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Investigating Executive Functions in Men Seeking Help for
Hypersexual Behavior Using Neuropsychological Testing

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A dissertation submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

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ABSTRACT

Investigating Executive Functions in Men Seeking Help for Hypersexual Behavior Using Neuropsychological Testing

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Doctor of Philosophy

Patients seeking help for hypersexual behavior often exhibit features of impulsivity, cognitive rigidity, poor judgment, deficits in emotion regulation, and excessive preoccupation with sex. Some of these characteristics are also common among patients presenting with neurological pathology associated with executive dysfunction. These observations led to the current investigation in which differences across scores on objective neuropsychological tests of executive functioning were explored in a group of hypersexual male patients ($n = 30$) compared with a non-hypersexual community sample ($n = 30$) of men. Using multivariate statistics, differences between the groups were examined yielding significant differences on measures of hypersexuality. However, the groups failed to exhibit significant differences across neuropsychological tests of executive functioning. These results contradict a previous finding of executive deficits among hypersexual men measured by self-report. These findings are discussed as they pertain to conceptualizations of hypersexual populations and possible implications for future research.

Keywords: hypersexual behavior, hypersexual disorder, executive functions, sex addiction

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Investigating Executive Functions in Men Seeking Help for Hypersexual Behavior Using Neuropsychological Testing

Over a century ago, German psychiatrist Krafft-Ebbing wrote about a phenomenon he labeled “pathological sexuality”—a condition of maladaptive sexual appetite that drove affected individuals to impulsively pursue an “insatiable succession of sexual enjoyments” (Krafft-Ebbing, 1886, p. 70). In the past few decades, this same phenomenon has become the subject of an increasing amount of research under such labels as sexual addiction (Carnes, 1987; Earle & Crow, 1990; Goodman, 1993, 2001; Lundy, 1994; Myers, 1995; Schwartz & Brasted, 1985), sexual impulsivity (Barth & Kinder, 1987), sexual compulsivity (Coleman, 1987; Kalichman & Rompa, 1995; McCarthy, 1994; Pincus, 1989; Quadland, 1985; Travin, 1995), compulsive sexual behavior (Black, Kehrberg, Flumerfelt, & Schlosser, 1997; Coleman, 1991; Coleman, Gratzner, Nesvacil, & Raymond, 2000; Raymond, Coleman¹, & Miner, 2003), and hypersexual behavior (Brandell & Nol, 1992; Finlayson, Sealy, & Martin, 2001; Kafka, 2001; Montaldi, 2002; Orford, 1978; Reid, 2007; Reid, Carpenter, Lloyd, 2009; Rinehart & McCabe, 1997; Stein, Black, Shapira, & Spitzer, 2001). Although these terms are still largely absent in the current nomenclature of diagnostic sexual disorders, the phenomenon they attempt to label is becoming the focus of increased attention among researchers.

Research attention to this phenomenon of maladaptive sexual appetite was scarce until the last couple of decades, but since the 1980s it has grown steadily, as reflected in venues for professional dialogue about hypersexual behavior. For example, several social science journals have included articles on the topic of hypersexual behavior in recent years and in 1993 a new journal emerged dedicated exclusively to this subject matter: *Sexual Addiction and Compulsivity*. The topic of hypersexual behavior also receives attention at professional conferences such as the

¹ Dr. Eli Coleman currently describes hypersexuality as an impulsive/compulsive sexual behavior.

national conventions of the American Psychological Association and the American Association of Marriage and Family Therapists, where workshops, papers, and posters have been presented to address this subject. There has also been an increase in literature associated with sexual issues in general: Whereas in 2001 there were 19 professional journals devoted to issues of human sexuality, just five years later there were 44 social science journals on the topic (Reid & Woolley, 2006).

Although these journals address a wide array of topics on sexuality, there has been an increase in articles specifically devoted to the topic of hypersexuality. This growth has likely occurred in reaction to clinicians seeing an increase in the number of patients seeking help for hypersexual behavior. Whether there has been an actual increase in the phenomena of hypersexuality or whether patients feel more able to seek help for these presenting problems is unclear. Cooper, Delmonico, and Burg (2000) have suggested that the Internet may have played a role in promoting greater sexual curiosity, which for some has led to increased sexual behavior, including hypersexuality.

One explanation for the increasing number of patients seeking help for hypersexual behavior may be related to the extensive variety of sexual experiences now offered via the Internet (Carnes, 2003; Cooper, 1998), the exploration of which may fuel sexual curiosity and experimentation. There appears to be something intoxicating about these Internet experiences that perpetuates patterns of increased use and reports of diminished control over sexual behavior. People who might not have otherwise met are now finding each other via the Internet and “hooking up” to explore their sexual fantasies. In some situations these individuals are participating in activities that might be perceived as bizarre or deviant, and a portion of them are crossing the boundaries of societal norms and finding themselves in conflict with legal

authorities (Mitchell & Wells, 2007). Although it is likely that some amount of online sexual experimentation falls within the broad bandwidth of normative sexual behavior, a portion of individuals appear to become preoccupied, driven, or obsessed with sex to the extent that they experience psychological distress and interference with their activities of daily living.

