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An Examination of Response Inhibition Deficits in Symptoms of Obsessive-Compulsive and Related Disorders

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AN EXAMINATION OF RESPONSE INHIBITION DEFICITS IN SYMPTOMS OF OBSESSIVE-COMPULSIVE AND RELATED DISORDERS

by

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ABSTRACT

AN EXAMINATION OF RESPONSE INHIBITION DEFICITS IN SYMPTOMS OF OBSESSIVE-COMPULSIVE AND RELATED DISORDERS

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Response inhibition (RI; the ability to inhibit a pre-potent response) has been proposed as a cognitive vulnerability underlying a wide variety of psychological disorders. In particular, RI deficits have been proposed as an underlying factor in obsessive-compulsive and related disorders (OCRDs) given that they are characterized by largely involuntary and compulsive behaviors. While some OCRDs have been examined alongside RI capabilities, others have not. Further, the current body of literature has a paucity of work examining the three subprocesses of RI (cancellation, withdrawal, and interference control) as they relate to these symptoms. The present study assessed OCRD symptoms and the three RI subprocesses through Amazon's Mechanical Turk platform. An analogue sample completed self-report measures and three computerized cognitive tasks. Results suggest that RI deficits may not be associated with the severity of most OCRD symptoms, both in individuals reporting high and low symptoms. Implications and directions for future research are discussed.

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Finally, thank you to my Savior for being my refuge when I doubted my abilities. 2 Corinthians 12:9.

Response Inhibition

In recent years, many researchers have shifted to focus on cognitive vulnerabilities cutting across various disorders to better understand their etiology, maintenance, and treatment. By better understanding these vulnerabilities, we may be able to develop treatments that have transdiagnostic utility by creating interventions for disorders with shared underlying deficits or mechanisms. This shift is one that is highlighted in the National Institute of Mental Health's (NIMH) Research Domain Criteria (RDoC) initiative (Insel et al., 2010). This initiative proposes a multi-level framework through which mental disorders may be examined in order to better understand the underlying neuro-mechanisms that contribute to human behavior. By utilizing RDoC as a new lens through which psychological research can be viewed, many researchers are now looking past diagnostic labels to instead focus on RDoC's framework of five domains (made up of functional constructs and their corresponding sub-constructs) and the various units of analysis at which these domains can be assessed (e.g., genes, circuits, behavior, paradigms, etc.).

RI falls within the Cognitive Systems domain on the RDoC matrix, specifically within the Cognitive Control Construct. Cognitive Control is further broken down into subconstructs, including Response Selection and Inhibition/Suppression (NIMH, 2017). RI is considered a key characteristic of executive control and can be broken down into three distinct subprocesses. These include: cancellation, withdrawal, and interference control (Barkley, 1997). Cancellation is the stopping of an ongoing response, whereas withdrawal requires withholding or inhibiting an action without initiating it (i.e., correctly not responding). Interference control involves making a response in the presence of competing stimuli.

Numerous paradigms have been designed to measure various aspects of RI, including those such as flanker, Stroop, antisaccade, stop-signal, go/no-go, and Simon tasks (Nigg, 2000). Depending upon the context of the task, these all require the initiation of an alternative response or no response at all (Zhang, Geng, & Lee, 2017). The go/no-go task typically presents "go" and "no-go" stimuli in a random order. Participants are required to respond as quickly as possible to "go" trials, but should not respond on "no-go" trials. Because go/no-go tasks require participants not to initiate a response, they are commonly used to measure action withholding (Zhang et al., 2017). The stop-signal task requires participants to respond to target stimuli as quickly as possible, but not when a secondary stimulus is presented (e.g., an auditory tone). Because stop-signal tasks require participants to cancel a previously initiated response, they are often utilized to measure action cancellation (Zhang et al., 2017). Early research conceptualized the inhibition of responses (action cancellation in particular) as a race model in which go and stop processes are competing with one another (Logan, Cowan, & Davis, 1984). Whichever of these processes gets to the "finish line" first dictates whether or not the individual responds in a given situation or trial. Researchers have suggested that impulsive individuals perform more poorly on the stop-signal task due to slower inhibitory responses, as opposed to faster pre-potent responses (Logan, Schachar, & Tannock, 1997). The flanker task (Eriksen, 1974) requires participants to respond to a target stimulus while simultaneously ignoring surrounding distractor stimuli. Because tasks such as the flanker require participants to make a response in the presence of competing stimuli, it is one of several tasks that can be employed to measure interference control (Zhang et al., 2017). In a study examining how manipulating cognitive tasks completed by children might change their difficulty, changing the size of the target stimulus on a flanker task significantly impacted reaction time (Lindqvist & Thorell, 2009).

In validating a task that captures all three components of RI to be used during functional magnetic resonance imaging (fMRI), Sebastian and colleagues (2013) found that all three subcomponents activated a common neural network in the right inferior frontal cortex, pre-supplementary motor area, and parietal regions. However, there was different regional activation for the three subcomponents, as well as activation at different time points during the task. These findings provide support for RI being one construct, but with unique and distinctive subprocesses. Researchers believe that individuals that are impulsive have difficulties in inhibiting pre-potent responses (Logan, Schachar, & Tannock, 1997), therefore proposing that RI deficits may play a major role in various disorders characterized by impulsivity. Given the findings of the Sebastian and colleagues (2013) study suggest RI is not a unidimensional construct, it is imperative to investigate the association between symptoms and these three distinct subprocesses. It is important to explore how clinical symptoms may show differential patterns of association with various subcomponents of RI, as better understanding these relationships may provide a more nuanced understanding of the nature of these disorders.

The purpose of the present study was to examine the association of transdiagnostic response inhibition (RI; the ability to inhibit a pre-potent response) processes with obsessive-compulsive and related disorders (OCRDs). Furthermore, the proposed study is aimed at better understanding how RI subprocesses may be uniquely related to symptoms of OCRDs. RI deficits have been studied within the context of some of these conditions, but for others, little attention has been given to the potential role of underlying RI deficits. Even for those conditions within the OCRD classification that have been examined alongside RI capabilities, there is a paucity of work examining the three specific subprocesses of RI; most extant studies have only used one paradigm to examine RI as a whole, rather than capturing subfacets of the construct.

As such, we provide a brief summary of the extant literature or rationale for the inclusion of these disorders in the proposed study.

