scored significantly higher than the nonclinical comparison group on each of these measures of symptoms and thought suppression.

3.4 Neuropsychological tests

One-way analyses of variance (ANOVA) were conducted in order to evaluate differences in cognitive functioning between the three groups (see Table 4). There were no

significant main effects of group with respect to overall intelligence (WASI IQ). ANOVA revealed a significant main effect of group for working memory on the OSPAN, $F(2,69) = 7.23$, $p = .001$. Post hoc tests revealed that the OCD group performed significantly worse than the two comparison groups at $p < .05$. There was also a significant main effect for the Hayling, $F(2,70) = 6.06$, $p = .004$. Again, post hoc tests revealed that the OCD group demonstrated decreased inhibitory control relative to the SP and nonclinical comparison groups at $p < .05$. Finally, there was no main effect of group with respect to Trails A, Trails B, or Trails B minus Trails A ($ps > .10$).

3.5 Thought Suppression Task

Manipulation check. In order to verify that participants were complying with suppression instructions, a 3 (time) x 3 (group) mixed model ANOVA was conducted to examine suppression effort across time. There was a main effect for time, $F(2,142) = 27.47$, $p < .001$, $\eta = .28$, and for group, $F(2,71) = 3.35$, $p = .04$, $\eta = .09$, but no significant interaction, $F(4,142) = 2.18$, $p = .07$, $\eta = .06$. Inspection of marginal means demonstrated that, as expected, all three groups reported increased suppression effort from the baseline period, $M (SD) = 59.86 (31.51)$, to the experimental suppression period, $M (SD) = 71.89 (29.35)$. SNK *post-hoc* tests of the difference in suppression effort between the nonclinical group ($M = 48.75$) and the OCD ($M = 64.92$) and SP ($M = 62.93$) groups did not reach significance ($p = .10$).

Analyses examining effect of group, working memory, and beliefs on thought frequency and distress. A one way 3 (time) x 3 (group) repeated-measures -MANOVA was conducted to investigate the impact of group on intrusion frequency and distress experienced across the thought suppression task. There was a multivariate main effect of time, Wilks' $\Lambda = .54$, $F(2, 63) = 83.34$, $p < .01$, but no significant time by group interaction, Wilks' $\Lambda = .88$, $F(8, 126) = 1.01$, $p > .05$. Examination of univariate tests of intrusion frequency revealed a

main effect of time, $F(2, 132) = 9.84$, $p < .001$, such that the frequency of intrusions decreased over time. There was also a main effect of group, $F(2, 66) = 4.36$, $p < .05$, although the time by group interaction was not significant, $p > .10$. SNK *post-hoc* tests revealed that the OCD group experienced significantly more intrusions ($M = 5.00$, $SD = 4.25$) compared to the SP ($M = 3.79$, $SD = 3.70$) and nonclinical comparison groups ($M = 3.12$, $SD = 2.87$).

With respect to distress ratings, there was a univariate main effect of time, $F(2, 132) = 26.83$, $p < .001$, such that levels of distress also decreased over time. Again, there was no significant time by group interaction, $p > .10$. There was also a main effect of group, $F(2, 66) = 3.69$, $p < .05$, although the time by group interaction was nonsignificant, $p > .10$. SNK *post-hoc* tests indicated that the OCD group ($M = 31.43$, $SD = 26.32$) and SP group ($M = 31.67$, $SD = 24.61$) both experienced significantly more distress overall than the nonclinical group ($M = 17.08$, $SD = 21.36$), although they did not significantly differ from each other.

Next, we performed regression analyses to address our key research question regarding whether working memory, response inhibition, and control-related beliefs predicted frequency of intrusions and distress during the suppression phase, adjusting for general negative affect. First, because frequency of the target thought was in the form of a count, Poisson regression was conducted to assess the contribution of the OSPAN, the Hayling, and the CFTCQ (total) to number of intrusions reported during suppression. CFTCQ was positively related to frequency of intrusions ($\beta = 0.01$, $SE\ \beta = 0.01$, $X^2 = 4.48$, $p = .03$), after adjusting for the neuropsychological variables and general negative affect. The OSPAN ($\beta = -0.02$, $SE\ \beta = 0.02$, $X^2 = 0.91$, $p = .34$), the Hayling ($\beta = 0.01$, $SE\ \beta = 0.03$, $X^2 = 0.17$, $p = .68$), and the DASS ($\beta = 0.01$, $SE\ \beta = 0.00$, $X^2 = 1.73$, $p = .34$) were not related statistically to frequency of intrusions in the comprehensive model.