The importance of understanding hypersexual behavior cannot be underestimated, because the consequences associated with this behavior have potentially serious implications (Parsons, Bimbi, & Halkitis, 2001; Roller, 2004). Of course, preoccupation or obsession with any behavior can cause problems, but sexual behavior has unique consequences such as the transmission of disease and the creation of life (i.e., unintended pregnancies), and sex is also powerfully reinforced through neurophysiological processes (Bradford, 2001). Additionally, hypersexual individuals in monogamous committed relationships may find that their behavior causes them to break social norms related to fidelity, leading to attachment ruptures, which have their own set of challenges and obstacles (Ferree, 2002; Reid & Woolley, 2006; Zapf, Greiner, & Carroll, 2008). Numerous other implications, which will be addressed in the literature review section of this work, substantiate the need to develop a deeper understanding of hypersexuality and its associated features, comorbid conditions, and causal factors.

Despite the increase in understanding of hypersexual behavior in recent years, researchers have yet to investigate the possibility of an underlying biological link to hypersexuality independent of other clinical syndromes (e.g., ADHD, mania, dementias) that have identified neurophysiological explanations for changes in behavior. In these populations hypersexual behavior is secondary to an Axis I disorder and appears to have etiology associated with neurobiological substrates. Thus, it is reasonable to question whether cortical structures in the brain are implicated in hypersexual behavior in patients without comorbid disorders.

These novel ways of conceptualizing hypersexual behavior provide new possibilities for treatment interventions. One way of testing whether cortical structures are implicated in hypersexuality is through the assessment of executive functions (EF) associated with frontal lobe deficits. Deficits in these areas have been associated with poor impulse control (inhibition), impaired judgment, poor decision making skills, affect regulation, and cognitive flexibility which reflect similar deficits to those found among hypersexual populations (Reid, Karim, McCrory, & Carpenter, 2010).

Purpose of the Study

The primary purpose of this study is to explore whether individuals seeking help for hypersexual behavior exhibit symptoms of frontal lobe deficits as conceptualized by executive functions and, if such deficits exist, whether they will be significantly related to the severity of hypersexual behavior. This study will focus particularly on the findings from neuropsychological testing that are theorized to capture the following elements of executive functions: set shifting, hypothesis generation, problem solving, planning, organization, fluency, inhibition or self-control, initiative, cognitive flexibility, and attention. The rationale for these selections will be discussed later.

This study is considered exploratory in nature, in part because previous research linking hypersexual behavior and executive dysfunction is generally limited to cases where the presenting problem was clearly neurological (e.g., temporal lobe epilepsy, traumatic brain injury) rather than among individuals whose primary complaint is hypersexuality. One previous study examining executive functions among a sample of hypersexual men compared to controls using self-report measures noted several differences across multiple subscales of the Brief Rating Inventory of Executive Function–Adult Version (Reid et al., 2010). However, whether such

findings can be replicated when objective neuropsychological tests of executive functioning are employed is unknown.

Because some researchers and clinicians are advocate addiction or compulsivity models to explain hypersexual behavior, it is important that alternative explanations for hypersexuality be explored. This includes ruling out any possibility that hypersexual individuals have frontal lobe deficits that might be impairing their judgment or their ability to regulate their sexual choices. This study represents novel work in this area, in particular, because anecdotally speaking, many hypersexual individuals do not appear (at least to the average observer who is unaware of their hypersexual behavior) to have any deficits in their executive functions. Furthermore, a pilot sample of 30 hypersexual patients were shown to have elevated scores ($M = 120.5$, $SD = 11.2$) on intelligence testing, suggesting that as a group these individuals have high cognitive functioning (Reid & Lloyd, 2007). Yet, despite the existing evidence, associated features of executive functions could plausibly be implicated in the choices a hypersexual individual makes. This study will seek to answer questions relevant to understanding whether there is any empirical evidence that executive dysfunctions are implicated (meaning a positively correlated relationship) in individuals who seek help for hypersexuality.

Research Questions and Hypothesis

This study is designed to investigate if there any evidence of a relationship between hypersexual behavior and executive functions as measured by the results of neuropsychological testing sensitive to deficits in the frontal lobes? If a relationship does exist, what particular subcategories of executive function deficits are suggested by the data, and are these relationships significant when compared to a sample of community controls? In order to answer these research questions, the patient group will be compared to a sample of community controls in order to

determine whether the patient group exhibits significant differences across the respective neuropsychological tests measuring executive functions.

Deficits in executive functions have been noted among a number of populations that exhibit tendencies similar to hypersexual patients, such as those seeking help for substance-abuse, eating disorders, and pathological gambling. Individuals with substance-related disorders, for instance, commonly exhibit dysexecutive symptoms such as impulsivity, poor judgment and planning, and impoverished concentration (Giancola & Mezzich, 2003; Gonzalez, Bechara, & Martin, 2007; Ihara, Berrios, & London, 2000). Deficits in cognitive flexibility, affect regulation, and decision-making have been noted among women with anorexia and bulimia nervosa (Holliday, Tchanturia, Landau, Collier, & Treasure, 2005; Steinglass, Walsh, & Stern, 2006; Tchanturia et al., 2004; Wilsdon & Wade, 2006). Cavedini, Riboldi, Keller, D'Annunzi, and Bellodi (2002) advanced the hypothesis that pathological gambling patients exhibit deficits in ventromedial orbitofrontal circuits, a theory which they indirectly tested through neuropsychological testing on an executive function task of decision-making. Their results showed evidence in support of their hypothesis, with gamblers performing significantly worse than a healthy control group. Kalechstein et al. (2007) found similar levels of impaired performance on tests of executive function between a sample of pathological gamblers and methamphetamine-dependent participants compared to a healthy control group. Given these results, it's reasonable to hypothesize that hypersexual patients may likewise show evidence of executive function deficits. The specific hypothesis to be tested in this research will be discussed later in this manuscript.

