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# Neuropsychological Comparisons Of Obsessive-Compulsive Disorder Subtype And Body Dysmorphic Disorder Symptomatology

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# NEUROPSYCHOLOGICAL COMPARISONS OF OBSESSIVE-COMPULSIVE DISORDER SUBTYPE AND BODY DYSMORPHIC DISORDER SYMPTOMATOLOGY

by

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This thesis, submitted by Linda Renee Keenan in partial fulfillment of the requirements for the Degree of Master of Arts from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

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Linda Renee Keenan
October 18, 2013

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ABSTRACT

Body Dysmorphic Disorder (BDD) and Obsessive-Compulsive Disorder (OCD) are often severe and disabling psychiatric conditions. Although BDD is currently regarded as a somatoform disorder in the DSM-IV, it has been suggested that it would be better classified as being part of an obsessive-compulsive spectrum, as it shares many characteristics with OCD in terms of its clinical presentation. Although both disorders have been found to be associated with executive function deficits and other neuropsychological correlates, few studies have compared the two disorders directly in this regard. Further, some research has indicated that OCD symptom dimensions are associated with varying patterns of neuropsychological deficits. The goal of the present study was to assess performance on tasks of executive function, emotional interference, and emotion recognition associated with subclinical OCD symptom dimensions and BDD in 136 university students, with the aim of further clarifying the nosological relationship between the two disorders. A series of multiple regression analyses was used to analyze these relationships. Checking symptoms were found to be a significant predictor of self-reported executive function, hoarding symptoms were a significant predictor of set-shifting, ordering symptoms were a significant predictor of inhibition, and washing symptoms were a significant predictor of emotional interference. BDD symptoms were found to be a significant predictor of memory ability and set-shifting performance. Overall, no consistent pattern of relationships emerged between OCD and BDD

symptomatology on measures of neuropsychological performance. BDD symptoms were found to be significantly different than checking symptoms in predicting self-reported executive function, while delusional-BDD symptoms were found to be significantly different than checking symptoms in predicting self-reported executive function and significantly different than hoarding symptoms in predicting set-shifting. Overall, results were not conclusive in establishing clear relationships between BDD symptoms and OCD symptom dimensions, although a few notable similarities and differences did emerge in various areas of cognitive functioning. The results suggest that a relationship between the two disorders may exist, but is complex and requires further research to conceptualize.

Key Words: Body Dysmorphic Disorder, Obsessive-Compulsive Disorder, Neuropsychology, Subtypes, Symptom Dimensions

# CHAPTER I

## INTRODUCTION

Body Dysmorphic Disorder (BDD) is a condition occurring in approximately 1% of the general population (Phillips, 2001), and is characterized by an intense, distressing fixation with imagined flaws in appearance, or excessive concern with slight physical defects that do exist. These fixations for a given individual may be limited to a single bodily area (e.g. nose) or may encompass many areas. Among the most frequent areas found distressing by individuals with BDD include skin, teeth, hair, and facial proportions (Phillips et al., 2006a), however, areas of concern often extend beyond the head/face region and include the body as well. Time spent preoccupied with these distressing thoughts may consume a large portion of an individual's day. An individual may attempt to relieve their distress by engaging in avoidance behaviors, such as avoiding activities or situations in which other people may be present, and compulsive behaviors, such as camouflaging the area of concern, repetitive mirror-checking, and reassurance-seeking (Phillips et al., 2006a).

Many individuals with BDD have poor insight into their condition, failing to recognize that their perception of their real or imagined defect is not concordant with reality. The appearance-related beliefs of approximately one-third of BDD sufferers can be classified as delusional (Didie Kelly, & Phillips, 2010). This condition often presents

in early adolescence with a chronic course, and may become quite disabling, resulting in diminished academic, occupational, and psychosocial functioning, along with social isolation and suicidality (Didie et al., 2010).

Recent research focusing on the etiology, clinical features, and neuropsychological correlates of BDD has suggested that it may best be conceptualized as an Obsessive-Compulsive Spectrum Disorder (OCSD). Many researchers have hypothesized that there exists a latent network through which several disorders with similar underlying symptom features of impulsivity, compulsivity, and obsessionality are connected. Such disorders hypothesized to be part of this spectrum include Obsessive-Compulsive Disorder (OCD), Trichotillomania, Kleptomania, and BDD, among others (Sulkowski, Mancil, Reid, Chakoff, & Storch, 2011). In fact, one of the changes in the most recent *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) included the insertion of an Obsessive Compulsive and Related Disorders diagnostic category, and the inclusion of BDD within this category (American Psychiatric Association, 2013).

Although controversy remains regarding the existence of an OCSD network and how, if it does exist, its nosology should best be conceptualized, an ever-increasing research base is providing empirical support for the presence of associations between the symptomatology of these disorders.

## The Relationship between BDD and OCD

Obsessive-Compulsive Disorder is characterized by a pattern of recurrent and persistent obsessions and/or compulsions that are excessive or unreasonable, and that causes marked distress or impairment in an individual's life. OCD has a lifetime

prevalence rate of approximately 2% in the general population (Kessler et al, 2005) and often emerges in adolescence or early adulthood.

BDD and OCD appear to share several similarities, both clinically and neuropsychologically. Aspects of the clinical presentation and symptomatology of the two disorders look markedly similar. The intense preoccupations with appearance that occur in BDD can be characterized as meeting the diagnostic definition of an obsession in the OCD criteria: they are recurrent, persistent, intrusive thoughts that are difficult to ignore and cause marked distress and anxiety. In addition, the camouflaging, mirror-checking, and reassurance-seeking behaviors performed by individuals with BDD resemble the diagnostic definition of an OCD compulsion: they are repetitive behaviors or mental acts that an individual feels driven to engage in with the aim of reducing anxiety or distress.

Clinical features of the two disorders also appear to share some overlap: Phillips et al. (2007) found that the two groups did not significantly differ in terms of demographic variables, age of onset, illness duration, general functioning, and most cormorbidity. The two groups did differ significantly on measures of insight and suicidality, with the BDD group exhibiting greater morbidity for both. Family studies also provide support for a link between OCD and BDD. Bienvenu et al. (2000) found that BDD occurred more frequently in the first-degree relatives of OCD probands than in control probands. Hanes (1998) found that individuals with BDD and OCD were similarly impaired on measures of executive function.

## Subgroups in BDD and OCD

Individuals with BDD vary widely in terms of their degree of insight into their disorder. Some researchers have suggested two types of BDD: delusional, in which an individual lacks insight into their disorder, and non-delusional, in which an individual realizes that their appearance concerns are not congruent with reality. Although the DSM-5 does not formally recognize this distinction, individuals who present with non-delusional BDD symptoms are typically diagnosed with BDD, while individuals who present with delusional BDD symptoms have in the past tended to be diagnosed with Delusional Disorder, somatic type. This diagnostic method separates delusional BDD and non-delusional BDD, with one being classified as a disorder within the category of Obsessive Compulsive and Related Disorders and another being classified as a psychotic disorder.

However, it has been suggested by several researchers that the delusional variant would be better classified in the DSM as a subtype of BDD, rather than as a psychotic disorder (Phillips et al., 2010). Although the delusional and non-delusional variants are markedly similar in clinical presentation and response to pharmacotherapy, individuals with the delusional variant demonstrate poorer quality of life and are at increased risk of suicide, factors that seem to be mediated by symptom severity (Mancuso, Knoesen, & Castle, 2010a ; Phillips, Menard, Pagano, Fay, & Stout, 2006b). At this time, it is not clear whether the delusional variant simply represents a more severe form of the disorder or is qualitatively different. No research to date has examined whether neuropsychological differences between the two variants exist, or how the presence of delusions relates to the neuropsychological comparisons between BDD and OCD.

For decades, OCD has been recognized as a heterogeneous disorder in terms of its clinical presentation. Although there is substantial evidence for frontal lobe deficits among individuals with OCD on the whole, the specifics of such findings have been inconsistent and not clearly delineated. The explanation for these inconsistencies is likely due to the heterogeneity of the disorder and the wide variety of symptomatology that individuals can present while still receiving the same diagnosis. It has been suggested by many researchers that OCD may be better understood if it is classified by subtypes, due to the fact that the most effective treatment may differ according to the type of predominant symptoms an individual presents with. Thus, a number of subtyping paradigms have been proposed. One of these paradigms involves differentiating between individuals with OCD based on which primary cluster of symptoms they present with (e.g. washing, checking, etc.).

Several studies have found significant differences between individuals who present with various primary symptom dimensions of OCD, however, there is still controversy regarding how best to separate and classify these symptom dimensions, and how many dimensions OCD is comprised of (Leckman et al., 2010). Using an item- and category-level factor analysis, Pinto et al. (2008) proposed a five-factor model of Symmetry/Ordering, Taboo Thoughts, Hoarding, Doubt/Checking, and Contamination/Cleaning. In a meta-analysis, Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman (2008) determined that a four-factor structure of Symmetry, Forbidden Thoughts, Cleaning, and Hoarding accounted for a large proportion of the heterogeneity among OCD symptoms. Although, interestingly, a separate factor for

checking was not found in this study, the authors noted that checking symptoms loaded highest on the forbidden thoughts factor.

## Neuropsychological Differences in BDD

Although BDD has only been provided limited attention in research, and investigations into its underlying etiology have only primarily taken place in the last decade, several studies have found indications of certain neuroimaging and neuropsychological correlates in relation to BDD. One of these findings relates to visual processing deficits. Feusner, Hembacher, Moller, & Moody (2011) found that the brains of individuals with BDD, in comparison to the brains of healthy controls, displayed abnormal brain activity when viewing non-face/non-body objects. Specifically, individuals with BDD displayed hypoactivity in the visual association areas when viewing low-spatial-frequency, configural elements, and hyperactivity in prefrontal areas when viewing high-spatial-frequency, high-detail elements, suggesting that they allocate more neural resources to processing small details and less to processing holistic elements.