Obsessive-Compulsive and Related Disorders

It has been suggested RI may play a role in the etiology and maintenance of obsessive-compulsive disorder (OCD), a disorder characterized by distressing and persistent obsessions and/or compulsions (American Psychiatric Association, 2013). In a study examining RI capabilities in participants with OCD versus panic disorder, participants completed go/no-go and Stroop tasks, which assess behavioral inhibition and cognitive inhibition, respectively (Bannon, Gonsalvez, Croft, & Boyce, 2002). Participants with OCD were more likely to make commission errors on the go/no-go task and had slower reaction times on interference trials of the Stroop task. A study comparing OCD patients to matched healthy controls examined response inhibition on measures of both motor and cognitive inhibition, and found that the OCD patients performed significantly worse on go/no-go, motor Stroop, and stop signal tasks (Penadés et al., 2007).

When considering creating a new classification grouping for obsessive-compulsive and related disorders (OCRDs) in the DSM-5, researchers cited shared cognitive deficits as a potential hallmark of these disorders (Stein et al., 2010), suggesting their underlying role in OCRDs warrants further study. Included within the OCRD family are body-focused repetitive behaviors (BFRBs), including trichotillomania (hair-pulling disorder) and excoriation (skin-picking) disorder. Trichotillomania is a disorder characterized by irresistible urges to pull one's own body hair (American Psychiatric Assocation, 2013). A study by Chamberlain, Fineberg, Blackwell, Robbins, and Sahakian (2006) examined motor inhibition and cognitive flexibility in patients with OCD, patients with trichotillomania, and healthy participants. Both patients with

OCD and trichotillomania demonstrated deficits in inhibiting motor responses on a stop-signal task, but this impairment was more pronounced in the trichotillomania patients. Further, the degree of this deficit was correlated with symptom severity. More recent research investigating the association between RI and trichotillomania has examined impaired RI and excess cortical thickness as possible endophenotypes for trichotillomania (Odlaug, Chamberlain, Derbyshire, Leppink, & Grant, 2014). Excoriation (skin-picking) disorder is characterized by distressing urges to pick at one's own skin (American Psychiatric Association, 2013). Compared to healthy controls, skin pickers have shown significantly impaired inhibitory control as measured by a stop-signal task, but intact cognitive flexibility (Odlaug, Chamberlain, & Grant, 2010). In this study, symptom severity was not related to degree of deficit.

Hoarding disorder is characterized by difficulty in parting with possessions (regardless of value) resulting in impairing accumulation of objects (American Psychiatric Association, 2013). In a study examining neuropsychological impairment in hoarding, hoarding patients demonstrated difficulties initiating responses and inhibiting prepotent responses as compared to mixed clinical and nonclinical groups (Grisham, Brown, Savage, Steketee, & Barlow, 2007). However, Grisham and colleagues utilized the Conners' Continuous Performance Test – Second Edition, which is typically used to determine if the examinee's pattern of responses are indicative of ADHD. Tolin, Witt, and Stevens (2014) conducted an imaging study examining hemodynamic responses in hoarding patients, OCD patients, and healthy controls. While researchers did not find differences in behavioral data from a go/no-go task, they did find different neural activation on the task. When making commission errors on the go/no-go task, increased activity was found in the left and right orbitofrontal gyrus for OCD patients, but not for hoarding patients or healthy controls. On successful no-go trials, hoarding patients demonstrated

greater activation in the right precentral gyrus while OCD patients showed greater activation in the right orbitofrontal cortex. Researchers cited this as support for hoarding disorder being distinct from OCD with regards to classification, but it is still unclear if hoarding disorder is linked to RI deficits given similarities in performance on the go/no-go task.

Body dysmorphic disorder (BDD) is characterized by a preoccupation with a perceived flaw in one's physical appearance (American Psychiatric Association, 2013). To the best of our knowledge, at this point in time no work has been done examining RI and BDD. However, it is possible that RI deficits could play a role in compulsive behaviors in BDD, such as mirror checking, measuring body parts, or excessive grooming.

Tic disorders are characterized by recurrent and sudden nonrhythmic motor movements or vocalizations, and includes the diagnoses of Tourette syndrome, persistent (chronic) motor or vocal tic disorder, and provisional tic disorder (American Psychiatric Association, 2013). While this particular diagnosis is not classified as an OCRD in the DSM-5, some researchers proposed it should be given its high comorbidity with OCD (e.g., Roessner, Becker, Banaschewski, & Rothenberger, 2005). Rather than moving tic disorders to be grouped with OCRDs, a tic-related specifier was added for OCD in DSM-5, which still suggests underlying similarities between these two families of disorders (Van Ameringen, Patterson, & Simpson, 2014). Further, symptoms of tic disorders are typified by involuntary behaviors, similar to the aforementioned OCRD symptoms. As such, tic symptoms were included in the present study to better understand their association with RI capabilities. A study of comorbid Tourette syndrome and OCD alongside healthy controls and patients with just OCD, comorbid participants had more significant impairment in monitoring and RI (Müller et al., 2003). In order to clarify the relationship between Tourette syndrome and RI deficits, researchers compared performance

between adolescent boys with Tourette syndrome and no history of medication to healthy controls on a go/no-go task (Roessner, Albrecht, Dechent, Baudwig, & Rothenberger, 2008). Results showed no significant differences in task performance between the two groups, but the authors suggested that boys with Tourette's may employ other compensatory mechanisms to override tics. More recently, researchers have sought to better understand executive functioning in adults with Tourette syndrome, whose executive functioning systems are more mature than those of children. In comparing performance of adults with Tourette syndrome to healthy controls, RI deficits emerged as the predominant executive functioning impairment (Yaniv et al., 2017). Further, the authors suggested that the magnitude of RI deficits may impact tic symptom severity.

Present Study

While extant literature has explored the relationship between RI deficits and various OCRDs, it leaves numerous questions unanswered. First, for some of the OCRD symptoms, there is a paucity of research examining the potential association with RI capabilities. Further, in other areas of the current literature, mixed findings have resulted in ambiguity regarding the relationship between RI deficits and clinical symptoms. Additionally, little is known about the three RI subcomponents that have begun to gain more traction in the literature. What are the patterns of RI deficits associated with these various disorders? Are different clinical symptoms characterized by deficits in specific subcomponents of RI?

These questions led to the current study: an examination of RI capabilities and assessment of symptom severity across numerous RI-relevant OCRD symptom categories. Participants were recruited and completed assessments online through Amazon's Mechanical Turk (MTurk) platform. Clinical symptoms were assessed through completion of relevant self-

report questionnaires, while RI capabilities were assessed through three computerized cognitive tasks. In order to enroll in the study, potential participants first completed a prescreening survey in which they were required to endorse at least some level of clinical symptoms of at least one disorder to participate (i.e., they were not required to meet diagnostic status and do not need to endorse symptoms of all included conditions). An analogue sample was used in the present study, as non-clinical samples can still yield valuable new information in the field for several reasons. First, the included conditions are not dichotomous; they exist on a continuum. Capturing data from participants with a potentially wide range of OCRD symptom severity may allow to better examine how the magnitude of RI deficits is related to symptoms of OCRDs. Further, given the low base rates for many of the included range of psychological conditions, it was not feasible to recruit a large sample of participants meeting diagnostic criteria for all of the included clinical symptoms.