Definitions

The definitions here are intended to give the reader a quick reference for how the investigator conceptualizes the two main constructs of this work. More detail about these definitions is located in the literature review section of this study.

Hypersexual Behavior: Hypersexual behavior is defined as difficulty in regulating (e.g., diminishing or inhibiting) sexual thoughts, feelings, or behavior to the extent that negative consequences are experienced by self or others. The behavior causes significant levels of personal or interpersonal distress and may include activities that are incongruent with personal values, beliefs, or desired goals. The behavior may function as a maladaptive coping mechanism (e.g., used to avoid emotional pain or used as a tension-reduction activity) and may coincide with other psychopathology or neurological impairments.

Executive Functions: Executive functions consist of the constellation of cognitive processes that interact with various cortical mechanisms enabling a person to initiate action, attend to stimuli, adapt, organize, plan, inhibit behavior, formulate ideas or concepts, regulate affect, and self-motivate activities in a goal-directed or purposeful way.

Review of Relevant Literature

This chapter will begin with a brief overview of what the literature reports about hypersexual behavior and executive functions. Some rationale will then be provided from the literature to explain and why executive functions might be implicated in patients seeking help for hypersexual behavior.

Various Constructs of Hypersexual Behavior

Over the years the phenomenon of hypersexuality has been discussed under different labels including early categorizations such as nymphomania and satyriasis to more recent

conceptualizations including sexual addiction (Carnes, 1986, 1998, 2001; Carnes, Murray, & Charpentier, 2005; Goodman, 1993, 2001; Leedes, 2001; Myers, 1995; Ragan & Martin, 2000; Schneider & Irons, 2001; Schwartz & Brasted, 1985), sexual compulsivity (Coleman, 1987; Cooper & Lebo, 2001; Herring, 2001; Quadland, 1985; Travin, 1995; Weissberg & Levay, 1986), compulsive sexual behavior (Black et al., 1997; Coleman, 1991; Coleman et al., 2000; Raymond et al., 2003), sexual dependency (Wan, Finlayson, & Rowles, 2000), sexual impulsivity (Barth & Kinder, 1987; Gabbard & Bennett, 2005) and hypersexuality (Brandell & Nol, 1992; Finlayson et al., 2001; Kafka, 1997, 2001, 2003; Orford, 1978; Reid, 2007; Reid & Carpenter, 2009a, 2009b; Rinehart & McCabe, 1997, 1998; Salzman, 1972). There are numerous other labels that appear periodically but do not represent the core literature about this phenomenon. The vast array of terminology used to describe hypersexual behavior also includes labels such as unrestrained sexual desire, sexual disinhibition, sexual torridity, sexual sensation seeking, sexual desire disorders, sexaholism, excessive sexual desire disorder, hyperlibido, hyperactive sexual behavior, uninhibited sexual desire, paraphilia-related disorders, non-paraphilic sexual disorders, Don Juanism, and erotomania.

Although many of the perspectives of hypersexual behavior possess some overlap in their theoretical perspectives, some researchers note distinct and important differences that potentially influence how a clinician might treat or conceptualize the etiology of these issues. Some terminology attempts to emphasize difference aspects of hypersexuality (e.g., compulsivity) and the choice of labels by some researchers is intended to suggest pathways by which the phenomenon arises. Most researchers agree that the phenomenon of hypersexuality includes (1) diminished impulse control over sexual thoughts, desires, or behaviors, (2) repetitive, intense, preoccupation with sex over an extended period of time (e.g., several months), (3) persistence in

sexual activities despite undesirable or unpleasant consequences (e.g., interference, personal distress), and (4) the manifestation of symptoms is not due to a medical or psychiatric condition (e.g., manic phase of bipolar disorder). Several models attempting to embrace these traits will be given a brief overview and critique. It is important to note that although there are advocates for various conceptualizations and some significant philosophical differences between groups, researchers and clinicians in recent years often suspend conclusive positions on models in favor of collaborative effort to develop a more comprehensive understanding of hypersexual behavior.

Sexuality impulsivity. Barth and Kinder (1987) dismiss models of sexual compulsivity and addiction stating that diagnostically this phenomenon should be labeled an impulse control disorder. This rationale is based on their assertion that other conceptualizations (e.g., addiction or compulsion) fail to meet the criteria for their hypothesized models of hypersexual behavior or lack empirical evidence to support their claims. Although an impulse control model fits the DSM criteria for this categorization, Bancroft and Vukadinovic (2004) accurately note that this description has little explanatory value beyond suggesting a deficit in self-control. It does however, leave the field open to exploring competing explanations for this construct rather than adopting a particular view point. Despite some appeal, classifying hypersexuality as an impulse control disorder has etiological limitations because it may suggest that answers to understanding this phenomenon are to be found in the literature and research about impulse control disorders.