In a similar study, Feusner et al. (2010a) found that individuals with BDD, when compared with controls, displayed a significantly higher level of increased activation in prefrontal regions when viewing their own face as opposed to the face of a familiar actor. In contrast, they exhibited a significantly lower level of activation in the visual cortex when presented with a low-spatial-frequency image of their own face, as opposed to a low-spatial-frequency image of a gray oval resembling a face . In a similar vein, Feusner, Townsend, Bystritsky, & Bookheimer (2007) found that individuals with BDD, when viewing images of low-spatial, high-spatial, and normal faces, demonstrated greater left-

sided prefrontal activation than controls, and activation of the dorsal anterior cingulate activity when viewing low-spatial images, whereas controls only displayed these activation patterns when viewing high-spatial images.

Other studies have found that individuals with BDD display superior perceptual abilities in discerning differences between altered and unaltered photographs of faces (Stangier, Adam-Schwebe, Müller, & Wolter, 2008) and in assessing the proportions of their own face (Thomas & Goldberg, 1995), as well as shorter response times in accurately identifying an image of an inverted face when the upright face has been presented for a long duration (Feusner et al., 2010c). Thus, visuospatial processing deficits and differences in perceptual abilities appears to be prominent among those with BDD.

In a study on brain morphology of BDD patients, Atmaca et al. (2010) found that the volumes of the orbitofrontal cortex and anterior cingulate were significantly smaller than those of controls, while their thalamic and total white matter volumes were higher. Further, Feusner et al. (2009) found that volumetric size of the left inferior frontal gyrus and right amygdala correlated significantly with symptom severity among BDD patients, which may imply deficits in visual face processing and emotion recognition, respectively.

Other studies have in fact found deficits in recognition of emotional expressions among BDD patients. Buhlmann, McNally, Etcoff, Tuschen-Caffier, & Wilhelm (2004) found that BDD patients performed significantly worse than healthy controls, but not OCD patients, at accurately interpreting facial expressions, often misinterpreting various expressions as anger. A related study found this deficit to exist only when BDD patients

viewed facial expressions in the context of self-referent scenarios, but not in other-referent scenarios (Buhlmann, Etcoff, & Wilhelm, 2006). Further, Feusner, Bystritsky, Hellemann, & Bookheimer (2010b) found that individuals with BDD were significantly slower and less accurate than controls at matching pictures of emotional expressions to their neutral-expression counterparts, implying difficulties in processing visual information of faces.

Only one study has examined the role of emotional interference in visual processing among individuals with BDD. Using an emotional Stroop test, Buhlmann, McNally, Wilhelm, & Florin (2002) found that BDD patients, relative to controls, exhibited higher interference for BDD-related words than for neutral words, and this difference was especially large for BDD-positive words.

Executive function deficits have also been found among individuals with BDD. Dunai, Labuschagne, Castle, Kyrios, & Rossell (2010) found that individuals with BDD exhibited impairments in manipulation, planning, organization, and processing speed of spatial information, relative to controls. Deckersbach et al. (2000a) found that individuals with BDD performed significantly worse on the Rey-Osterrieth Complex Figure Test and the California Verbal Learning Test than controls, indicating deficits in both verbal and visual memory, which were mediated by poor organizational strategies. Similar deficits have been noted among OCD patients (Deckersbach, Otto, Savage, Baer, & Jenike, 2000b).

Other studies have found additional executive function deficits among individuals with BDD, including set-shifting, selective attention, and verbal memory (Bailey, 2004),

and response inhibition and planning (Hanes, 1998). Overall, then, the current research base has demonstrated a number of potential neuropsychological differences among individuals with BDD, including deficits in several areas of executive functioning, such as memory, set-shifting, and inhibition, deficits in emotion recognition, and emotional interference effects for BDD-salient words.

## Neuropsychological Differences in OCD

Deficits in visual processing, like those noted with individuals with BDD, have also been found among individuals with OCD, particularly when assessing perception of global and local features. Using a local-global paradigm task that required participants to attend either to the local or global components of visually-presented stimuli, Rankins, Bradshaw, & Georgiou-Karistianis (2005) found that OCD patients were significantly slower at processing global information, but not local, than were controls. This suggested that OCD patients were impaired at processing information that was presented holistically, but attended adequately to detailed components. Similarly, Savage et al. (1999) found that individuals with OCD demonstrated significant impairment on the Rey-Osterrieth Complex Figure Test, due to using a disorganized, overly-detailed approach to copying a complex figure, as opposed to using a more organized and holistic approach as non-OCD individuals did.

Emotion recognition impairments, such as those found among individuals with BDD, have also been noted among individuals with OCD. Corcoran, Woody, & Tolin (2008) found that individuals with OCD were significantly impaired at accurately detecting facial expressions of disgust, but were not impaired in detecting expression of

fear, anger, or sadness. This deficit, however, was demonstrated in only 33% of the OCD individuals, and was mediated by symptom severity and overall functioning. Similarly, Grisham, Henry, Williams, & Bailey (2010) found that individuals with high OCD symptomatology were significantly impaired at interpreting facial expressions of disgust. Aigner et al. (2007) found that individuals with OCD misinterpreted neutral facial expressions as sad and happy facial expressions as neutral significantly more than controls did.

Differences in neuropsychological deficits have also been found to be associated with various OCD symptom dimensions. Montagne et al. (2008) conducted a study to investigate sensitivity of perception in detecting emotional expressions among OCD subtypes. They found that individuals in the "High Risk Assessment and Checking" subgroup were significantly more perceptive of the fear and happiness expressions than were controls, while individuals in the "Contamination and Cleaning" and "Perfectionism and Symmetry" subgroups were not. Jhung et al. (2010) found that individuals with OCD were significantly more likely than controls to interpret ambiguous facial expressions as disgust and less likely to interpret them as anger. In addition, these effects were even more pronounced in individuals who obtained a higher symptom dimension score related to cleaning. Thus, differences in emotion recognition deficits have been noted among the various symptom dimensions in OCD.

Lawrence et al. (2007) found that OCD patients with high washing symptoms, when viewing facial expressions of disgust, demonstrated significantly higher activation

of the left inferior frontal gyrus, an area associated with visual processing of disgust expressions in healthy individuals, than controls did.

Individuals with OCD have also demonstrated emotional interference in visual processing. Using an optimized emotional Stroop task, Rao, Arasappa, Reddy, Venkatasubramanian, & Reddy (2010) found that individuals with OCD were significantly slower than controls at processing negative OCD-related words, however, this difference was only significant for individuals who were currently symptomatic and not for those in remission. In addition, this difference was even more pronounced for individuals with predominant checking symptoms. Thus, like individuals with BDD, individuals with washing and checking symptoms have been found to display emotional interference effects.

Executive function deficits among the symptom dimensions have also been identified. Lawrence et al. (2006) administered the Wisconsin Card Sorting Test to OCD patients and controls, and found that OCD patients performed significantly worse, indicating impaired set-shifting ability. Further, a negative association between the OCD symptom dimension of symmetry/ordering and set-shifting performance was found, as well as a negative association between the hoarding dimension and decision-making ability.

Nedeljkovic et al. (2009) compared executive function performance among OCD subtypes (washers, checkers, obsessionals, and mixed) and found that checkers displayed the most impairment in spatial working memory compared to controls, and in pattern recognition compared to controls and washers. Omori et al. (2007) administered the

Stroop test, GO/NO GO test and Trail Making test to OCD patients categorized as washers or checkers. They found that checkers, relative to washers, displayed significant impairments on tests of inhibition and cognitive flexibility. Hashimoto et al. (2011) found that the symmetry/ordering symptom dimensions were associated with significantly impaired performance on tests of inhibition and cognitive flexibility, while the cleaning/contamination dimension was associated with better performance. In addition, the aggressive/checking dimension was associated with deficits in cognitive flexibility. Jang et al. (2010) found that OCD patients displayed deficits in nonverbal memory and visuospatial organization. Moreover, they found that the nonverbal memory deficit was significantly associated with the symmetry/ordering symptom dimension, while the organizational deficit was associated with the obsessions/checking symptom dimension.

Only a few studies have examined the relationship between OCD symptom dimensions and levels of insight. Some studies have found, among individuals with OCD, poor insight into their disorder to be significantly associated with hoarding symptoms (Jakubovski et al., 2011; Kishore, Samar, Reddy, Chandrasekhar, & Thennarasu, 2004). Other studies have found poor insight to be significantly more frequent among those with cleaning symptoms (Cherian et al., 2012) and ordering symptoms (Elvish, Simpson, & Ball, 2010).

Therefore, a number of similarities can be identified between BDD and the various OCD symptom dimensions. Both BDD and the OCD checking dimension have been associated with organizational, spatial memory, set-shifting, and inhibition deficits,

while impairments in nonverbal memory, inhibition, and set-shifting ability have been observed in both BDD and the OCD ordering dimension. The washing dimension, however, has not been found to be associated with impairments in inhibition and cognitive flexibility, thus, BDD and the washing dimension seem to be dissimilar in this way. Both BDD and OCD have been found to be related to deficits in emotion recognition, however, it is not clear for which symptom dimensions these deficits are most pronounced. In addition, BDD and the washing and checking dimensions have all been found to be related to emotional interference effects. A final area of cognitive functioning that BDD and OCD can be compared on is that of insight: insight has been found to be most impaired among those with hoarding, cleaning, and ordering symptoms. Therefore, individuals with delusional BDD features and individuals with hoarding, washing, and ordering symptoms may share similarities in neuropsychological performance.