We then conducted a standard regression to examine the unique contributions of neuropsychological performance and control-related beliefs to distress ratings during suppression, again adjusting for general negative affect (DASS). Distress during suppression was the dependent variable and OSPAN score, Hayling score, CFTCQ, and the DASS were entered simultaneously as the independent variables. The model containing all variables explained 23% of the variance in distress, $F(4, 68) = 4.78$, $p = .002$. CFTCQ was a significant predictor of distress during suppression, $\beta = 0.59$, $SE = 0.19$, $Beta = .37$; $t = 3.11$, $p = .003$. The OSPAN ($\beta = 0.20$, $SE = 0.46$, $Beta = .05$; $t = 0.43$, $p = .67$), the Hayling ($\beta = -1.21$, $SE = 1.88$, $Beta = -.07$; $t = -.64$, $p = .52$), and the DASS ($\beta = 0.17$, $SE = 0.11$, $Beta = .18$; $t = 1.51$, $p = .14$) did not contribute uniquely to the prediction of distress during suppression.

4. Discussion

The current study extended previous research on thought control difficulties in OCD by evaluating both cognitive functioning (working memory, response inhibition, and set-shifting) and beliefs about needing to control thoughts, two key factors implicated in the pathogenesis of OCD. Results regarding cognitive performance were partially consistent with predictions. Despite comparable general intelligence, the OCD group had poorer working memory and response inhibition (but not set-shifting) than both comparison groups, as well as more frequent intrusions during the suppression task. It is possible that these differences in cognitive performance reflected anxiety and lack of confidence during the task rather than a true deficit integral to OCD. It was therefore critical that we included a SP group characterized not only by high levels of anxiety, but by fears of negative evaluation in particular. Given the OSPAN task required participants to perform the task aloud with the experimenter tracking accuracy, if task performance was attributable solely to anxiety we would have expected the greatest deficit to be observed in the social phobia group. However, the SP group did not exhibit impaired response inhibition nor impaired working memory.

With respect to the self-report measures, the OCD group reported more chronic, daily difficulties with intrusive thoughts on the WBSI and more beliefs about the need to control thoughts on the CFTCQ than the nonclinical control group, but did not differ on either of these measures from the SP group. The lack of difference between the clinical groups on these constructs supports proposals that thought suppression is a transdiagnostic process that is not unique to OCD (Aldao & Nolen-Hoeksema, 2010). However previous research on the use of suppression in social anxiety has been mixed. One experimental study has demonstrated that individuals with SP have difficulty suppressing social anxiety and non-social anxiety specific information (Fehm & Margraf, 2002), while other investigations have found an enhanced ability to suppress socially-relevant material (Kingsep & Page, 2010). Future studies may compare and contrast the use of thought suppression strategies across Axis I diagnoses.

In addition to cognitive tasks and self-report measures, the current study included an *in vivo* suppression task to evaluate the contribution of working memory and control metacognitions to thought suppression failures and distress. The OCD group experienced more intrusions than both comparison groups and both clinical groups both reported more distress than nonclinical comparison participants. Contrary to prediction, performance the OSPAN and the Hayling did not predict responding to the suppression task, although beliefs about the need to control thoughts uniquely predicted both frequency of intrusions and distress during thought suppression. These findings support the models of Clark and Purdon (Clark, 2004; Purdon, 1999), which suggest a central role for metacognitive beliefs about thought control and the meaning of failures in thought control. According to these models, metabeliefs such as "I can and should be able to control all my thoughts" and "Mental control is an important part of self-control" motivate suppression and other control efforts. In the current study, these metacognitive beliefs predicted response to thought suppression beyond

neuropsychological factors and general negative affect, providing support for the critical role of secondary appraisals in the struggle with intrusive thoughts.

In contrast, current findings did not provide support for the disinhibition model of OCD (Chamberlain et al., 2005; Olley, Malhi, & Sachdev, 2007). Although OCD patients demonstrated poorer working memory and response inhibition than the comparison groups, working memory did not predict response to the *in vivo* thought suppression task. Moritz and colleagues noted that the disinhibition model is unable to account for important aspects of OCD, including the universality of intrusive thoughts and findings that OCD patients do not have difficulty inhibiting random stimuli, but struggle with specific thoughts related to sensitive themes such as sexuality, aggression, and morality (Moritz, Rietschel, Jelinek, & Bäuml, 2011). An interesting possibility is that OCD symptoms experienced during the neurocognitive tasks may have accounted for the OCD group's poorer performance on the neuropsychological tests rather than neuropsychological vulnerability leading to OCD symptoms (Moritz, Hottenrott, Jelinek, Brooks, & Scheurich, 2011).