Sexual addiction. The label of sexual addiction has been popularized by the media and has become the most frequently applied term among lay people when referring to hypersexuality. Despite harsh criticism from clinicians and researchers, the term sex addiction remains a common label in social science journals despite being removed from earlier versions of the DSM (DSM-III-R) which included the term nonparaphilic sexual addiction under the heading of sexual

disorders not otherwise specified. The change was precipitated by the paucity of empirical data supporting its inclusion and also the political climate about sexual issues in the psychiatric community (Schmidt, 1992; Smith, 1994).

Operational definitions of sexual addiction characterize its associated features as (1) unmanageable, intense, preoccupation with sex, (2) a sense of powerless or loss of control, (3) persistence in sexual activities despite aversive consequences, and (4) patterns of escalating sexual behavior from mild to more severe, deviant, or perverse activities (Adams & Robinson, 2001; Carnes, 1986; Goodman, 1993, 2001; Manley & Koehler, 2001; Roller, 2004; Vesga-Lopez, Schmidt, & Blanco, 2007).

Advocates of sexual addiction often promote 12-step support groups as an essential element of recovery despite a lack of empirical data supporting this position (Parker & Guest, 2003). Some proponents of sexual addiction advance a disease model and encourage patients to embrace a powerlessness perspective about their sexual behavior. This perspective can be used at times to rationalize sexual choices, (e.g., helplessness because one *is* addicted) or lead one to abdicate responsibility for behavior. Goodman (2001) attempts to clarify these positions as misunderstandings, yet, the connotations associated with these labels persist, making it difficult for the scientific community to escape these criticisms. The labels associated with sexual addiction have also been widely misunderstood by lay persons. A woman who feels betrayed by a partner's sexual choices finds little comfort when a therapist conceptualizes such behavior as an addiction, disease, or a phenomenon similar to a substance-related disorder. Although these obstacles could be overcome if the mental health community agreed on terminology, definitions, and their meanings, such a commitment is unlikely under the label of sexual addiction.

Some concerns have been expressed that an addiction classification may prejudice research based on addiction models and limit opportunities to explore alternative treatment strategies that could provide more complex explanations for hypersexuality (Coleman, 1987). Controversy also exists regarding studies linking hypersexual behavior with chemical dependency (Schneider & Irons, 2001), as similarities between hypersexual behavior and addiction may exist because a portion of hypersexual patients present with comorbid substance related disorders. Studies with hypersexual patients who are substance naïve are needed to clarify some of these observations. For example, Reid and Carpenter (2009b) examined psychopathology among hypersexual patients ($N = 152$) who were substance naïve using data from the Minnesota Multiphasic Personality Inventory-2 (MMPI-2). Their results found significantly greater obsessive features among their sample and little support for characteristics associated with addiction potential or addiction traits. The results from their study did find evidence favoring obsessive traits in hypersexual patients which supports the hypothesis that “addiction” tendencies among hypersexual patients is more strongly associated with patients who also have comorbid substance related disorders rather than hypersexuality alone.

Additional criticisms of addiction classification have argued there is a lack of data supporting features of tolerance or withdrawal in patients with hypersexual behavior, although Goodman (2001) accurately notes that these characteristics are not common among all substance related disorders or unique to addiction (Miller, Dackis, & Gold, 1987). Abstinence as a goal is also problematic since the majority of substance treatment programs promote abstinence, not harm-reduction, whereas treatment of hypersexual behavior focuses on helping patients live in harmony with their sexuality not abstinence from it.

A predominant criticism of labeling hypersexual behavior as an addiction comes from resistance to embracing terminology that has historically been associated with substance-related disorders. Opponents argue that expanding the concept of addiction to sex dilutes its meaning (Levine & Troiden, 1988; Satel, 1993). Coleman (1987) has noted potential danger in labeling sex as an addiction because it may imply addiction to all manifestations of sex rather than a specific sexual object or group of sexual behaviors, although this criticism could also be made of substance related disorders as well. Arguments have also highlighted that legitimate addictions are associated with physiological dependence on a substance to which advocates of sexual addiction respond by stating that physiological mechanisms of action— such as neurochemicals implicated in the sexual response cycle—are part of hypersexual behavior (Goodman, 2001; Sunderwirth, Milkman, & Jenks, 1996). Some have simply, and perhaps carelessly, inferred similarities between substance-related disorders and sexual addiction as evidence supporting this thesis as though face validity was sufficient to warrant a diagnostic label (Ragan & Martin, 2000; Schneider & Irons, 2001).

Goodman (1993) attempted to make a strong case for the label sexual addiction and was harshly criticized by Moser (1993) who pointed out that research had yet to clearly demonstrate whether manifestations of addictive sexual behavior were secondary to other psychopathology or constituted a separate diagnosis. Furthermore Moser commented that it is incumbent upon sex researchers to show that the sexual behaviors are the source of the distress as opposed to a manifestation of some other psychopathology or psychiatric condition.