## The Present Study

The goal of the present study was to compare subclinical OCD and BDD symptomatology on measures of neuropsychological performance, with the aim of further clarifying the nosological relationship between OCD and BDD. Neither of these disorders is well understood at this point in time, and determining how these disorders are related could potentially impact treatment options. Given the recent research into the heterogenous nature of OCD and the possibility that distinct symptom dimensions of OCD exist, it is especially important to determine, if OCD and BDD are in fact related,

where BDD exists in relation to these symptom dimensions, so that the knowledge base for treatment efficacy for both disorders can be further informed.

Because the tests used in previous studies to assess neuropsychological deficits in BDD have not been identical to those used to assess deficits related to OCD symptom domains, it was difficult to hypothesize specifically about which OCD symptoms would be most similar to and different from BDD. Further, many neuropsychological aspects, while found to be deficient in OCD, had not been studied specifically in terms of how they relate to OCD symptom domains. However, primary hypotheses could be made based on which deficits have been observed in both BDD and the various symptom dimensions of OCD. Both BDD and the OCD checking dimension had been associated with organizational, spatial memory, set-shifting, and inhibition deficits. In addition, both BDD and the OCD ordering dimension had been associated with impairments in nonverbal memory, inhibition, and set-shifting ability.

The washing dimension, in contrast, had been found to be unrelated to impairments in inhibition and cognitive flexibility. Therefore, it was hypothesized that the OCD checking and ordering symptoms would be most similar to BDD symptoms in predicting performance on tasks that assess cognitive inhibition, visual processing, task switching, memory, set-shifting, and self-reported executive function, that is, OCD checking and ordering symptoms would not be statistically different from, and most statistically equivalent to, BDD in predicting performance on these tasks. It was hypothesized, however, that the washing symptoms would be most dissimilar to BDD symptoms in predicting performance on these tasks, that is, that they would be

statistically different from, and least statistically equivalent to, one another in predictive ability. Determining where BDD falls in relation to the symptom dimensions of OCD could potentially impact the nature of treatment for both BDD and OCD. Washing symptoms may, in fact, imply a qualitatively different underlying disorder than that which underlies the checking, ordering, and BDD symptoms, and may thus not currently be conceptualized accurately in terms of effective treatment options.

In addition, emotional interference effects had been observed among both BDD and the OCD symptom dimensions of washing and checking, with an even more pronounced effect for checking. However, the only studies to investigate differences in emotional interference among OCD symptom dimensions, such as the Rao et al. (2010) study, only differentiated between washers and checkers and did not assess other symptom dimensions. Because BDD and the checking dimension appear to share other deficits, and the checking dimension was related to an increased deficit in the Rao et al. (2010) study, it was hypothesized that the present study would find BDD symptoms and checking symptoms to be most similar in predicting emotional interference.

Hypothesizing about results on the emotion recognition task was less clear. Both BDD and OCD had been found to be related to deficits in emotion recognition, but investigations into how this manifests exactly has resulted in mixed findings. Individuals with BDD have been found to be inaccurate at interpreting many facial expressions, and especially likely to misperceive them as anger. The OCD symptom dimension of washing had been found to be the least likely dimension to misperceive ambiguous expressions of anger, instead misperceiving them as disgust. Therefore, it was

hypothesized that BDD symptoms and washing symptoms would be the least similar in predicting performance in emotion recognition.

The few studies that have examined associations between insight and OCD symptom dimensions had found insight to be most impaired among those with hoarding, cleaning, and ordering symptoms. Therefore, it was hypothesized that delusional symptomatology would be most similar to the hoarding, washing, and ordering symptoms of OCD in predicting performance on all of the neuropsychological measures.

In summary, then, the hypotheses of this study were as follows:

1) Ordering symptoms would be more statistically equivalent to BDD symptoms than washing and hoarding symptoms in predicting self-reported executive function, memory performance, set-shifting, global-local processing, cognitive inhibition, and task switching.
2) Checking symptoms would be more statistically equivalent to BDD symptoms than washing and hoarding symptoms in predicting self-reported executive function, memory performance, set-shifting, global-local processing, cognitive inhibition, and task switching.
3) Washing symptoms would be the least statistically equivalent to BDD symptoms in predicting self-reported executive function, memory performance, set-shifting, global-local processing, cognitive inhibition, task switching, and emotion recognition.

4) Delusional-BDD symptoms would be more statistically equivalent to washing symptoms than checking symptoms in predicting all measures of neuropsychological performance.
5) Delusional-BDD symptoms would be more statistically equivalent to ordering symptoms than checking symptoms in predicting all measures of neuropsychological performance.
6) Delusional-BDD symptoms would be more statistically equivalent to hoarding symptoms than checking symptoms in predicting all measures of neuropsychological performance.
7) Checking symptoms would be most statistically equivalent to BDD symptoms in predicting emotional interference.

# CHAPTER II

# METHOD

## Participants

The sample consisted of 136 undergraduates attending a Midwestern university. Females comprised 84.6% of the sample, and Caucasians accounted for 95.6% of the sample. All subjects were between the ages of 18 and 25, with a mean of 19.43 years, were enrolled in an undergraduate psychology class and participated in the study for 1 hour of course credit.

## Materials

### Ex*ecutive Function Index*

The Executive Function Index (EFI) is a self-report scale designed to assess executive function in a non-clinical population (Spinella, 2005). It is a 27-item Likert-type rating scale, consisting of five subscales measuring various domains of executive functioning: Motivational Drive, Strategic Planning, Organization, Impulse Control, and Empathy. A second-order factor analysis determined that these subscales accounted for 77.2% of the variance in EFI performance. Internal consistency was good for the total score ($\alpha$=.82) and acceptable for the subscales (.76, .70, .75, .69, and .70, respectively). Inverse correlations between the EFI scales and established measures of executive dysfunction and impulsivity, and positive correlations between the EFI scales and a measure of empathy, were found as an indication of construct validity of the EFI.

*Obsessive-Compulsive Inventory – Revised*

The Obsessive-Compulsive Inventory – Revised (OCI-R) is a self-report measure designed to assess various symptoms of OCD in both clinical and non-clinical populations, as well as to be used as a screening measure for OCD (Foa et al., 2002). It is comprised of 18 items that are rated on a five-point Likert scale, consisting of six subscales representing symptom categories that are common within OCD: Washing, Checking, Ordering, Obsessing, Hoarding, and Neutralizing. The OCI-R provides a total score of OCD symptomatology as well as individual subscale scores. For this study, only the washing, checking, ordering, and hoarding scores were used in analyses.

Internal consistency of the OCI-R among non-clinical controls for the total score was high ($\alpha = 0.89$), and was high for four of the six subscales, including ordering, hoarding, and washing, ranging from 0.73 to 0.89, but was only acceptable for the checking score ($\alpha = .65$). Test-retest reliability among non-clinical controls for the total score ($r = 0.84$) and subscale scores (ranging between 0.57 and 0.87) were high.

*Dysmorphic Concern Questionnaire*

The Dysmorphic Concern Questionnaire (DCQ) is brief self-report scale to assess excessive concern with physical appearance and bodily functioning (Oosthuizen, Lambert, & Castle, 1998) and has been used as a screening measure for BDD (Mancuso, Knoesen, Castle, 2010b). It is comprised of seven items that are rated on a Likert-type scale, and its internal consistency is high ($\alpha = 0.88$).

### *Peters Delusional Inventory*

The Peters Delusional Inventory (PDI) is a self-report measure that was developed to assess delusional ideation in a non-clinical population (Peters, Joseph, & Garety, 1999), but it has also been used to assess delusionality in BDD populations (Labuschagne, Castle, Dunai, Kyrios, & Rossell, 2010). It is comprised of 40 yes/no questions that assess a range of delusional components, including paranoia, grandiosity, religiosity, and thought disturbances. In addition, each item, if endorsed, assesses three dimensions (measuring belief strength, preoccupation, and distress), each of which is rated on a five-point Likert scale. Internal consistency ($\alpha = 0.88$) and test-retest reliability at one year ($r = 0.82$) were high.

### *American National Adult Reading Test*

The American National Adult Reading Test (AMNART; Grober & Sliwinski, 1991) is a word reading task that was developed as a brief measure of verbal intelligence. Individuals are presented with a list of 45 words of varying levels of difficulty and asked to pronounce them. An estimate of verbal IQ, with a mean of 100 and standard deviation of 15, can be calculated with a formula devised by the developers of this test, which utilizes number of errors made on the task and years of education. The AMNART has demonstrated good validity and internal reliability (Crawford, Deary, Starr, & Whalley, 2001; Lastine-Sobecks, Jackson, & Paolo 1998). For the purposes of this study, the AMNART was used to ensure that participants demonstrated sufficient verbal ability to comprehend questionnaires and written task instructions, and that responses and results could not be accounted for poor verbal skills.

### *Eating Disorder Diagnostic Scale*

The Eating Disorder Diagnostic Scale (EDDS) is a brief self-report measure designed as a diagnostic tool in assessing eating pathology, specifically, anorexia nervosa, bulimia nervosa, and binge eating disorder (Stice, Telch, & Rizvi, 2000). It is comprised of 22 questions assessing attitudes and behaviors related to eating disorder DSM-IV diagnostic criteria, using a combination of Likert, yes/no, open-ended, and frequency score responses. It contains a diagnostic scale, which can be used to diagnose each of the eating disorders, and a symptom composite scale, which provides an overall indicator of eating pathology. Stice et al. (2000) reported good internal consistency ($\alpha$ = .89) and test-retest reliability ($r$ = .87) for the symptom composite score. For the purposes of this study, the EDDS was used as a covariate to factor out body image dissatisfaction related to eating concerns.