The following specific aims were proposed:

First, while some OCRD symptoms have been studied alongside RI, others have not (and in those that have, findings have been somewhat inconclusive). We sought to examine if OCRD symptoms and RI deficits are related (Aim 1). The potential association between RI capabilities and symptom levels were examined on both an individual condition level (i.e., individual symptom clusters and RI indices) (Aim 1a), as well as overall OCRD symptoms and RI capabilities (i.e., composite scores) (Aim 1b). Based on literature showing significant RI problems in these disorders, as well as clinical observations for other disorders whose association with RI capabilities have not been thoroughly investigated, we predicted positive correlations between RI deficits and symptom level.

Pending successful findings of Aim 1, further analyses were planned to be conducted to examine the nature of the observed association. More specifically, whether RI deficits would be more important predictors of OCRD symptoms above and beyond other concomitant clinical symptoms (Exploratory Aim). Other planned covariates included demographic variables such as gender, education, and age, as well as clinical factors such as sleep quality, general impulsivity, negative affect, and motivational dimensions of OCRDs (i.e., incompleteness and harm avoidance). These relationships were to have been examined on both an individual level (i.e., individual symptom clusters and RI indices), as well as overall OCRD symptoms and RI capabilities (i.e., composite scores). We predicted that after controlling for other covariates, RI deficits would still be a significant predictor of clinical symptom severity.

Method

Participants

Participants (i.e., Workers) were recruited through MTurk, an online marketplace in which individuals complete "Human Intelligence Tasks (HITs)" in exchange for payment (see below for additional information about MTurk). Inclusion criteria included endorsing at least some presence of relevant clinical symptoms on the brief prescreening survey, being age 18 to 60, access to a desktop or laptop computer with internet access, living in the United States, being a fluent English speaker, and the absence of uncorrected hearing or vision impairments that could impact task completion. Four hundred eighty-two Workers signed the online consent form. Of those 482, 315 Workers were found to be eligible after the prescreening questionnaire (i.e., endorsed at least one relevant clinical symptom). Of the 315 eligible workers, 125 completed all steps of the study and were believed to have been honest while attempting to enroll in the study, as well as putting forth good effort on all measures. In addition to these 125

completers, three others were excluded from analyses for various reasons. First, one completer was found to have completed the study twice. Batches of HITs were posted at various times, and this Worker completed the HIT twice prior to the researchers implementing qualifications on MTurk to prevent repeat Workers. Their first set of data was selected for inclusion in analyses given that it would be considered the most authentic and novel. A second completer was found to have attempted the consent/prescreening procedure more than once (after failing to qualify their first time through), as well as demonstrating extremely poor task performance suggestive of inattention to directions. A third completer demonstrated extremely poor performance on all three cognitive tasks, again indicative of lack of effort or gross inattention to instructions.

Mean age of the sample was 32.33 (*SD* = 9.89). Workers were allowed to self-report as many ethnicities as they felt appropriate, hence a cumulative percentage over 100%. 73.6% self-reported as Caucasian/White, 2.4% as American Indian/Alaskan Native, 4.0% as Asian, 15.2% as African American/Black, 8.8% as Spanish/Hispanic, and 0.8% as Middle Eastern. 68.8% self-reported as female, 30.4% as male, and 0.8% (i.e., one Worker) self-identified as "female to male."

Amazon Mechanical Turk

MTurk is an online marketplace originally designed for completion of jobs such as transcription and other tasks that cannot always be accurately executed by computers. In recent years, researchers have begun to use MTurk as a means of participant recruitment. Samples recruited through MTurk have been found to be highly representative of the general population with regards to demographic qualities such as age, gender, and income (Ross, Zaldivar, Irani, & Tomlinson, 2009). Through various investigations in recent years, researchers have begun to arrive at the conclusion that MTurk is a valid tool for research, and that it yields high-quality

data (e.g., Buhrmester, Kwang, & Gosling, 2011; Berinsky, Huber, & Lenz, 2012; Goodman, Cryder, & Cheema, 2012). A study conducted by Shapiro, Chandler, and Mueller (2013) found that MTurk can aid researchers in working with clinical populations (as opposed to nonclinical samples typically recruited through universities), but that care should be taken given potential motivation for malingering. The use of cognitive tasks in MTurk studies has demonstrated similar performance to the same tasks in a laboratory setting (Crump, McDonnell, & Gureckis, 2013). MTurk allows for researchers to apply selection criteria to target specific populations, as well as to ensure better quality data. Additionally, recruitment through MTurk is both time and cost efficient, particularly when compared to laboratory-based studies.

Measures of Response Inhibition

Three computerized cognitive tasks were used to measure the three subprocesses of RI. Workers were required to download the free Inquisit software to their personal computers in order to execute the tasks. The tasks were presented to Workers in a randomized order.

Go/no-go task. A go/no-go task (Casey et al., 1997) was used to measure action withholding, which is the ability to inhibit a pre-potent response. In this task, participants were presented with target and distracter symbols. They were directed to press the response key when the target object appeared (i.e., go trial), but refrain from responding to a distracter (i.e., no-go trials). In this task, participants were instructed to respond by pressing the space bar for all letters except for X (see Figure 1). Number of commission errors served as the primary outcome variable in this task.

This particular version of the task included one practice block with eight trials, with a 50/50 split of go trials and no-go trials for the practice. Participants were given feedback on

performance during the practice block, but not during the actual testing block. There was one test block consisting of 140 trials, 75% of which are go trials and 25% are no-go trials.

Stop-signal task. A stop-signal task (Chamberlain et al., 2006, 2007) was used to measure action cancellation, which is the ability to inhibit an ongoing response. In this task, participants were instructed to indicate the orientation of the arrow on the screen using response keys, but were directed to inhibit their response when a stop signal (auditory beep) followed (see Figure 2). The length of time between the presentation of the visual stimulus and stop signal is referred to as the stop-signal delay (SSD). Using a tracking algorithm, stop-signal reaction time (SSRT = mean go RT – mean SSD) was the primary outcome variable for this task. This particular version of the stop-signal task utilized a tracking algorithm to adjust the stop-signal delay to maintain a 50% inhibition success rate on stop-signal trials. The initial SSD was 250 milliseconds long, with the value adjusted by 50 milliseconds after each trial to try and maintain the 50% success rate. The minimum length of the SSD is 0 milliseconds.