Sexual compulsivity. Quadland (1985) suggests that the outbreak of sexually transmitted diseases caused many individuals to rethink their sexual attitudes and behaviors. As attempts were made to reduce the frequency or number of sexual partners, many individuals

found themselves unable to do so and subsequently they sought treatment. This subjective loss of control is generally considered a hallmark of sexual compulsivity as people feel driven to satiate their sexual desires. Additionally, Quadland and others (Coleman, 1991; Travin, 1995) have observed that many sexually compulsive patients appear to use sex to reduce anxiety or alleviate symptom distress associated with other uncomfortable or unpleasant affective states (e.g., depression, loneliness). Indeed, mounting evidence from research has linked deficits in affect regulation (Raymond, Coleman, & Miner, 2003; Reid, 2010; Reid, Carpenter, Spackman, & Willes, 2008; Reid, Harper, & Anderson, 2009) to hypothesized models of sexual compulsivity.

A common criticism of a compulsive classification is that sex produces pleasure which is contraindicated as an associated feature of compulsions (Barth & Kinder, 1987; Goodman, 2001). Diagnostically, compulsions are repetitive behaviors used to prevent or reduce anxiety or stress but do not in themselves, provide pleasure. This criticism however, may assume that sex is a pleasurable experience because it activates neuroanatomy implicated in pleasure-reward systems in the brain (e.g., nucleus accumbens). Although this is true, pleasure is not entirely a physiological experience and hypersexual patients often report that their excessive preoccupation with sex has desensitized them to its pleasurable effects. Quadland (1985) also noted that his patient sample often reported their sexual behavior was unsatisfying. In cases where patients use sex to cope with undesirable affective states, the primary function of orgasm is to provide *relief* from emotional distress or pain, a perspective that provides some support for a compulsivity model.

Results from research advocating a compulsivity model have been mixed. Some studies suggest that OCD symptoms are associated with sexual avoidance (Aksaray, Yelken, &

Kaptanoglu, 2001; Schwartz & Abramowitz, 2003) rather than compulsive sex. Yet, the tension reduction aspect of sex as a compulsion is appealing and is supported by many studies.

Tendencies of reassurance seeking, rumination, and repetitive behaviors are often prevalent among hypersexual patients supporting an obsessive-compulsive spectrum classification but these traits are also characteristic of patients with insecurity, low self-esteem, depression, and anxiety.

Despite some limitations with classifying hypersexual behavior as an obsessive-compulsive spectrum disorder, the label sexual compulsivity appears to have legitimacy and is less fraught with problems when compared with addiction models of hypersexual behavior.

In summary of the various constructs, the label of sexual impulsivity, while diagnostically feasible, lacks explanatory value and may limit research to impulse control disorders. The constellation of challenges associated with advancing the construct of sexual addiction seems daunting. The label of sexual addiction carries a history of connotations and misunderstandings that seem hard to avoid. The use of the term addiction has become so common and applied to a so wide a range of activities that the field would likely benefit by distancing itself from a label that evokes undemonstrated connections with other literatures and could hinder researchers and clinicians from distinguishing the phenomena of hypersexual behavior as a construct that would probably receive less resistance and more acceptance, even among members of the medical community. Sexual compulsivity has merit, more so than addiction models, yet it too is limited and may suggest an etiology of obsessive-compulsive spectrum which the field has yet to demonstrate.

Hypersexuality as a Construct

An alternative term, such as hypersexuality, avoids confusing or prematurely drawing conclusions about etiological factors or pathogenesis associated with this construct. Choice of the label hypersexual behavior has been made in part, as an effort to divorce terminology from nomenclature traditionally associated with addictions or compulsion models and give the field an opportunity to embrace a variety of perspectives and positions about this phenomena without a host of associated connotations that come with alternative labels. It also allows for varied causal pathways across subjects. Hypersexuality as a construct, avoids some of the challenges with establishing nosology for this phenomenon by limiting itself to a description of associated features. While this approach may provide support for other models or classifications, the label of hypersexuality itself does not attempt to pathologize or explain causal relationships. This has been a harsh criticism of other classifications which are seen by some as attempts by the mental health community to stigmatize sexual behavior based on subjective beliefs, conservative perspectives, or prejudice imposed by cultural values (Catalan & Singh, 1995; Giles 2006; Levine & Troiden, 1988; Rinehart & McCabe, 1997; Todd, 2004). Regardless, sex for most people is limited by boundaries of self-restraint and to some degree, it is likely that these constraints will always be influenced by societal norms and laden with values endorsed by the majority.

Despite the advantages of labeling this phenomenon as hypersexual behavior, it is acknowledged that this term is not completely void of limitations. The term hypersexuality suggests an excessive frequency of sexual behavior and determining what is excessive is difficult to judge given the broad spectrum and bandwidth of human sexuality. This criterion may only apply to a small portion of individuals as some studies show less than 4 percent of young

heterosexual adults in the United States and United Kingdom participate in sex more than 20 times per week irrespective of gender or education (Catalan & Singh, 1995; Seidman & Rieder, 1994). Additionally, excessive sexual behavior alone should not be considered problematic even though it may be abnormal. In this respect, Kafka has made meaningful contributions to the field in his efforts to investigate the significance of hypersexual behavior, based on weekly total sexual outlet (e.g., frequency) and its associations with psychopathology, personal distress, interference with lifestyle and so forth (Kafka 1997, 2001, 2003; Kafka & Hennen, 2002, 2003; Kafka & Prentky, 1992).