### *Reading the Mind in the Eyes Test-Revised*

The Reading the Mind in the Eyes Test-Revised (Revised Eyes Test) was developed to assess social intelligence and has found to be a sensitive measure in distinguishing subtle differences in social cognition even among non-clinical populations (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). The Revised Eyes Test contains 36 photographs of sets of human eyes, each expressing a certain emotion. Four response options of emotion words are provided with each photograph, with one option being the target word that matches the emotional expression displayed in the photograph.

### *PsychoPy Tests*

PsychoPy is an open-source software package designed to facilitate computerized psychological tasks (Peirce, 2007). Experimenters can use classic experiments provided with the software or can create their own. The PsychoPy software was used for three tasks in this study: the Stroop task, the Navon task, and an emotional Stroop task.

#### *Stroop Task*

The Stroop task (Stroop, 1935) was designed as a measure of executive function and inhibition, and has been widely used with clinical and non-clinical participants. A computerized version of the task was used for this study, which presented individuals with words of colors presented in various ink colors, and then required the individual to either indicate the word or the color of the ink as quickly as possible. Half of the words presented were congruent, that is, the color word and the ink color were the same (e.g. red), and half were incongruent, that is, the color word was different than the ink color. In the incongruent condition, individuals must suppress the irrelevant information and focus only on the word or color. Reaction times were recorded for each response, and an interference score was calculated by subtracting the the average congruent reaction times from the average incongruent reaction times.

#### *Navon Task*

A computerized version of the Navon task (Navon, 1977) was used as a measure of global and local processing. In this task, individuals are presented with a large figure in the shape of an “S” or “H”, comprised by a large number of smaller “S” or “H” shapes.

The individual must indicate if the smaller letters are "S" or "H", ignoring the shape of the larger letter figure, as quickly as possible. Half of the figures presented were congruent, that is, the large letter and the small letters comprising it were the same, while half were incongruent. In the incongruent condition, the individual must suppress the global information and respond at the local level. Reaction times were recorded for each response, and an interference score was calculated using the ratio of average incongruent reaction time divided by the average congruent reaction time.

*Emotional Stroop*

A computerized emotional Stroop task was created using the PsychoPy software. Word lists were comrpised using previous studies of emotional interference in OCD (Rao et al., 2010) and BDD (Buhlmann et al., 2002). The emotional Stroop is similar to the traditional Stroop task, except that instead of measuring the difference in reaction time between color-congruent and color-incongruent words, it measures the reaction time between emotional and neutral words. Reaction times were recorded for negative BDD words, such as *ugly*, negative OCD words, such as *dirty*, and neutral words, such as *chair*. The reaction times for the negative OCD words and negative BDD words were each subtracted from the reaction time for neutral words in order to create the emotional interference scores.

*PEBL Tests*

The Psychology Experiment Building Language (PEBL; Mueller, 2012) is public-domain software providing a computerized platform for many classic and widely used neuropsychological tasks. Piper et al. (2012) found that age-related performance effects

of four of the PEBL tasks, including versions of the Wisconsin Card Sort and Trail Making Test, were comparable to those demonstrated in non-PEBL versions of these tests. They concluded that the PEBL battery provides a valid and useful means by which to assess executive function. Four PEBL tasks were used for this study: the Corsi Block Test, the Card Sorting Task, the Trail Making Test, and Digit Span.

*Corsi Block Test*

A computerized version of the Corsi Block Test (CBT; Corsi, 1972) was used as a measure of spatial memory. The CBT has been used widely with individuals of various ages and neuropsychological abilities, and is considered to be a good measure of visuospatial working memory (Kessels, van Zandvoort, Postma, Kappelle, & de Haan, 2000).

In this task, progressively longer sequences of blocks in various locations on the screen are illuminated, and the individual must then recall this sequence using the correct order and correct locations. The primary outcome measure in this study was the total score, which is the product of number of correct trials and length of the longest sequence.

*Card Sorting Task*

A computerized version of the Wisconsin Card Sorting Test (WCST) was used as a measure of executive function. The WCST was developed by Berg (1948) and has been widely used with clinical and non-clinical populations to assess reasoning, set-shifting, and cognitive flexibility. In this task, the individual must place cards in one of four piles depending on the shape, color, or number of the patterns on the cards. The rules for card placement shift during the task, and the individual must infer whether the rule has

changed using conceptual reasoning. A number of performance measures are calculated, including number of perseverative errors made, which is when an individual continues to use a rule that is no longer applicable. For this study, the Card Sorting Task score was created using a composite of perseverative responses, perseverative errors, trials to complete the first category, non-perseverative errors, failure to learn, and unique errors.

*Trail Making Test*

A computerized version of the Trail Making Test (TMT) was used to assess visual attention, scanning, and task switching (Armitage, 1946). It is comprised of 2 parts, A and B. In part A, the participant must connect, in order, a series of 25 numbers, and in part B, they must alternate between connecting 25 numbers and letters in sequential order. For this study, the total reaction time in part B was used as the outcome measure.

*Digit Span*

A computerized digit span task was used to assess auditory attention and short-term numerical memory. In the task, progressively longer sequences of numbers are presented, both visually and verbally, and the individual is then required to enter each sequence with keyboard entry. The primary output measure of this task is the length of the longest numerical sequence that the individual is able to recall correctly.

## Procedure

Participants were recruited using postings displayed on bulletin boards throughout the psychology department. Participants signed up, and received credit, for the study using SONA, the online human subjects pool for the university. Most psychological studies conducted through the university are listed in the SONA database, and

participants select which studies they would like to participate in and sign up for a particular timeslot. In SONA, studies are available to participants based on eligibility criteria; in this study, individuals were required to be at least 18 years of age.

Subjects participated in the study individually, and were provided a consent form to read and sign prior to the beginning of the study. They then completed the demographic form, followed by the psychological tests. The five self-report measures and nine tasks were then administered in a randomized order to prevent order effects. A random number generator was used to assign the order in which measures were administered, and to ensure that no participant received measures in the same order. The nine tasks were given to participants by undergraduate research assistants, who received training in proper administration. The experiment lasted approximately 60 minutes. Participants were then debriefed, thanked for their efforts, and provided their credit.

# CHAPTER III

# RESULTS

## Descriptive Statistics

Tables 1 and 2 outline the demographic statistics and the score means, standard deviations, ranges, minimums, and maximums for each measure.

All AMNART scores fell between 95.92 and 119.04, indicating that the verbal IQ of all subjects was in the average range and any deviations on the dependent measures could not be accounted for by poor reading ability.

## Zero-Order Correlations

Table 3 outlines the correlations between each of the dependent variables and the other measures.

## Statistical Analyses

SPSS 20 (IBM Corp, 2011) and Stata 13 (StataCorp, 2013) were used to conduct all statistical analyses. A series of 48 regression analyses was conducted, consisting of six regressions for each of the eight dependent variables. Each regression consisted of only the covariate (i.e. EDDS) and one variable of interest (i.e. washing, checking, ordering, hoarding, body dysmorphic, and delusional body dysmorphic symptoms), with the exception of the regressions examining the delusional body dysmorphic symptoms. These eight regressions also included the body dysmorphic (i.e. DCQ) and delusional (i.e.

Table 1. Demographic Statistics.

| | *N* | *%* |
|---|---|---|
| *Gender* | | |
| Male | 21 | 15.4 |
| Female | 115 | 84.6 |
| *Age* | | |
| 18 | 26 | 19.1 |
| 19 | 58 | 42.6 |
| 20 | 33 | 24.3 |
| 21 | 12 | 8.8 |
| 22 | 4 | 2.9 |
| 23 | 1 | 0.7 |
| 24 | 1 | 0.7 |
| 25 | 1 | 0.7 |
| *Year* | | |
| 1 | 70 | 51.5 |
| 2 | 41 | 30.1 |
| 3 | 21 | 15.4 |
| 4 | 4 | 2.9 |
| *Ethnicity* | | |
| Asian/Pacific Islander | 2 | 1.5 |
| Asian Indian | 1 | 0.7 |
| Black/African American | 2 | 1.5 |
| Caucasian/White | 130 | 95.6 |
| More than one race | 1 | 0.7 |

Table 2. Descriptive Statistics of All Measures.

| | N | Mean | *SD* | Range | Min. | Max. |
|---|---|---|---|---|---|---|
| PDI | 136 | 7.63 | 6.27 | 38.00 | 0.00 | 38.00 |
| EDDS | 136 | 0.00 | 11.84 | 51.42 | -13.68 | 37.74 |
| AMNART | 136 | 109.73 | 5.01 | 23.12 | 95.92 | 119.04 |
| DCQ | 136 | 4.59 | 3.83 | 18.00 | 0.00 | 18.00 |
| Wash | 136 | 1.27 | 2.10 | 9.00 | 0.00 | 9.00 |
| Order | 136 | 3.30 | 2.75 | 12.00 | 0.00 | 12.00 |
| Hoard | 136 | 2.49 | 2.45 | 10.00 | 0.00 | 10.00 |
| Check | 136 | 2.46 | 2.51 | 12.00 | 0.00 | 12.00 |
| EFI | 136 | 100.21 | 8.77 | 40.00 | 78.00 | 118.00 |
| Digit Span | 136 | 6.63 | 1.26 | 8.00 | 2.00 | 10.00 |
| Corsi | 135 | 57.99 | 20.56 | 97.00 | 20.00 | 117.00 |
| Navon Task (original) | 119 | 1.04 | 0.06 | 0.46 | 0.83 | 1.29 |
| Trail-Making Test | 136 | 27916.65 | 6169.96 | 56220.00 | 18614.20 | 74834.20 |
| Stroop Task | 135 | 0.07 | 0.09 | 0.76 | -0.24 | 0.52 |
| Revised Eyes Test | 136 | 23.86 | 4.16 | 24.00 | 8.00 | 32.00 |
| *Card Sorting Task* | | | | | | |
| Perseverative Responses | 136 | 20.14 | 5.53 | 41.00 | 0.00 | 41.00 |
| Perseverative Errors | 136 | 8.44 | 5.00 | 28.00 | 0.00 | 28.00 |
| Trials to Complete | 136 | 13.94 | 6.87 | 60.00 | 0.00 | 60.00 |
| Non-perseverative Errors | 136 | 6.48 | 6.36 | 48.00 | 0.00 | 48.00 |
| Failure to Learn | 136 | 0.43 | 0.71 | 4.00 | 0.00 | 4.00 |
| Unique Errors | 136 | 1.15 | 2.60 | 23.00 | 0.00 | 23.00 |
| *Emotional Stroop* | | | | | | |
| BDD | 135 | -0.04 | 0.26 | 2.58 | -2.06 | 0.52 |
| OCD | 135 | -0.02 | 0.23 | 2.45 | -1.91 | 0.54 |