This task included one practice block with 32 trials, 75% of which were go trials and 25% of which were stop trials. The SSD on the last trial of the practice block was carried over to the main testing block. Testing included three test blocks with 64 trials each for a total of 192 trials. Testing blocks utilized the same 75% go/25% stop ratio as the practice block for trials.

Flanker task. A flanker task (adapted from Eriksen & Eriksen, 1974) was used to measure interference control, which measures the ability to filter out extraneous information to focus on a target. In this task, participants were directed to indicate the orientation of an arrow on screen while controlling the interference of surrounding arrows. In some trials the surrounding arrows were all facing the same direction as the target (congruent trials) and in others they were not (incongruent trials) (see Figure 3).

This task included one practice block with 12 trials, 50% congruent versus 50% incongruent. There was one testing block with a total of 80 trials, also 50% congruent and 50% incongruent. Two separate outcome variables were used in analyses. The first of these considered interference control, which was the value of reaction time in correct incongruent trials minus reaction time in correct congruent trials (with a larger value indicating poorer performance). The second of these was a deficit index, which was the value of the number of errors in incongruent trials minus number of errors in congruent trials (again, with a larger value indicating poorer performance). In calculating the RI index composite score, these two variables were first transformed into z-scores and averaged, then this combined flanker task score was averaged with the z-scores for the other cognitive task outcome variables. This ensured that the flanker task was weighted equally with the other tasks in the RI composite score.

Measures of Symptoms

The following questionnaires were be included in the Qualtrics survey. These measures are designed to assess symptom severity (i.e., they are not intended to be diagnostic in nature). Time frames were modified to assess symptoms in the past four weeks for scales with no time frame or whose original anchor points extend further back. See Table 1 for additional information on each measure.

Adult Tic Questionnaire (ATQ; Abramovitch et al., 2015). The ATQ was used to assess for the frequency, intensity, and severity of a wide range of motor and vocal tics. The ATQ yields separate total frequency, intensity, and severity scores for both motor and vocal tics. Further, it also yields a global tic severity score.

Obsessive-Compulsive Inventory – Revised (OCI-R; Foa et al., 2002). The OCI-R was used to assess for the severity of OCD symptoms. It yields a total score and five subscale scores: checking, hoarding, neutralizing, obsessing, ordering, and washing.

Massachusetts General Hospital Hairpulling Scale (MGH-HPS; Keuthen et al., 1995). The MGH-HPS was used to assess the severity of trichotillomania symptoms. Participants answered questions about hair pulling urges, actual hair pulling, and the consequences of hair pulling. Items are summed to produce a total score.

Skin Picking Scale – Revised (SPS-R; Snorrason et al., 2012). The SPS-R was used to assess the severity of excoriation disorder symptoms. Participants answered questions about urges to pick skin, time spent picking, impairment caused by the picking, and resulting skin. Items are summed to produce a total score.

Hoarding Rating Scale (HRS; Tolin, Frost, & Steketee, 2010). The HRS was originally designed as a brief interview to assess for the presence and severity of compulsive hoarding. However, a self-report adaptation of the same items has demonstrated strong correlations with the interview version of the measure, as well as high agreement with diagnostic status based on self- and interviewer-report (Tolin, Frost, Steketee, & Fitch, 2008). Items are summed to produce a total score.

Body Dysmorphic Disorder Symptom Scale (BDD-SS; Wilhelm, Greenberg, Rosenfield, Kasarskis, & Blashill, 2016). The BDD-SS is self-report measure that assesses a wide range of BDD and BDD-related symptoms and their severity. Participants first indicate the presence of symptoms within a total of seven symptom categories by selecting "yes" or "no." These categories include: checking, grooming, weight/shape, picking/plucking, avoidance, surgical/dermatological, and cognitions. Then, participants collectively rate the severity of

present symptoms within each symptom category. The BDD-SS yields two scores: a total severity score (sum of the seven severity scores) and a total symptom score (number of specific symptoms endorsed).

Other Self-Report Measures

The following measures were also included in the Qualtrics survey. These measures are self-report and were originally included to serve as potential covariates during data analysis.

Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995). The BIS-11 is a 30-item self-report measure that assesses general impulsivity. Items are rated on a 4-point scale from 1 (rarely/never) to 4 (almost always/always). It yields a total score, three second-order factors, as well as six first-order factors. The first-order factors combine to produce the second-order factors as such: attention and cognitive instability items make up the attentional factor, motor and perseverance items make up the motor factor, and self-control and cognitive complexity items make up the nonplanning factor.

Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1991). Given that sleep deprivation has been found to impact RI capabilities (Drummond, Paulus, & Tapert, 2006), we assessed sleep quality. The PSQI is a19-item self-report measure that assesses quality of sleep over the previous month. Participants rate answers on a 4-point scale from 0 (not during the past month; very good) to 4 (three or more times a week; very bad). It produces seven different component scores: duration of sleep, sleep disturbance, sleep latency, day dysfunction due to sleepiness, sleep efficiency, overall sleep quality, and needing medication to sleep. These component scores are summed to yield an overall total score, with a score of five or below being associated with good sleep quality.

State-Trait Anxiety Inventory (STAI-T; Speilberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The trait subscale of the STAI was administered to assess dispositional experiences of anxiety and stress. The STAI-T consists of 20 self-report items rated on a 4-point scale from 1 (almost never) to 4 (almost always).

Depression Anxiety Stress Scales – short form (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 is a 21-item self-report scale that assesses three components of negative affect: depression, anxiety, and stress. Items are scored on a 4-point scale from 0 (did not apply to me at all – never) to 3 (applied to me very much, or most of the time – almost always). It yields three scores for each of these areas, as well as a total score, which are doubled to be compared to the original 42-item DASS.

Sheehan Disability Scale (SDS; Sheehan, Harnett-Sheehan, & Raj, 1996). The SDS is a three-item self-report scale designed to assess how symptoms impact functioning across several domains: work/school, social life, and family life/home responsibilities. These three domains are assessed on an 11-point scale from 0 (no impairment) to 10 (extreme disability). While there are no official cutoff scores, scores above a five on any of the domain scales typically indicate significant functional impairment.

Obsessive-Compulsive Trait Core Dimensions Questionnaire (OCTCDQ; Summerfeldt, Kloosterman, Antony, & Swinson, 2014). The OCTCDQ is a 20-item self-report measure designed to assess two motivational dimensions in OCD: harm avoidance and incompleteness. Items are rated on a 5-point scale from 0 (never) to 4 (always). It yields two scores, one for each core dimension.