The associated features of hypersexual behavior advanced in this paper are somewhat similar to other classifications, namely, that individuals report (1) diminished control over sexual thoughts, desires, or behaviors, (2) repetitive, intense, preoccupation with, or pursuit of sex over an extended period of time (e.g., several months), and (3) persistence in sexual activities despite undesirable or unpleasant consequences such as significant interference with activities of daily living, personal or interpersonal distress, loss of employment, legal complications, and so forth. There are a number of modifiers that can be applied to clarify the etiology, course, onset, pathogenesis, or comorbidity of hypersexual behavior with psychopathology, psychiatric disorders, or medical conditions. A constellation of subtypes (e.g., pornography dependence, compulsive masturbation, protracted promiscuity, etc.) should be developed to guide and direct future research in this area. Until we study such distinctions we cannot know if they have any etiological course or treatment implications. Because of the complexity of issues associated with hypersexual behavior, it is important for clinicians to consider a wide range of issues. For example, it may be important to distinguish paraphilic and non-paraphilic manifestations of hypersexuality (Kafka, 1997; 2001; Kafka & Hennen, 2003; Krueger & Kaplan, 2001). Do the

behaviors involve relational and/or solo-sex? Exploring whether manifestations of hypersexuality are context specific and the function of sexual behavior is especially important considering recent findings that identified 237 different reasons why people have sex (Meston & Buss, 2007). These modifiers will likely be an important addition to helping advance a more comprehensive understanding of hypersexuality. In some cases, they will determine whether hypersexuality is a unique and separate phenomenon or an associated feature of other conditions that provide a more parsimonious explanation of hypersexual symptoms.

A significant advantage of classifying this phenomenon as hypersexual behavior may arise in facilitating collaboration between medical and mental health professionals on issues of sexuality. The term hypersexuality has been frequently adopted in the medical literature to describe acute changes in sexual behavior provoked by brain injury (Britton, 1998; Gorman & Cummings, 1992; Kobayashi, 2004; Miller, Cummings, & McIntyre, 1986; Monga, Monga, Raina, & Hardjasudarma, 1986; Mutarelli, Omuro, & Adoni, 2006; Spinella, 2004; Zencius, Wesolowski, Burke, & Hough, 1990), neurological pathology such as dementia-related disorders (Freyman, Michael, Dodel, & Jessen, 2005; Higgins, Barker, & Begley, 2004; Jensen, 1989; Kuhn, Greiner, & Arseneau, 1998; Robinson, 2003), multiple sclerosis (Frohman, Frohman, & Moreault, 2002; Gondim, & Thomas, 2001; Huws, Shubsachs, & Taylor, 1991), temporal lobe deficits such as epilepsy and Kluver-Bucy syndrome (Andy & Velamati, 1978; Blumer, 1970; Devinsky & Vazquez, 1993; Hayman, Rexer, Pavol, Strite, & Meyers, 1998; Janati, 1985; Luef, 2008; Nakada, Lee, Kwee & Lerner, 1984), frontal lobe insults (Murad, 1999), medication effects (Ivanco & Bohnen, 2005; Korpelainen, Hiltunen, & Myllyla, 1998; Merims & Giladi, 2007; Voon & Fox, 2007), and etiology associated with endocrinological factors, (Herzog, 1999; Namer, 1988; Neumann & Topert, 1986). Yet, despite associations of hypersexuality and

medical etiology, mental health professionals are often unable to identify medical factors in assessment because of restrictions in scope of practice, lack of knowledge, or limited access to medical professionals. Unifying the construct using common terminology of hypersexuality could bridge gaps that currently exist in investigations exploring this phenomenon.

Current Measures of Hypersexual Behavior

There have been several attempts to develop or validate measures that capture the essence of hypersexual behavior (Carnes, 1991; Carter & Ruiz, 1996; Coleman, Miner, Ohlerking, & Raymond, 2001; Exner, Meyer-Bahlburg, & Ehrhardt, 1992; Garos & Stock 1998a, 1998b, Kafka, 1991, 1997; Kalichman & Rompa 1995, 2001; Lo Conte, O'Leary, & Labouvie, 1997; Mercer, 1998; Miner, Coleman, Center, Ross, & Rosser, 2007; Nelson & Oehlert, 2008). These measures have a wide range of psychometrics and the underlying construct and conceptualization of each scale varies. The following represent a brief overview and critique of some existing measures.

Perceived Sexual Control Scale (PSCS). The PSCS is a 10-item Likert-type scale that purports to measure perceived control over sexual drive and risky sexual behavior. The two-factor were extracted using principal components with varimax rotation with item loadings $\geq .60$ being retained. The scale was developed on a sample of gay adult men ($N = 156$) with scale reliability (α) ranging from .81 to .82. The scale was developed as part of a study investigating HIV and has not been widely used or acknowledged by the field (Exner et al., 1992). Although this measure has remained obscure from the field, it appeared to be one of the more well-designed early measures of sexual impulsivity. It has limited external validity beyond gay male populations and contains several items that would discriminate against those who engage in solitary hypersexual behavior (e.g., compulsive masturbation and/or pornography use).