Table 3. Zero-Order Correlations.

| | EDDS | PDI | DCQ | Wash | Order | Hoard | Check | PDI-DCQ |
|---|---|---|---|---|---|---|---|---|
| Revised Eyes Test | 0.060 | 0.054 | 0.040 | -0.009 | -0.023 | 0.042 | -0.063 | 0.095 |
| *p* | *0.493* | *0.538* | *0.655* | *0.919* | *0.791* | *0.638* | *0.472* | *0.281* |
| EFI | -0.315 | -0.235 | -0.113 | -0.125 | -0.059 | -0.169 | -0.299 | 0.044 |
| *p* | *0.001*** | *0.007*** | *0.199* | *0.154* | *0.502* | *0.054* | *0.001*** | *0.616* |
| Memory Perf. | -0.110 | 0.051 | -0.216 | -0.092 | 0.058 | -0.028 | 0.001 | -0.029 |
| *p* | *0.212* | *0.561* | *0.014** | *0.297* | *0.513* | *0.750* | *0.993* | *0.741* |
| Stroop Task | -0.090 | -0.023 | 0.048 | -0.007 | 0.130 | 0.025 | -0.041 | -0.044 |
| *p* | *0.302* | *0.794* | *0.579* | *0.933* | *0.132* | *0.777* | *0.639* | *0.610* |
| Trail-Making Test | 0.108 | 0.021 | 0.052 | 0.161 | 0.035 | -0.114 | 0.160 | -0.023 |
| *p* | *0.223* | *0.814* | *0.557* | *0.068* | *0.692* | *0.196* | *0.068* | *0.797* |
| Em. Stroop - BDD | -0.046 | -0.119 | -0.035 | 0.061 | -0.083 | 0.037 | 0.112 | -0.049 |
| *p* | *0.602* | *0.178* | *0.689* | *0.493* | *0.349* | *0.678* | *0.206* | *0.583* |
| Em. Stroop - OCD | -0.007 | -0.071 | -0.002 | 0.184 | -0.145 | -0.014 | 0.025 | 0.027 |
| *p* | *0.941* | *0.426* | *0.979* | *0.036** | *0.099* | *0.875* | *0.780* | *0.761* |
| Navon Task | -0.073 | -0.038 | -0.104 | -0.091 | 0.071 | -0.055 | -0.065 | 0.119 |
| *p* | *0.438* | *0.691* | *0.271* | *0.336* | *0.451* | *0.559* | *0.492* | *0.206* |
| Card Sorting Task | 0.133 | 0.006 | -0.116 | -0.104 | -0.143 | -0.281 | -0.145 | 0.098 |
| *p* | *0.133* | *0.942* | *0.189* | *0.241* | *0.104* | *0.001*** | *0.101* | *0.267* |

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

PDI) variables, since the delusional body dysmorphic variable was an interaction term between the DCQ and PDI scores (i.e. PDI-DCQ). In order to reduce multicollinearity, the DCQ and PDI scores were first centered before creating the interaction term. Table 4 presents the summarized results of the 48 regressions for the OCD and BDD variables of interest, and Table 5 presents the EDDS covariate coefficients for each regression.

*Post-Hoc Analyses*

In order to determine which independent variables were most equivalent to and different from each other in terms of predictive power, following the multiple regressions for each dependent variable, each of the BDD coefficients (i.e. DCQ and PDI-DCQ) were compared to each of the OCD coefficients (i.e. Wash, Check, Order, and Hoard) for statistical equivalence. This comparison was performed using the *Suest* procedure in Stata (StataCorp, 2013), which is an appropriate method when comparing regressions that have correlated errors. Table 6 presents the summarized results of the 64 contrasts that were performed. Statistical significance for the contrasts was determined adjusting for family-wise error rate for each hypothesis. The alpha criterion was .008 for hypotheses 1 and 2; .0071 for hypothesis 3; .00625 for hypotheses 4, 5, and 6; and .025 for hypothesis 7.,

*Self-Reported Executive Function*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the EFI score after controlling for EDDS. Five cases with extreme values were eliminated, and the EDDS and OCI-R Wash and Check scores were transformed with square root transformation due to non-normality. Regression results.

Table 4. BDD and OCD Regression Coefficients for All Dependent Variables.

| *Executive Function Index* | *β* | *p* | *Stroop Task* | *β* | *p* |
|---|---|---|---|---|---|
| Wash | -0.106 | 0.205 | Wash | 0.026 | 0.766 |
| Check | -0.268 | 0.001** | Check | -0.023 | 0.794 |
| Order | -0.018 | 0.829 | Order | 0.175 | 0.049* |
| Hoard | -0.072 | 0.418 | Hoard | 0.079 | 0.400 |
| DCQ | 0.116 | 0.268 | DCQ | 0.119 | 0.278 |
| PDI-DCQ | 0.073 | 0.381 | PDI-DCQ | -0.143 | 0.108 |
| *Memory Performance* | *β* | *p* | *Trail-Making Test* | *β* | *p* |
| Wash | -0.085 | 0.338 | Wash | 0.155 | 0.079 |
| Check | 0.014 | 0.875 | Check | 0.151 | 0.088 |
| Order | 0.074 | 0.408 | Order | 0.021 | 0.812 |
| Hoard | 0.012 | 0.897 | Hoard | -0.169 | 0.070 |
| DCQ | -0.233 | 0.032* | DCQ | -0.019 | 0.865 |
| PDI-DCQ | -0.039 | 0.659 | PDI-DCQ | -0.027 | 0.767 |
| *Card Sorting Test* | *β* | *p* | *Emotional Stroop* | *β* | *p* |
| Wash | -0.114 | 0.196 | Wash | 0.187 | 0.035* |
| Check | -0.160 | 0.070 | Check | 0.026 | 0.772 |
| Order | -0.158 | 0.072 | Order | -0.147 | 0.099 |
| Hoard | -0.368 | <.001** | Hoard | -0.013 | 0.888 |
| DCQ | -0.295 | 0.006** | DCQ | -0.012 | 0.917 |
| PDI-DCQ | 0.089 | 0.306 | PDI-DCQ | -0.032 | 0.724 |
| *Navon Task* | *β* | *p* | *Revised Eyes Test* | *β* | *p* |
| Wash | -0.086 | 0.367 | Wash | -0.013 | 0.886 |
| Check | -0.057 | 0.550 | Check | -0.071 | 0.426 |
| Order | 0.078 | 0.410 | Order | -0.032 | 0.721 |
| Hoard | -0.035 | 0.732 | Hoard | 0.024 | 0.797 |
| DCQ | -0.093 | 0.426 | DCQ | 0.005 | 0.961 |
| PDI-DCQ | 0.131 | 0.171 | PDI-DCQ | 0.090 | 0.313 |

**. Coefficient is significant at the 0.01 level (2-tailed).

*. Coefficient is significant at the 0.05 level (2-tailed).

Table 5. EDDS Coefficients for All Dependent Variables.