Procedure

Potential participants first completed a brief screener questionnaire that assessed for the presence of any symptoms included in the study (about one question per condition). Provided they answered "yes" to at least one of the screener questions, participants were invited to enroll in the full study. All questionnaires and cognitive tasks were completed from participants' personal computers. Questionnaires were completed through Qualtrics. Participants were compensated $0.10 if they were ineligible for the study based on an absence of clinical symptoms or if they were eligible but withdrew before completing all aspects of the study. Eligible participants that completed all three tasks and the full questionnaire battery were compensated a total of $5.00.

Data Analysis Plan

First, two overall composite scores were calculated. The first of these was an overall RI impairment composite, the second an overall symptom severity composite. For the overall RI impairment composite, this was done by transforming each of the RI indices (i.e., SSRT from the stop-signal task, interference control and the deficit index from the flanker task, and commission errors from the go/no-go task) into z-scores and then averaging these z-scores to create one composite score. For any individuals who demonstrated abnormally poor performance on any tasks (e.g., extremely low accuracy, indiscriminant responding, etc.), their RI impairment composite was adjusted to exclude those particular tasks. Poor performance was operationalized in the following manner. For the stop-signal task, participants' whose chance of responding on stop trials that deviated significantly from 50% (which was the target based on the tracking algorithm). For the flanker task, participants with accuracy below 80% or abnormally long reaction times approaching 1000 milliseconds. For the go/no-go task, accuracy below 80% or abnormally long reaction times approaching 1000 milliseconds. For the overall symptom severity

composite, the composite score was calculated by transforming each of the total scores from the self-report symptom severity measures into a z-score and then averaging these z-scores to create one composite score.

Zero-order Pearson correlations were then computed and multiple linear regression analyses were conducted to determine if RI deficits were significantly associated with clinical symptoms (Aim 1). This was done using individual RI indices and symptom severity measures (Aim 1a), as well as the RI impairment and symptom severity composites (Aim 1b). Given the preliminary and exploratory nature of the investigation of this aim, a correction procedure for the Type-1 error inflation was not applied to avoid the possibility of failing to detect the relationship due to overly stringent criteria.

Further, to examine the RI-symptom association among those displaying high levels of OCRD symptoms, an additional set of regression analyses was conducted with only those participants endorsing significantly elevated symptoms for each of the OCRD categories. These analyses were conducted with symptom severity as the dependent variable, and RI indices (both individual and composite, in separate models) as the independent variables.

Results

Descriptive statistics of participants' symptom severity scores and RI indices are presented in Table 2. Correlations between symptom severity scores, RI indices, and measures included as potential covariates are presented in Table 3. The only statistically significant association between RI indices and symptom severity scores that emerged was that of hoarding and errors for interference on the flanker task, but this relationship was relatively weak, $r(122) = 0.19$, $p = 0.04$, small effect.

First, regression analyses were conducted with the entire completer sample, as doing so allowed for a dimensional approach to the included OCRD symptoms. When entering all four RI indices into the model as separate predictors, SSRT on the stop-signal task, interference control and the deficit index on the flanker task, and commission errors on the go/no-go task as a set were not significant predictors of the symptom severity composite score, $R^2 = 0.02$, $F(4, 119) = 0.63$, $p = 0.65$. Neither SSRT on the stop-signal task ($\beta = 0.05$, $t = 0.52$, $p = 0.61$), interference control ($\beta = -0.01$, $t = -0.09$, $p = 0.93$) or the deficit index on the flanker task ($\beta = 0.13$, $t = 1.37$, $p = 0.18$), nor commission errors on the go/no-go task ($\beta = -0.01$, $t = -0.06$, $p = 0.95$) had significantly unique contributions in predicting the symptom severity composite. Similarly, when the RI composite was entered into the model as a single predictor ($\beta = 0.08$, $t = 0.90$, $p = 0.37$), it was also not a significant predictor of symptom severity as a whole, $R^2 = 0.01$, $F(1, 123) = 0.81$, $p = 0.37$. Given the lack of significant associations between the RI indices and symptom severity measures, regression analyses were not conducted including the proposed covariates, as it was no longer relevant to examine if RI capabilities were predictors of symptom severity above and beyond other related constructs.

Since the null findings in the RI-symptom association could be due to the overall low level of symptom severity, additional set of regression analyses was conducted including only those displaying significantly elevated symptoms for each of the OCRD categories. To this end, rather than including all completers in each set of regression analyses, cutoff scores (see Table 1) were used to include only those participants that reported OCRD symptoms at a level that would be indicative of being clinically significant. In doing so, RI composite scores were recalculated for each set of regression analyses so that z-scores included in the composite were standardized based on only the participants at or above the clinical cutoff for each particular measure. For

symptom severity measures that did not have a validated cutoff score (i.e., ATQ and BDD-SS), only participants at the 50th percentile (i.e., the median) and above for the corresponding measure for the present sample were included. For the ATQ, this was a score of 9 or above; for the BDD-SS, this was a score of 13 or above. It should be noted that the sample size (n = 11) for participants above the cutoff of ≥ 13 on the MGH-HPS was considered too small for regression analyses. As such, they were not conducted with the sample reporting significantly elevated symptoms of trichotillomania. Results of these regression analyses are presented in Tables 4 and 5. Of these regression analyses including either the 4 RI individual indices or the composite RI index as predictors, the only model that emerged as statistically significant was that in which the RI composite was used to predict hoarding symptom severity, R^2 = 0.15, $F(1, 37) = 6.75$, p = 0.01. When considering the regression model using individual RI indices to predict hoarding symptom severity, it suggests that SSRT is likely the only predictor marginally significantly contributing to the RI composite, $\beta = 0.32$, $t = 1.94$, $p = 0.06$.

Discussion

This study sought to examine the RI indices and their association with various OCRD symptoms. Contrary to hypotheses, no statistically significant RI-symptom associations were found for most of the OCRD symptom categories. Exceptions to this include a weak positive correlation between hoarding symptom severity and number of errors on the flanker task. Additionally, overall RI composite index was found to be a significant predictor of hoarding symptoms in individuals reporting elevated symptoms. Regression analyses for this same hoarding sample using separate RI indices suggest that SSRT tended to contribute to predicting symptom severity. RI deficits and impulsivity have been found to predict hoarding symptoms, above and beyond other OCD symptoms (Grisham et al., 2007). Further, inattention (but not

hyperactivity/impulsivity) symptoms of attention-deficit/hyperactivity disorder have been found to predict hoarding symptoms (Tolin & Villavicencio, 2011). This may help to explain why the number of errors on the flanker task was the only RI index significantly correlated with hoarding in the present study. However, the overall pattern of proposed associations between RI capabilities and OCRD symptoms was largely unsupported in this study.