Sexual Outlet Inventory (SOI). The SOI is a clinician-administered inventory that purports to capture the incidence of sexual fantasies, cravings, urges, and activities in a specified week. Classifies conventional and unconventional sexual behavior and data reports frequencies, intensity, preoccupation, and total number of orgasms or activities that would produce orgasm without voluntary restraint in a given week. (Kafka & Prentky, 1992; Kafka, 1991, 1997). Although this measure lacks psychometric development and has not been published, it makes an important contribution as one of the few inventories currently reported in empirical investigation of hypersexual patients that provides descriptive characteristics of this population. It is limited, as others have noted, in that it fails to capture perceived deficits in control, inhibition, compulsivity, and distress (Miner et al., 2007).

Sex Addicts Anonymous Questionnaire (SAAQ). The SAAQ is a 16-item self-report 3-point Likert-type scale developed to assess sexual addiction. A cross-sample of self-identified sex addicts ($n = 45$) from several states, predominantly male, were compared to controls ($n = 37$) consisting of students in dorm residence at a Kentucky university. In addition a group of sex offenders served as a third criterion group ($n = 45$). The original 12-item survey was modified to a 3-point Likert-type format with some modified wording to reflect declarative statements rather than true/false questions and double barreled items were split into multiple statements. Analysis of variance of between group differences were significant. No reliability or other psychometrics are reported other than means of the three groups (Mercer, 1998).

Sexual Addiction Scale (SAS). The SAS is a 5-item self-report 5-point Likert-type scale embedded within the Disorders Screening Inventory (DSI), which purports to measure sexual compulsions, loss of control, consequences, covert tendencies, and interpersonal conflict due to sexual activities. Validated with a group of self identified sex addicts ($n = 34$) who were

predominantly male contrast with a second group of patients (24 women and 10 men) and a third group of male patients ($n = 34$) seeking help for a variety of mental health disorders. Analysis based on inter-item correlations showed positive inter-correlations (.63 to .87). Cronbach's alpha for the 5 items was .83. Carter and Ruiz (1996) report significant differences ($p < .0001$) between sex addict and patient groups but it is unclear from their publication what statistical tests were used. Furthermore, an attempt is made to show correlations between the SAS and other subscales of the DSI such as alcoholism, eating disorders, and drug use but very little is indicated about psychometric properties of other items on the DSI which may have impacted endorsement of the SAS items. The scale developers are overly optimistic in their interpretation and discussion of the results. For example, they discuss divergent validity for the SAS comparing it to other items on the DSI which had yet to be psychometrically validated. Furthermore, the SAS purports to measure five facets of sexual addiction using 1 item for each facet which is problematic from a measurement perspective for several reasons, particularly posing a threat to construct validity. An additional limitation is that it contains double barreled items (e.g., queries about sexual thoughts *and* activities are asked in the same question stem).

Sexual Compulsivity Scale (SCS). The SCS is a 10-item self-report 4-point Likert-type scale, the SCS was developed to assist in research of high-risk sexual behaviors, predominantly among homosexual male subjects, although it has since been used in several studies of both heterosexual and homosexual populations (Cooper et al., 2000; Dodge, Reece, Cole, & Sandfort, 2004; Kalichman & Rompa, 1995, 2001; Reece & Dodge, 2004; Reece, Plate, & Daughtry, 2001). The SCS queries sexual thoughts, feelings, and behaviors. Respondents endorse items ranging from 1 (not at all like me) to 4 (very much like me). High reliability (Cronbach's $\alpha = .89$) was demonstrated in a pilot convenience sample of homosexual men (Kalichman, Johnson,

& Adair, 1994), and internal consistency for the scale has been shown from $\alpha = .86$ to $\alpha = .87$, with a sample of homosexual men and with a sample of inner-city men and women, respectively (Kalichman et al., 1994; Kalichman & Rompa 1995, 2001). The measure has been a useful tool in early research of sexual compulsivity, however, it contains items that assume compulsive sex is relational and its single factor lacks omits additional features of hypersexual behavior limiting opportunities to investigate the phenomena with greater specificity that is obtained scales with multiple factors. Although Dodge et al. (2004) found a positive correlation between a broader range and higher frequency of solo-sex behaviors and sexual compulsivity, these relationships were modest and may not reflect true score tendencies because of relational items that exist on the SCS.

Sexual Impulse Control Questionnaire (SICQ). The SICQ is a 15-item self-report 5-point Likert-type scale derived from STD patient focus groups and STD staff interviews. Items purport to capture perceptions of out of control and maladaptive sexual behavior that disrupt or complicate life experiences. The measure was developed within the context of an investigation exploring relationships of sexually transmitted disease, including HIV infection among a sample of African American inner city men ($N = 83$). A principal components analysis was used to reduce items which had loadings of .50 or greater. The coefficient alpha for the 15-item scale was .85. In scoring the SICQ the authors indicated that lower scores represented greater difficulty with sexual impulse control and in their research found greater difficulties with sexual impulse control were associated with higher prevalence of unprotected sexual intercourse, higher number of sex partners, and a significant history of prior STD diagnosis. The scale does not appear to have received any additional attention in the literature other than the article in which it was initially developed (Lo Conte et al., 1997).