The current study was limited by a restricted selection of neuropsychological tests. Given the many possible aspects of cognitive functioning, it is possible that additional measures would have tapped other aspects of inhibition that influenced responding to intrusions during the suppression task. Another limitation of the current study was the modest sample size. Future studies may include a more comprehensive battery of cognitive tests and a larger sample size. Nonetheless, the current study has several important strengths, including the use of a self-relevant *in vivo* task as well as a measure of chronic thought suppression, the inclusion of both nonclinical and anxiety disordered (SP) comparison groups, and the inclusion of several measures of key aspects of neuropsychological functioning, including a reliable and valid test of working memory.

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Table 1

Current Axis I diagnoses for the obsessive-compulsive disorder and social phobia groups.

	OCD *n* (%)	Social Phobia *n* (%)
DiagnosisMajor Depressive Disorder	3 (14)	8 (32)
Generalized Anxiety Disorder	1 (.05)	4 (16)
Specific Phobia	2 (.09)	1 (.04)
Panic Disorder	2 (.09)	1(.04)
Post Traumatic Stress Disorder	2 (.09)	0

Note. Percentages do not sum to 100 due to multiple comorbidities.

Table 2

Demographic characteristics by group.

Demographic	OCD (*n* = 24)	Social Phobia (*n* = 25)	Nonclinical Control (*n* = 25)
Gender			
Female	15 (62.5%)	17 (68.0%)	21 (84.0%)
Male	9 (37.5%)	8 (32.0%))	4 (16.0%)
Age	28.96 (9.66)	4 (13.78)	33.84 (9.38)
Race/Ethnicity			
Asian/Pacific Islander	2 (8.3%)	5 (20.0%)	3 (12.0%)
Caucasian	20 (83.0%)	15 (60.0%)	17 (68.0%)
Indian/Bangladeshi	0 (0.0%)	4 (16.0%)	0 (0.0%)
Other/Missing	2 (8.3%)	1 (4.0%)	5 (20.0%)

Table 3

Self-report questionnaires by group.

Variable	OCD M (SD)	Social Phobia M (SD)	Nonclinical M (SD)	F
DASS ANX	10.17 [a] (9.34)	11.04 [a] (7.66)	3.28 [b] (2.99)	8.79***
DASS DEP	14.42 [a] (12.41)	17.28 [a] (10.26)	5.36 [b] (6.99)	9.47***
DASS STRESS	20.67 [a] (10.98)	19.84 [a] (8.87)	8.88 [b] (7.07)	13.00***
CFTCQ	31.88 (6.29) [a]	28.16 (7.72) [a]	20.80 (10.31) [b]	11.35***
OCI-R	38.05 [a] (8.54)	14.91 [b] (9.21)	6.00 [c] (8.00)	50.20***
WBSI	63.29 [a] (7.32)	60.13 [a] (6.74)	43.72 [b] (10.99)	36.79***
WBSI INTRUS	38.71 [a] (5.10)	36.50 [a] (5.96)	26.04 [b] (6.55)	32.27***
WBSI SUPP	24.58 [a] (3.11)	23.63 [a] (3.24)	17.68 [b] (5.60)	19.86***

Note. Student-Newman-Keuls *post hoc* testing was conducted to examine group differences. DASS = Depression, Anxiety and Stress Scale; CFTCQ = Concern About Failures in Thought Control Questionnaire; OCI-R = Obsessive-Compulsive Inventory Revised; WBSI = White Bear Suppression Inventory; WBSI Intrus= WBSI Intrusion Subscale; WBSI Supp = WBSI Suppression subscale. Means with different superscripts differ significantly at $p < .05$ by the Student-Newman-Keuls *post hoc* test.

*** $p < .001$.

Table 4

Neuropsychological test results by group.

Variable	OCD M (SD)	Social Phobia M (SD)	Nonclinical M (SD)	F
WASI IQ	108.59 (11.57)	115.67 (11.19)	111.96 (11.18)	2.26
OSPAN	7.14 [a] (4.02)	12.67 [b] (6.00)	12.58 [b] (6.39)	7.23**
HAYLING	5.09 [a] (1.69)	6.00 [b] (1.56)	6.17 [b] (0.96)	3.71*
TRAILS A (s)	34.81 (11.94)	31.29 (11.75)	28.38 (7.55)	2.27
TRAILS B (s)	73.36 (41.87)	67.76 (24.88)	60.68 (20.97)	1.07
TRAILS B-A	38.55 (38.93)	36.47 (22.26)	32.30 (20.19)	0.31

Note. Student-Newman-Keuls *post hoc* testing was conducted to examine group differences. Means with different superscripts differ significantly at $p < .05$ by the Student-Newman-Keuls *post hoc* test.

$* p < .05,** p < .01$.