Despite the existence of mixed findings, there is a fairly well-established literature demonstrating the RI deficits in OCD and its related conditions (e.g., Penadés et al., 2007; Chamberlain et al., 2006; Grisham et al., 2007; Yaniv et al., 2017; Lipszyc & Schachar, 2010). Thus, it is important to consider several aspects of this study that may have contributed to its null findings. First, while analogue samples may endorse symptoms of the included conditions given that they exist on a spectrum, perhaps this sample overall did not possess sufficiently severe symptoms to display their associated RI deficits. Additionally, while some of the included OCRD symptoms are likely to be found in the general population, others are more difficult to capture in an analogue sample. For example, trichotillomania and excoriation disorder are conditions that are less so on a continuum than others; an individual either pulls their hair/picks their skin, or they do not. It is possible that potential participants that pull or pick at subclinical levels (e.g., lack of lesions, presence of urges that are not necessarily acted on, etc.) were not captured by the simple yes or no questions in included in the screener. As other researchers have noted, diagnoses such as trichotillomania and excoriation disorder rely on monothetic criteria, often making it difficult to assess and examine them in a more dimensional manner (Houghton et al., 2015). Further, while the sample recruited for this study was large enough to detect a medium sample size, not every eligible participant demonstrated symptoms for all of the included OCRDs. Nevertheless, additional analyses that utilized only participants who scored at

or above clinical cutoffs on corresponding OCRD measures still did not reveal significant associations between symptom severity and RI capabilities.

Second, while MTurk has been established as a valuable research tool, it is possible that its methodological shortcoming may have resulted in the failure to accurately assess RI deficits using the online cognitive tasks. In conducting this study entirely online with no direct contact with participants, it is possible that some participants may not have fully understood the computerized cognitive tasks or questionnaires. Individuals whose data on individual cognitive tasks that were excluded from their RI composite provide evidence for not understanding task instructions (e.g., responding to every trial on the stop-signal task), but this occurred for only a very small number of participants. It is also possible that some participants may have completed similar tasks on other HITs, which could potentially have improved their performance on the tasks on this particular study. The MTurk platform does not allow for researchers to have access to a Worker's work history. Asking Workers if they completed similar tasks in the past is not feasible, given they are unlikely to remember their names if presented with them. Further, many Workers have completed hundreds or thousands of HITs, making it quite difficult for them to accurately recall the wide range of tasks they may have formerly completed. Another limitation of the MTurk platform is that given the monetary incentive, some participants may have responded in such a way to ensure that they would qualify for the full study (i.e., motivation for malingering). As such, it is possible that participant responses may have been artificially inflated. Other researchers have taken steps to prevent malingers from skewing data, utilizing tools such as validity scales from the MMPI-2 (e.g., Arch & Carr, 2017). In reviewing data from prescreening surveys, some potential participants did indeed appear to employee dishonest tactics in order to qualify for the study. Repeat IP addresses and MTurk Worker IDs were found

within these data. Efforts were made to exclude any participants who appeared to try and qualify for the study more than once.

Finally, perhaps the association between RI and OCRD symptoms is present, but not quite as robust as previously thought. The current body of literature contains mixed findings when comparing measures of RI in clinical versus non-clinical samples, as well as across various disorders. Both null and significant findings concerning RI deficits and psychopathology have been found in the literature on OCD (Bannon et al., 2002; Hamo, Abramovitch, & Zohar, 2018; Kalanthroff et al., 2017; Penadés et al., 2007), trichotillomania (Bohne, Savage, Deckersbach, Keuthen, & Wilhelm, 2008; Chamberlain et al., 2006; Odlaug et al., 2014), excoriation disorder (Odlaug, Chamberlain, & Grant, 2010; Oliveira, Leppink, Derbyshire, & Grant, 2015), hoarding disorder (Grisham et al., 2007; Tolin et al., 2014), and tic disorders (Eichele et al., 2010; Müller et al., 2003; Roessner et al., 2008; Yaniv et al., 2017). However, a recent meta-analysis examining studies employing the stop-signal task indicated that OCD is the condition most strongly characterized by RI deficits, even when compared to attention-deficit/hyperactivity disorder (Lipszyc & Schachar, 2010). Nonetheless, as is demonstrated by the current body of work and the results of the present study, findings regarding RI deficits and other OCRDs appear less consistent. Overall, the findings of this study contribute to the existing literature showing null findings regarding the relationship between RI deficits and symptoms of OCRDs. In contrast, there was a significant positive correlation between general impulsivity (as measured by the BIS-11) and trichotillomania, excoriation, hoarding, and BDD symptom severity, as well as the overall symptom composite. OCRD symptom severity may be differentially related to self-reported versus behaviorally-assessed impulsivity and disinhibition. Overall, further research is needed to better understand the potential link between RI and OCRDs, using better research

methodologies (examining various modes of assessment for inhibitory control – e.g., online vs. offline, self-report vs. computerized cognitive tasks) and clinical samples before firmer conclusions can be drawn.

As for the three RI subprocesses, this study was not successful in detecting any differential associations between specific OCRDs and these subprocesses. However, the lack of significant associations among the RI indices do lend support to the three subprocesses as being distinct subfacets of RI. The only significant correlation found among the three tasks was that of commission errors on the go/no-go task and the deficit index on the flanker task. Overall, the considerable lack of intercorrelations of the RI indices suggest that action withholding, action cancellation, and interference control as measured by the go/no-go, stop-signal, and flanker tasks (respectively) may be distinguishable subfacets of RI as a singular construct. These findings support extant literature proposing that RI is made up of various subprocesses that can be assessed by separate tasks measuring non-overlapping aspects of RI as a whole (Sebastian et al., 2013). While the results of the present study support these separate subprocesses, they did not provide evidence that different disorders within the OCRDs cluster are characterized by specific RI subprocesses deficits (with the exception of interference control in hoarding).

Limitations

The present study is not without its limitations. Some of these limitations may have potentially contributed to the null findings. First and foremost, while the use of an analogue sample was appropriate given that the include conditions exist on a continuum, it is possible that the potential associations between OCRD symptoms and RI capabilities was not found due to OCRD symptom levels or its associated psychopathology not being severe enough. However, even after examining only those participants at or above clinical cutoff scores on each symptom

severity measure, the proposed relationship was not supported. Thus, the RI-OCRD associations need to be examined using individuals presenting with clinically impairing OCRD psychopathologies.