| ***Executive Function Index*** | | *β* | *p* | ***Stroop Task*** | | *β* | *p* |
|---|---|---|---|---|---|---|---|
| *Wash* | EDDS | -0.308 | <.001** | *Wash* | EDDS | -0.084 | 0.343 |
| *Check* | EDDS | -0.286 | 0.001** | *Check* | EDDS | -0.080 | 0.368 |
| *Order* | EDDS | -0.312 | <.001** | *Order* | EDDS | -0.105 | 0.235 |
| *Hoard* | EDDS | -0.291 | 0.001** | *Hoard* | EDDS | -0.108 | 0.247 |
| *DCQ* | EDDS | -0.384 | <.001** | *DCQ* | EDDS | -0.154 | 0.163 |
| *PDI-DCQ* | EDDS | -0.347 | 0.001** | *PDI-DCQ* | EDDS | -0.158 | 0.159 |
| ***Memory Performance*** | | *β* | *p* | ***Trail-Making Test*** | | *β* | *p* |
| *Wash* | EDDS | -0.104 | 0.239 | *Wash* | EDDS | 0.099 | 0.261 |
| *Check* | EDDS | -0.112 | 0.210 | *Check* | EDDS | 0.092 | 0.298 |
| *Order* | EDDS | -0.119 | 0.179 | *Order* | EDDS | 0.105 | 0.241 |
| *Hoard* | EDDS | -0.114 | 0.227 | *Hoard* | EDDS | 0.164 | 0.078 |
| *DCQ* | EDDS | 0.029 | 0.790 | *DCQ* | EDDS | 0.119 | 0.281 |
| *PDI-DCQ* | EDDS | 0.002 | 0.986 | *PDI-DCQ* | EDDS | 0.122 | 0.281 |
| ***Card Sorting Test*** | | *β* | *p* | ***Emotional Stroop*** | | *β* | *p* |
| *Wash* | EDDS | 0.141 | 0.110 | *Wash* | EDDS | -0.028 | 0.752 |
| *Check* | EDDS | 0.149 | 0.091 | *Check* | EDDS | -0.001 | 0.914 |
| *Order* | EDDS | 0.149 | 0.091 | *Order* | EDDS | 0.014 | 0.874 |
| *Hoard* | EDDS | 0.257 | 0.004** | *Hoard* | EDDS | -0.002 | 0.980 |
| *DCQ* | EDDS | 0.306 | 0.004** | *DCQ* | EDDS | -0.039 | 0.726 |
| *PDI-DCQ* | EDDS | 0.304 | 0.006** | *PDI-DCQ* | EDDS | -0.011 | 0.923 |
| ***Navon Task*** | | *β* | *p* | ***Revised Eyes Test*** | | *β* | *p* |
| *Wash* | EDDS | -0.067 | 0.482 | *Wash* | EDDS | 0.061 | 0.490 |
| *Check* | EDDS | -0.066 | 0.485 | *Check* | EDDS | 0.068 | 0.444 |
| *Order* | EDDS | -0.080 | 0.398 | *Order* | EDDS | 0.065 | 0.469 |
| *Hoard* | EDDS | -0.062 | 0.541 | *Hoard* | EDDS | 0.052 | 0.576 |
| *DCQ* | EDDS | -0.019 | 0.868 | *DCQ* | EDDS | 0.057 | 0.604 |
| *PDI-DCQ* | EDDS | -0.032 | 0.795 | *PDI-DCQ* | EDDS | 0.046 | 0.683 |

**. Coefficient is significant at the 0.01 level (2-tailed).

Table 6. Contrasts between BDD and OCD Coefficients for All Dependent Variables.

| *Executive Function Index* | | $\chi^2$ | *p* |
|---|---|---|---|
| DCQ | Wash | 2.32 | 0.128 |
| | Check | 10.37 | 0.001[a] |
| | Order | 0.89 | 0.345 |
| | Hoard | 1.79 | 0.181 |
| PDI-DCQ | Wash | 1.73 | 0.189 |
| | Check | 9.17 | 0.003[b] |
| | Order | 0.12 | 0.732 |
| | Hoard | 0.76 | 0.384 |
| *Memory Performance* | | $\chi^2$ | *p* |
| DCQ | Wash | 0.54 | 0.464 |
| | Check | 2.95 | 0.086 |
| | Order | 4.78 | 0.029 |
| | Hoard | 2.19 | 0.139 |
| PDI-DCQ | Wash | 1.39 | 0.239 |
| | Check | 0.05 | 0.817 |
| | Order | 0.63 | 0.428 |
| | Hoard | 0.03 | 0.856 |
| *Card Sorting Test* | | $\chi^2$ | *p* |
| DCQ | Wash | 0.77 | 0.380 |
| | Check | 0.05 | 0.827 |
| | Order | 0.35 | 0.556 |
| | Hoard | 5.70 | 0.017 |
| PDI-DCQ | Wash | 1.78 | 0.182 |
| | Check | 3.67 | 0.055 |
| | Order | 3.11 | 0.078 |
| | Hoard | 22.40 | <.001[b] |
| *Navon Task* | | $\chi^2$ | *p* |
| DCQ | Wash | 0.78 | 0.377 |
| | Check | 0.00 | 0.979 |
| | Order | 1.82 | 0.177 |
| | Hoard | 0.04 | 0.839 |
| PDI-DCQ | Wash | 1.19 | 0.275 |
| | Check | 0.74 | 0.389 |
| | Order | 0.46 | 0.497 |
| | Hoard | 0.40 | 0.525 |

| *Stroop Task* | | $\chi^2$ | *p* |
|---|---|---|---|
| DCQ | Wash | 0.01 | 0.932 |
| | Check | 0.24 | 0.623 |
| | Order | 0.58 | 0.445 |
| | Hoard | 0.00 | 0.956 |
| PDI-DCQ | Wash | 0.08 | 0.778 |
| | Check | 0.04 | 0.832 |
| | Order | 2.67 | 0.102 |
| | Hoard | 1.26 | 0.261 |
| *Trail-Making Test* | | $\chi^2$ | *p* |
| DCQ | Wash | 2.25 | 0.134 |
| | Check | 2.61 | 0.106 |
| | Order | 0.11 | 0.738 |
| | Hoard | 3.15 | 0.076 |
| PDI-DCQ | Wash | 2.29 | 0.130 |
| | Check | 2.66 | 0.103 |
| | Order | 0.07 | 0.785 |
| | Hoard | 4.42 | 0.036 |
| *Emotional Stroop* | | $\chi^2$ | *p* |
| DCQ | Wash | 2.76 | 0.097 |
| | Check | 0.14 | 0.707 |
| | Order | 1.97 | 0.160 |
| | Hoard | 0.00 | 0.962 |
| PDI-DCQ | Wash | 2.67 | 0.102 |
| | Check | 0.12 | 0.726 |
| | Order | 2.87 | 0.090 |
| | Hoard | 0.01 | 0.922 |
| *Revised Eyes Test* | | $\chi^2$ | *p* |
| DCQ | Wash | 0.03 | 0.853 |
| | Check | 0.61 | 0.435 |
| | Order | 0.11 | 0.738 |
| | Hoard | 0.04 | 0.833 |
| PDI-DCQ | Wash | 0.04 | 0.837 |
| | Check | 0.63 | 0.428 |
| | Order | 0.26 | 0.607 |
| | Hoard | 0.02 | 0.893 |

[a]. Contrast is significant at the 0.008 level (2-tailed; Hypotheses 1 & 2).

[b]. Contrast is significant at the 0.00625 level (2-tailed; Hypotheses 4, 5, & 6).

indicated that the only significant predictor of the EFI was the checking score, $\beta$ = -0.268, $t(128)$ = -3.3, p = .001. The first hypothesis for EFI, that is, that ordering symptoms would be most related to DCQ, was supported. The second hypothesis that is, that checking symptoms would be most related to DCQ, and the third hypothesis, that is, that washing symptoms would be least related, were not supported. The DCQ coefficient was most closely related to that of Order, followed by, in order, those of Hoard, Wash, and Check. The difference between DCQ and Check was the only one to reach significance; DCQ was significantly larger than Check ($\chi^2$ = 10.37, p = .001). DCQ was not statistically different from Order or Wash. Therefore, although DCQ was most related to Order, it was least related to, and significantly different than, Check.

The fourth, fifth, and sixth hypotheses for EFI, that is, that PDI-DCQ would be most related to Wash, Order, and Hoard, was supported. PDI-DCQ was most closely related to Order, followed by, in order, Hoard, Wash, and Check. The PDI-DCQ coefficient was not statistically different from those of Order, Hoard, or Wash. It was, however, significantly larger than that of Check ($\chi^2$ = 9.17, p = .003). Therefore, PDI-DCQ was most related to Order, Hoard, and Wash, while it was least related to, and significantly different than, Check.

*Memory Performance*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the Memory Performance score after controlling for EDDS. The Memory performance score was created using a composite of the Digit Span score and

Corsi Block Test score. Six cases with extreme values were eliminated, and the EDDS and OCI-R Wash score were transformed with square root transformation due to non-normality. Regression results indicated that the only significant predictor of the Memory Performance score was the DCQ, $\beta = -0.233$, $t(128) = -2.16$, $p = .032$.

The first two hypotheses for Memory Performance, that is, that Check and Order would be most related to DCQ, and the third hypothesis, that is, that washing symptoms would be least related to DCQ, were not supported. DCQ was most closely related to Wash, followed by, in order, Hoard, Check, and Order. None of these differences reached significance. Therefore, DCQ was the most related to Wash, while it was least related to, but not significantly different than, Order.

The fourth and fifth hypotheses for Memory Performance, that is, that PDI-DCQ would be most related to Wash and Order, was not supported, while the sixth hypothesis, that PDI-DCQ would be most related to Hoard, was supported. PDI-DCQ was most closely related to Hoard, followed by, in order, Check, Order, and Wash. None of these differences reached significance. Therefore, PDI-DCQ was most related to Hoard, but Wash and Order were not more related to PDI-DCQ than was Check.

### *Card Sorting Task*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the Card Sorting Test score after controlling for EDDS. Six cases with extreme values were eliminated, and the EDDS and OCI-R washing score were transformed with square root transformation due to non-normality. Regression results

indicated that the only significant predictors of the Card Sorting Test were the hoarding score, $\beta$ = -0.368, $t(128)$ = -4.21, $p < .001$ and the DCQ, $\beta$ = -0.295, $t(128)$ = -2.8, p = .006.

The first and second hypotheses for the Card Sorting Task, that is, that checking and ordering symptoms would be most related to DCQ, was supported, while the third hypothesis, that is, that washing symptoms would be least related to DCQ, was not supported. DCQ was most closely related to Check, followed by, in order, Order, Wash, and Hoard. None of these differences reached significance. Therefore, although DCQ was not the least related to Wash, it was most closely related to Check and Order.