While using MTurk allowed for more efficient and economical recruitment, it is also not without its limitations. First and foremost, conducting this study entirely online with no face-to-face contact with participants may have resulted in potentially inflated symptom reports for enrollment in the study. Above and beyond potential issues with participants potentially being dishonest due to monetary incentives, the use of only self-report measures to capture symptom severity may have been impacted by lack of insight (whether that be participants rating themselves as having more or less severe symptoms than they actually possess). Another limitation of the present study due to no individual contact with participants is a lack of information regarding the substantial dropout of eligible participants after prescreening (i.e., 190 dropped out of 315). This study included an "ethical withdrawal" option, generating the validation code required to receive MTurk payment immediately after the prescreening survey. A second unique code was generated after the completion of the study. Many studies do not employ this set-up, meaning participants that choose to withdraw partway through are not captured by the MTurk system (i.e., they are not counted as a Worker if they do not submit the required validation code). It is possible that some participants were satisfied with the $0.10 they earned from completing the prescreening portion of the study, and did not feel motivated to continue further, resulting in the significant dropout. The present study did not collect detailed information about dropouts (i.e., questionnaires were administered at a stage of data collection they did not complete), so it is not possible to determine if certain RI-relevant characteristics were related to who dropped. For example, perhaps likelihood of electing not to complete all

portions of the study was related to conscientiousness, impulsivity, or resiliency. Finally, it was not possible to know if participants had completed any of the three cognitive tasks as part of other studies. The included sample largely demonstrated excellent performance on the three tasks, and it is possible that repeated completion of these tasks may have resulted in practice effects bolstering their RI capabilities.

Implications and Directions for Future Research

While the present study expands upon our knowledge of the relationship between RI, its three subprocesses, and clinical symptoms, it only seems to contribute to the extant mixed findings regarding these associations. Future studies should consider improving upon the aforementioned methodological limitations that may have contributed to the null findings of the present study. Should more definitive evidence be found in support of the relationship between RI and OCRD symptoms, future studies should consider examining these variables across multiple time points as a majority of extant literature are correlational and cross-sectional in nature. Doing so would serve multiple purposes. First, it would provide more insight into how stable they are over time. Do we see any significant fluctuation across multiple time points, or do they largely remain the same? Second, examining these variables longitudinally will provide researchers with more evidence regarding potential directions of causality. Are RI deficits leading to clinical symptoms, or are clinical symptoms resulting in decreased RI capabilities? Lastly, in order to truly understand a potential causal relationship between RI capabilities and clinical symptoms, future work should consider manipulating or modifying RI capabilities. Computerized training programs aimed at improving RI deficits and examining changes in clinical symptom severity would provide the most definitive support for such a hypothesized causal relationship.

Presentation of target and distracter

Participant should respond

Participant should not respond

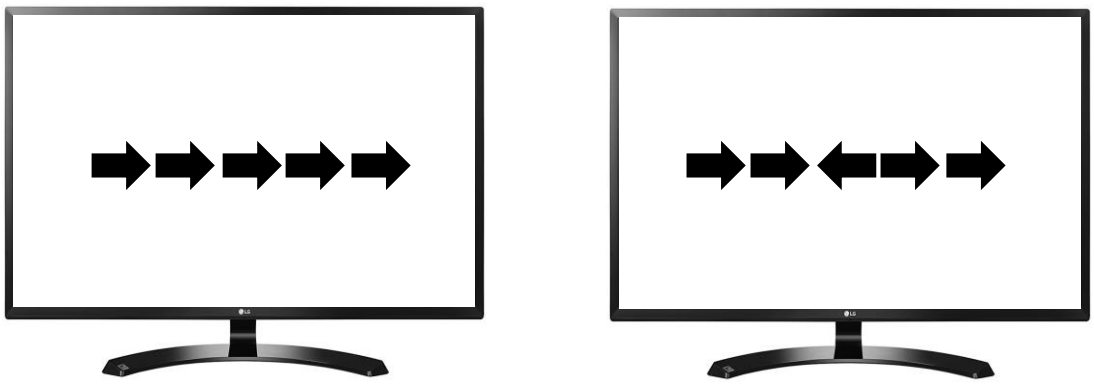
Figure 1. Schematic representation of go/no-go task. Participants are asked to press the spacebar for all letters except for X.

Participant should indicate arrow is pointing right

Participant should indicate arrow is pointing left

Participant should not respond when auditory tone is present

Figure 2. Schematic representation of stop-signal task. Participants should respond with orientation of arrow, except when an auditory tone is present.



Congruent trial Incongruent trial

Figure 3. Schematic representation of flanker task. Participants should quickly respond with orientation of center arrow.

Table 1

Measures of Symptoms

Measure	Number of Items	Response Format	Psychometrics	Scores		Time Frame	
				Range	Cutoff	Original	Modified
Adult Tic Questionnaire (ATQ)	27	Mixed; presence on 2-point scale (0-1), frequency and intensity on 4-point scales (1-4)	Internal consistency: total tic severity (α = .91), total intensity (α = .83); Test-retest: total severity (*r* = .87)	0-28	N/A	Past week	N/A
Obsessive-Compulsive Inventory – Revised (OCI-R)	18	5-point scale (0-4)	Internal consistency: total scale (α = .81); Test-retest: total and subscales (*r* = .74 - .91)	0-72	21	Past month	N/A
Massachusetts General Hospital Hairpulling Scale (MGH-HPS)	7	5-point scale (0-4)	Internal consistency: total (α = .85)	0-28	13	Past week	N/A
Skin-Picking Scale – Revised (SPS-R)	8	5-point scale (0-4)	Internal consistency: total (α = .83)	0-32	7	Past week	N/A
Hoarding Rating Scale (HRS)	5	9-point scale (0-8)	Internal consistency: total (α = .97); Test-retest: total (*r* = .96)	0-40	14	None	Past four weeks
Body Dysmorphic Disorder Symptom Scale (BDD-SS)	54	11-point scale (0-10)	None available	0-70	None currently established	Past week	N/A

Table 2

Descriptive Statistics of Symptom Severity Measures and RI Indices

	N	Mean	Standard Deviation
ATQ Total	125	14.11	15.66
OCI-R Total	125	18.16	12.52
MGH-HPS Total	125	2.42	5.32
SPS-R Total	125	5.94	5.92
HRS Total	125	9.54	8.96
BDD-SS Total Severity	125	16.46	12.83
Symptom Composite	125	0.00	0.67
Stop-Signal Reaction Time (ms)	111	250.35	49.65
Flanker: Reaction Time Interference (ms)	122	81.29	34.92
Flanker: Error Interference	121	1.58	2.04
Go/No-Go: Commission Errors	123	5.27	3.53
RI Composite	125	0.00	0.64

Note. ATQ = Adult Tic Questionnaire; OCI-R = Obsessive-Compulsive Inventory – Revised; MGH-HPS = Massachusetts General Hospital Hairpulling Scale; SPS-R = Skin Picking Scale – Revised; HRS = Hoarding Rating Scale; BDD-SS = Body Dysmorphic Disorder Symptom Scale.

Table 3

Correlations of RI Indices, OCRD Symptom Measures, and Covariate Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1.Stop-Signal: SSRT	1.00																					
2.Flanker: RT Interference	0.13	1.00																				
3.Flanker: Error Interference	0.10	-0.15	1.00																			
4.Go/No-Go: Commission Errors	0.15	0.03	0.28**	1.00																		
5.RI Composite	0.50**	0.32**	0.51**	0.71**	1.00																	
6.ATQ	0.04	0.06	0.02	0.13	0.09	1.00																
7.OCI-R	0.04	0.03	0.09	0.06	0.04	0.41**	1.00															
8.MGH-HPS	0.06	-0.05	0.07	-0.05	0.03	0.11	0.18	1.00														
9.SPS-R	-0.05	-0.09	0.13	-0.02	0.03	0.20*	0.23*	0.41**	1.00													
10.HRS	0.13	-0.10	0.19*	-0.00	0.07	0.22*	0.52**	0.28**	0.41**	1.00												
11.BDD-SS	0.02	0.07	0.06	0.04	0.08	0.39**	0.46**	0.51**	0.57**	0.33**	1.00											
12.Symptom Composite	0.06	-0.02	0.14	0.04	0.08	0.58**	0.70**	0.62**	0.66**	0.65**	0.81**	1.00										
13.BIS-11	0.05	0.03	0.15	-0.06	0.09	0.18*	0.12	0.23**	0.21*	0.26**	0.35**	0.35**	1.00									
14.PSQI	-0.02	0.08	-0.04	-0.07	0.01	0.26**	0.25**	0.07	0.28**	0.17	0.38**	0.35**	0.22*	1.00								
15.STAI-T	-0.01	0.15	0.06	0.02	0.08	0.27**	0.44**	0.23**	0.32**	0.34**	0.53**	0.53**	0.46**	0.51**	1.00							
16.DASS-21 Depression	0.04	0.08	0.05	-0.02	0.10	0.27**	0.39**	0.28**	0.28**	0.32**	0.46**	0.50**	0.41**	0.36**	0.77**	1.00						
17.DASS-21 Anxiety	-0.01	0.04	0.16	0.15	0.17	0.39**	0.49**	0.28**	0.40**	0.28**	0.54**	0.59**	0.36**	0.23	0.65**	0.65**	1.00					
18.DASS-21 Stress	-0.07	0.16	0.03	0.04	0.06	0.29**	0.48**	0.20*	0.34**	0.30**	0.51**	0.53**	0.45**	0.36**	0.71**	0.65**	0.65**	1.00				
19.DASS-21 Total	-0.01	0.11	0.09	0.06	0.12	0.36**	0.52**	0.29**	0.38**	0.34**	0.57**	0.62**	0.46**	0.37**	0.81**	0.88**	0.87**	0.88**	1.00			
20.SDS	0.10	0.11	0.05	-0.04	0.09	0.31**	0.36**	0.28**	0.22*	0.32**	0.52**	0.50**	0.46**	0.47**	0.70**	0.66**	0.55**	0.59**	0.69**	1.00		
21.OCTCDQ Harm Avoidance	-0.08	-0.02	-0.01	-0.07	-0.12	0.31**	0.64**	0.18*	0.30**	0.34**	0.50**	0.57**	0.29**	0.28**	0.62**	0.58**	0.61**	0.55**	0.66**	0.48**	1.00	
22.OCTCDQ Incompleteness	-0.06	0.07	-0.06	-0.18*	-0.17	0.34**	0.67**	0.05	0.17	0.39**	0.35**	0.49**	0.11	0.28**	0.45**	0.42**	0.36**	0.45**	0.47**	0.37**	0.65**	1.00

*$p \leq 0.05$, **$p \leq 0.01$

Table 4

Regression Analyses Using Symptom-Based Approach – Separate RI Indices

DV	N	Overall Model for Separate RI Indices	RI Index	*β*	*t*	*p*
ATQ	65	$R^2 = 0.07$, $F(4, 60) = 1.20$, $p = 0.32$	Stop-Signal: SSRT	0.09	0.69	0.49
			Flanker: RT Interference	0.08	0.63	0.53
			Flanker: Error Interference	-0.17	-1.24	0.22
			Go/No-Go: Commission Errors	0.19	1.48	0.14
OCI-R	50	$R^2 = 0.05$, $F(4, 45) = 0.56$, $p = 0.70$	Stop-Signal: SSRT	0.13	0.81	0.42
			Flanker: RT Interference	0.09	0.58	0.57
			Flanker: Error Interference	0.03	0.16	0.87
			Go/No-Go: Commission Errors	-0.19	-1.12	0.27
SPS-R	50	$R^2 = 0.00$, $F(4, 45) = 0.04$, $p = 0.997$	Stop-Signal: SSRT	0.06	0.39	0.70
			Flanker: RT Interference	-0.02	-0.10	0.92
			Flanker: Error Interference	-0.02	-0.10	0.92
			Go/No-Go: Commission Errors	-0.01	-0.09	0.93
HRS	39	$R^2 = 0.17$, $F(4, 34) = 1.68$, $p = 0.18$	Stop-Signal: SSRT	0.32	1.94	0.06
			Flanker: RT Interference	0.13	0.74	0.47
			Flanker: Error Interference	0.09	0.46	0.65
			Go/No-Go: Commission Errors	0.19	1.10	0.28
BDD-SS	62	$R^2 = 0.05$, $F(4, 57) = 0.69$, $p = 0.61$	Stop-Signal: SSRT	0.11	0.80	0.43
			Flanker: RT Interference	0.07	0.52	0.61
			Flanker: Error Interference	0.06	0.40	0.69
			Go/No-Go: Commission Errors	-0.17	-1.19	0.24

Table 5

Regression Analyses Using Symptom-Based Approach – RI Composite

DV	N	Overall Model for RI Composite		β	*t*	*p*
ATQ	65	$R^2 = 0.02$, $F(1, 63) = 1.42$, $p = 0.24$	RI Composite	0.15	1.19	0.24
OCI-R	50	$R^2 = 0.00$, $F(1, 48) = 0.02$, $p = 0.90$	RI Composite	-0.02	-0.13	0.90
SPS-R	50	$R^2 = 0.00$, $F(1, 48) = 0.02$, $p = 0.89$	RI Composite	0.02	0.15	0.89
HRS	39	$R^2 = 0.15$, $F(1, 37) = 6.75$, $p = 0.01$	RI Composite	0.39	2.60	0.01
BDD-SS	62	$R^2 = 0.00$, $F(1, 61) = 0.04$, $p = 0.85$	RI Composite	0.03	0.19	0.85

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