The fourth and fifth hypotheses for the Card Sorting Task, that is, that PDI-DCQ would be most related to Wash and Order, was supported, while the sixth hypothesis, that is, that it would be most related to Hoard, was not. PDI-DCQ was most closely related to Wash, followed by, in order, Order, Check, and Hoard. The PDI-DCQ and Hoard difference was the only one to reach significance. Hoard was significantly smaller than PDI-DCQ ($\chi^2$ = 22.4, $p < .001$). PDI-DCQ was not significantly different than Wash, Order, or Check. Therefore, while PDI-DCQ was most related to Wash, it was least related to, and significantly different than, Hoard.

*Global-local processing*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the Navon score after controlling for EDDS. Five cases with extreme values were eliminated, and the EDDS and OCI-R washing score were transformed with

square root transformation due to non-normality. Regression results indicated that there were no significant predictors of the Navon score.

Due to a technical malfunction, the Navon task data for 17 subjects was lost. A multiple imputation procedure (Rubin, 1987) was used to estimate the missing data, and the imputed data was used in secondary regressions to substantiate the results obtained with the original data. The secondary regressions did not indicate substantially different results than those obtained with the original data, and none of the coefficients was significantly predictive of the Navon score.

The first hypothesis for the Navon Task, that is, that ordering symptoms would be most related to DCQ, was not supported, while the second hypothesis, that is, that checking symptoms would be most related to DCQ, was supported. In addition, the third hypothesis, that is, that washing symptoms would be least related to DCQ, was not supported. DCQ was most closely related to Check, followed by, in order, Hoard, Wash, and Order. None of these differences reached significance. Therefore, while DCQ was most related to Check, it was least related to Order, although not significantly different than Order.

The fourth hypothesis for the Navon task, that is, that PDI-DCQ would be the most related to Wash, was not supported, while the fifth and sixth hypotheses, that is, that Hoard and Order would the most related to PDI-DCQ, were supported. PDI-DCQ was most closely related to Hoard, followed by, in order, Order, Check, and Wash. None of these differences reached significance. Therefore, while PDI-DCQ was most related to Hoard, it was least related to, although not significantly different than, Wash.

*Stroop Task*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the Stroop Task score after controlling for EDDS. Six cases with extreme values were eliminated, and the EDDS and OCI-R washing and checking scores were transformed with square root transformation due to non-normality. Regression results indicated that the only significant predictor of the Stroop Task score was the ordering score, $\beta = .175$, $t(128) = 1.99$, $p = .049$.

The first and second hypotheses for the Stroop task, that is, that checking and ordering symptoms would be most related to DCQ, were not supported, and the third hypothesis, that is, that washing symptoms would be least related to DCQ, was not supported. DCQ was most closely related to Hoard, followed by, in order, Wash, Check, and Order. None of these differences reached significance. Therefore, DCQ was most related to Hoard and least related to, but not significantly different than, Order.

The fourth, fifth, and sixth hypotheses for the Stroop task, that is, that PDI-DCQ would be most related to Wash, Order, and Hoard, were not supported. PDI-DCQ was most closely related to Check, followed by, in order, Wash, Hoard, and Order. None of these differences reached significance. Therefore, PDI-DCQ was most closely related to Check, and least related to, but not significantly different than, Order.

*Trail-making Test*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and

ordering scores on the Trail-Making Test score after controlling for EDDS. Six cases with extreme values were eliminated, and the EDDS and OCI-R washing and checking scores were transformed with square root transformation due to non-normality. Regression results indicated that there were no significant predictors of the TMT score. The first hypothesis for TMT, that is, that ordering symptoms would be most related to DCQ, was supported, while the second hypothesis, that is, that checking symptoms would be most related to DCQ, was not supported. The third hypothesis, that is, that washing symptoms would be least related to DCQ, was not supported. DCQ was most closely related to Order, followed by, in order, Wash, Check, and Hoard. None of these differences reached significance. Therefore, while DCQ was most related to Order, it was least related to, but not significantly different than, Hoard.

The fourth and fifth hypotheses for TMT, that is, that PDI-DCQ would be the most related to Wash and Order, were supported, while the sixth hypothesis, that is, that it would be most related to Hoard, was not supported. PDI-DCQ was most closely related to Order, followed by, in order, Wash, Check, and Hoard. None of these differences reached significance. Therefore, while PDI-DCQ was most related to Order and Wash, it was least related to, but not significantly different than, Hoard.

### *Emotional Interference*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the Emotional Stroop scores after controlling for EDDS. An Emotional Stroop score of OCD-negative words was used for the four OCD regressions,

while a score of BDD-negative words was used for the two BDD regressions (i.e. DCQ and PDI-DCQ). Six cases with extreme values were eliminated, and the EDDS and OCI-R washing score were transformed with square root transformation due to non-normality. Regression results indicated that the only significant predictor of the Emotional Stroop score was the washing score, $\beta = .187$, $t(128) = 2.13$, $p = .035$. The first hypothesis for emotional Stroop, that is, that checking symptoms would be most related to DCQ, was not supported. DCQ was most closely related to Hoard, followed by, in order, Check, Order, and Wash. None of these differences reached significance. The DCQ coefficients in the BDD regression were found to be statistically equivalent with all the coefficients in the OCD regression. Therefore, although DCQ was most closely related to Hoard, it was least related to, but not significantly different than, Wash.

The second and third hypotheses for emotional Stroop, that is, that PDI-DCQ would be most related to Wash and Order, were not supported, while the fourth hypothesis, that is, that it would be most related to Hoard, was supported. PDI-DCQ was most closely related to Hoard, followed by, in order, Check, Wash, and Order. None of these differences reached significance. Therefore, PDI-DCQ was most related to Hoard, while it was least related to, but not significantly different than, Order.

*Emotion Recognition*

Six multiple regressions were conducted to determine the influence of the DCQ score, the PDI-DCQ interaction score, and the OCI-R washing, checking, hoarding, and ordering scores on the Revised Eyes Test score after controlling for EDDS. Five cases with extreme values were eliminated, and the EDDS and OCI-R washing score were

transformed with square root transformation due to non-normality. Regression results indicated that there were no significant predictors of the Revised Eyes Test score.

The first Revised Eyes Test hypothesis, that is, that Wash would be least related to DCQ, was not supported. DCQ was most related to Wash, followed by, in order, Hoard, Order, and Check. None of these differences reached significance. DCQ was not statistically different than Wash ($\chi^2$= .03, p = .853). Therefore, DCQ was not the least related to Wash.

The second, third, and fourth Revised Eyes Test hypotheses, that is, that PDI-DCQ would be most related to Wash, Order, and Hoard, were supported. PDI-DCQ was most closely related to Hoard, followed by, in order, Wash, Order, and Check. None of these differences reached significance. Therefore, PDI-DCQ was most related to Wash, Hoard, and Order, although not significantly different than Check.

Overall, then, the summarized findings in relation to the hypotheses are as follows:

1) Hypothesis 1, that is, that ordering symptoms would be more statistically equivalent to BDD symptoms than washing and hoarding symptoms in predicting self-reported executive function, memory performance, set-shifting, global-local processing, cognitive inhibition, and task switching, was partially supported. Ordering symptoms were found to be more statistically equivalent to BDD symptoms than washing and hoarding symptoms in predicting self-reported executive function, set-shifting, and task switching.

2) Hypothesis 2, that is, that checking symptoms would be more statistically equivalent to BDD symptoms than washing and hoarding symptoms in predicting self-reported executive function, memory performance, set-shifting, global-local processing, cognitive inhibition, and task switching, was partially supported. Checking symptoms were found to be more statistically equivalent to BDD symptoms than washing and hoarding symptoms in predicting set-shifting and global-local processing.
3) Hypothesis 3, that is, that washing symptoms would be least statistically equivalent to BDD symptoms in predicting self-reported executive function, memory performance, set-shifting, global-local processing, cognitive inhibition, task switching, and emotion recognition, was not supported.
4) Hypothesis 4, that is, that delusional-BDD symptoms would be more statistically equivalent to washing symptoms than checking symptoms in predicting all measures of neuropsychological performance, was partially supported. Delusional-BDD symptoms were found to be more statistically equivalent to washing symptoms in predicting self-reported executive function, set-shifting, task switching, and emotion recognition.
5) Hypothesis 5, that is, that delusional-BDD symptoms would be more statistically equivalent to ordering symptoms than checking symptoms in predicting all measures of neuropsychological performance, was partially supported. Delusional-BDD symptoms were found to be more statistically equivalent to

ordering symptoms in predicting self-reported executive function, set-shifting, task switching, global-local processing, and emotion recognition.

6) Hypothesis 6, that is, that delusional-BDD symptoms would be more statistically equivalent to hoarding symptoms than checking symptoms in predicting all measures of neuropsychological performance, was partially supported. Delusional-BDD symptoms were found to be more statistically equivalent to hoarding symptoms in predicting self-reported executive function, memory ability, global-local processing, emotion recognition, and emotional interference.
7) Hypothesis 7, that is, that checking symptoms would be most statistically equivalent to BDD symptoms in predicting emotional interference, was not supported.

# CHAPTER IV

# DISCUSSION

The goal of the present study was to examine the neuropsychological similarities and differences between subclinical Body Dysmorphic Disorder and Obsessive-Compulsive Disorder subtypes, with the hope of further clarifying the relationship between the two disorders. No previous study has examined a potential link between these two disorders by comparing the neuropsychological performance of BDD symptoms and OCD symptom dimensions. It was expected that BDD would share the most similarities in neuropsychological performance with the OCD subtypes of checking and ordering, while it would share the most differences with the washing subtype. Further, it was expected that the delusional variant of BDD would share the most similarities with the hoarding, ordering, and washing symptom dimensions.

Although several similarities and differences were found, no consistent pattern of relationships emerged between OCD and BDD symptomatology on measures of neuropsychological performance. This suggests that while BDD and OCD may share overlap with one another in neuropsychological features, BDD does not align perfectly with any of the OCD symptom dimensions. Like previous studies, this study did find BDD symptoms to be associated with executive functioning (Dunai et al, 2010; Hanes, 1998), specifically, memory performance and set-shifting ability, although in this study, they were associated with improved set-shifting performance, contrary to findings from

previous studies. This study, however, did not find BDD symptoms to be associated with emotion recognition deficits, or emotional interference, contrary to the few previous studies that examined these abilities among individuals with BDD (Buhlmann et al., 2002; Buhlmann et al, 2004). This could be due to the fact that only individuals with subclinical symptoms were assessed and any potential deficits associated with BDD symptoms were not profound enough in these individuals to demonstrate a significant impairment in neuropsychological functioning. In addition, the measures used in this study to assess functioning were not identical to those used in these noted studies; this could partially account for the differences in results.

In comparing BDD and OCD symptoms on measures of neuropsychological performance, BDD symptoms were only found to be significantly different than checking symptoms in predicting self-reported executive function. BDD symptoms were found to be the most statistically equivalent to ordering symptoms in predicting self-reported executive function and task switching; to washing symptoms in predicting memory ability and emotion recognition; to checking symptoms in predicting global-local processing and set-shifting; and to hoarding symptoms in predicting inhibition and emotional interference.

This study did not find OCD symptoms to be associated with emotion recognition deficits, contrary to previous studies (Aigner, 2007; Grisham et al., 2010), which again could be due to the use of subclinical individuals and use of a different measure of emotion recognition. However, this study did find that washing symptoms were a significant predictor of emotional interference, just as a previous study had (Rao et al,

2010). In addition, previous studies have found OCD symptoms to be associated with deficits in set-shifting, inhibition, and general executive functioning (Hashimoto et al., 2011; Lawrence et al., 2006; Omori, 2007). The present study also found OCD symptoms to be associated with performance in these areas: checking symptoms were associated with poorer self-reported executive function and ordering symptoms were associated with poorer inhibition; however, hoarding symptoms were predictive of better performance in set-shifting. It is unclear why hoarding was associated with better performance in these areas, as this contradicts results from a previous study, which found the OCD hoarding subtype to be associated with poor decision-making (Lawrence et al, 2006). Hoarding symptoms are not unique to OCD, but are also listed as one of the criteria for Obsessive-Compulsive Personality Disorder (OCPD; American Psychiatric Association, 2013). There is still controversy regarding whether the presence of hoarding symptoms is more of a marker for OCD or OCPD, but they have been associated with both disorders independently (Fineberg, Sharma, Sivakumaran, Sahakian, & Chamberlain, 2007), and nonclinical hoarding behavior has been associated with obsessive-compulsive personality traits (Frost & Gross, 1993; Frost, Krause, & Steketee, 1996). OCPD traits have, however, been associated with adaptive characteristics. Ullrich, Farrington, & Coid (2007) found that obsessive-compulsive personality traits in a nonclinical sample were associated with increased status and wealth, and King (1998) found that, among college students, compulsive personality traits were associated with increased academic performance. Therefore, it is possible that OCPD traits, including hoarding, among a nonclinical college sample could be associated with better

performance on tasks that measure abilities that contribute to academic success, such as set-shifting.

Likewise, BDD symptoms were found to be predictive of improved set-shifting performance. The reason for this paradoxical finding is unclear, as it is inconsistent with the findings of the few studies that have examined neuropsychological performance in BDD. However, BDD symptoms, like hoarding symptoms, have been linked to obsessive-compulsive personality traits, such as perfectionism (Schieber, Kollei, de Zwaan, Müller, and Martin (2013). Therefore, just as may be the case with hoarding symptoms, BDD symptoms in a nonclinical sample may be related to OCPD traits, which may account for the superior set-shifting performance.

Just as with BDD symptoms, a consistent relationship between delusional-BDD and OCD symptoms was not demonstrated, although they did share many similarities and differences. Poor insight among individuals with OCD has been associated with impaired memory and inhibition (Kashyap, Kumar, Kandavel, & Reddy, 2012), however, no known previous studies have examined neuropsychological performance among poor-insight individuals with BDD symptoms or OCD symptom dimensions. Although not a significant predictor of any outcome measure, delusional-BDD symptoms were found to be significantly different than checking symptoms in predicting self-reported executive function and significantly different than hoarding symptoms in predicting set-shifting. Delusional-BDD symptoms were found to be most statistically equivalent to ordering symptoms in predicting self-reported executive function and task switching; to washing symptoms in predicting set-shifting, to checking symptoms in predicting inhibition; and

to hoarding symptoms in predicting global-local processing, emotional interference, memory ability, and emotion recognition.

The results found by this study suggest a potential relationship between BDD and OCD, and in particular, the OCD symptom dimensions, given that most of the OCD symptom dimensions and the BDD and delusional-BDD symptoms did not statistically differ in predicting any measure of neuropsychological performance. No statistical differences were found between BDD and any OCD symptoms in predicting memory ability, set-shifting, global-local processing, inhibition, task switching, emotional interference, or emotion recognition, and no statistical differences were found between delusional-BDD and any OCD symptoms in predicting memory ability, global-local processing, inhibition, task switching, emotional interference, or emotion recognition. However, due to the fact that the nature of the relationships between BDD and OCD symptoms differed across each area of cognitive functioning, these results may indicate that a relationship between BDD and OCD, if one exists, is potentially complex and multifaceted. The OCD symptom dimensions that did significantly differ from BDD symptoms varied depending across each particular neuropsychological task. Hanes (1998) found that BDD and OCD patients performed similarly on measures of executive function, but this study only assessed OCD symptoms as a whole. BDD and each OCD symptom dimension may, in fact, be associated with specific neuropsychological deficits, but this study's findings did not indicate that any OCD symptom dimension was consistently similar to BDD symptoms across all measures of neuropsychological performance.

This may point to the possible need for considering interaction effects when identifying the relationship between BDD and OCD. Several studies have noted differences in clinical presentation between individuals who have only OCD or BDD and individuals who have both OCD and BDD, including the symptom dimensions that they predominantly display and the severity of those symptoms (Costa et al, 2012) and the clinical presentation of symptoms (Frare, Perugi, Ruffolo, & Toni,2004). Costa et al. (2012) found that the severity of ordering and washing symptoms were higher among individuals with BDD and OCD than among individuals with only OCD. Similarly, Stewart, Stack, & Wilhelm (2008) found that the severity of hoarding, ordering, and checking symptoms were higher among individuals with BDD and OCD than among individuals with OCD alone. Because this study only assessed subclinical BDD and OCD, it did not analyze neuropsychological performance separately for individuals who displayed both OCD and BDD symptoms. It is possible, then, that comorbidity could account for the differences in results between the various neuropsychological measures. In addition, this study assessed only quantity of symptoms, and not severity. It is possible that severity of symptoms could impact the nature of the relationship between BDD and OCD symptom dimensions. Therefore, additional research is required to further identify how BDD and OCD should be conceptualized in relation to one another.

Despite the lack of consistent findings in this study, the line of inquiry initiated by it could potentially have important clinical implications. There is still very little known about the etiology and nosology of BDD, and while OCD has been the subject of myriad studies in the last several decades, its conceptualization is still not clearly-defined due to

its heterogeneity in presentation. Further clarifying and identifying the precise nature of the relationship between BDD and OCD, and especially the relationship between BDD and OCD symptom dimensions, could provide a better picture of the etiological factors of both disorders, the ideal methods of treatment, and perhaps insight into preventative measures.

There were several notable limitations of this study. A primary limitation is the fact that BDD symptoms were only found to be a significant predictor of two of the eight measures of neuropsychological performance, and no more than one OCD symptom dimension was found to be a significant predictor for any given outcome variable. It is possible that the outcome measures were not sensitive enough to adequately capture subclinical symptomatology or neuropsychological performance. Therefore, comparing the predictive power of BDD symptoms and the symptom dimensions would be more valuable and informative if each symptom set to be compared was a significant predictor of the outcome measures.

Although the majority of the hypotheses were partially supported, and BDD and delusional-BDD symptoms were found to more statistically equivalent to certain OCD coefficients than others, only three of all contrasts conducted were found to reach differences of statistical significance. Although comparisons demonstrated a trend for BDD symptoms to be more equivalent to checking and ordering symptoms, and for delusional-BDD symptoms to be more equivalent to washing, ordering, and hoarding symptoms, in predicting certain performance areas, it is important to note that no comparison between BDD symptoms and washing and hoarding symptoms, and no

comparison between delusional-BDD and checking symptoms, was found to be statistically different. Therefore, conclusions drawn regarding the relative equivalence of BDD and OCD coefficients should be made cautiously, given that the majority of the contrasts between them were not found to be statistically different from one another.

Another limitation concerns the lack of diversity among the sample. The study consisted of 136 students, all of which were young adults, at a public university in North Dakota. Therefore, the results of this study may not necessarily be representative of the population. In addition, the majority of the participants were Caucasian and the results may not generalizable to other racial or ethnic groups. To increase generalizability of the findings, this study should be replicated in other geographic regions, among individuals of other age groups and ethnicities. An additional limitation of this study is its reliance on self-report. Five of the measures were based on self-report, which may decrease the reliability of the data obtained.

In addition, this study examined individuals with subclinical profiles and only assessed symptomatology of OCD and BDD rather than determine diagnoses of these disorders. Thus, it could potentially be useful to pursue this line of inquiry among individuals who have obtained clinical diagnoses of BDD and OCD and who have had OCD symptom domains assessed through a clinical structured interview, in order to investigate whether the hypothesized relationships between BDD and OCD exist in a clinical setting.

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