Sex Addiction Screening Test (SAST). The SAST is a 25-item self-report yes/no response measure developed to capture elements of sexual addiction such as powerlessness or inability to control sexual behavior. Some studies have used the SAST in their investigation of hypersexual behavior and it does appear to discriminate between individuals who participate in self-help support groups for sexual addiction and controls. A cut-off score of 13 or higher is suggestive of sexual addiction tendencies. The author does appear to have preformed some type of factor analysis, but self-authored books that describe the measure lack specificity about the data analysis (Carnes, 1991). A Cronbach alpha of .92 for a male sex addict group ($N = 191$) was reported. A recent study attempted to reduce the items of the SAST using exploratory factor analysis with promax rotation and maximum likelihood estimation on a sample of predominantly male ($N = 302$) subjects who were veteran patients in a substance dependence program. The scree plot suggested a one-factor solution accounting for 31.9% of the variance and reported high internal reliability of Cronbach's alpha = .91 (Nelson & Oehlert, 2008). Logistic regression was used to determine accuracy in classification based on cut-off scores of a six-item version of the measure which correctly identified the majority of participants who were grouped as sex addicts based on a cut-off score of 3 for the 6-item revised SAST. The authors of the study acknowledge limited generalizability of their findings beyond the subjects in their sample. Although the SAST has some face validity to the items, there are a number of questions that are problematic because they are double-barreled, ambiguous, or contain content that someone who is sexually healthy might endorse. The forced choice yes/no format also limits variance associated with item endorsement depriving researchers of a more comprehensive understanding of hypersexual behavior.

Compulsive Sexual Behavior Inventory (CSBI). The CSBI is a 22-item self-report measure with two factors based on a 5-point Likert-type scale developed to measure control, sexual abuse and violence. The initial version of the CSBI was a 28-item measure with a 3-factor solution that was extracted using principal components with varimax rotation. Items were retained based on factor loading exceeding .60, visual examination of the scree criteria, and face validity of items. Cronbach's alpha for the three subscales ranged from .88 to .96. Using linear discriminant function analysis, the scale correctly classified 92% of cases when combining a pedophiles ($n = 35$) with non-paraphilic sexually compulsive individuals ($n = 15$) compared to controls ($n = 42$). The measure appears to discriminate sexually compulsive individuals from controls. Limitations include a small sample size used in the initial sample. (Coleman et al., 2001). Recently, additional psychometrics were established using a confirmatory factor analysis on a sample of Latino gay men ($N = 1026$) from data collected online (Miner et al., 2007). Prior to administration, 6 items were removed (items related to childhood abuse). The current version of the CSBI is a 22-item scale yielding a 2-factor structure of control and violence. An additional change was made to reverse score items so higher scores would indicate higher levels of sexually compulsive behavior. The measure showed acceptable goodness of fit with an RMSEA of .045 and a CFI of .99 after correlating one item that loaded on both factors. A test-retest reliability test was also preformed on a small subset ($N = 29$) across a 7-10 day period yielding good results ($r = .86, p \leq .001$). The test developers are to be commended for their efforts to perform a more rigorous psychometric evaluation of the CSBI using confirmatory factor analysis, nevertheless, the use of a specific population limits the generalizability of their results across other samples of subjects and as others have noted (Noar, 2003), it may bias the

psychometrics of the scale. Despite these limitations, the CSBI appears to be one of the more psychometrically validated tests among this population.

Hypersexual Behavior Inventory (HBI). The HBI is a 19-item self-report measure formatted on a 5-point Likert-type scale was developed in an initial clinical sample ($N = 324$) gathered from Arizona, Utah, California, and Texas. The measure purports to capture the extent to which respondents use sex to cope with emotional discomfort, the degree which they feel unable to control their sexual thoughts, feelings, and behavior, and negative consequences experienced as a result of their sexual activities. In the initial development of the HBI, a three-factor structure was extracted using a maximum likelihood method with oblique rotation. Cronbach's alpha for the three subscales ranged from .87 to .94. A second study was conducted on an additional clinical sample ($N = 203$) from treatment clinics in Arizona, Utah, California, Texas, and Pennsylvania. Confirmatory factor analysis supported a 3-factor structure showing an acceptable goodness of fit with RMSEA of .057 and a CFI of .95. The HBI also showed an acceptable goodness of fit using CFA with a mixed college sample ($N = 450$) from Utah, Texas, and Kentucky yielding an RMSEA of .06 and a CFI=.95 (Reid & Garos, 2007).

Test-retest reliability of the HBI was derived from a small subset of college students ($N = 81$) over a two-week time period. The total HBI score ($r = .85, p < .001$), the Control subscale ($r = .87, p < .001$), the Coping subscale ($r = .87, p < .001$) and the Consequences ($r = .88, p < .0001$) all showed high correlations between the first and second administrations suggesting excellent test-retest reliability over a two-week time interval.

Gender differences among the college sample were explored using one-way ANOVA's yielding significant differences on all HBI scales. The HBI total [$F(1,448) = 34.6, p < .0001$], the Control subscale, [$F(1,448) = 14.2, p < .0001$], the Coping subscale, [$F(1,448) = 32.9, p <$

.0001] and the Consequences subscale [$F(1,448) = 43.9, p < .0001$]. Differences across age groups were not significant.

Suggested clinical cut-off scores for the HBI. Several strategies for statistically establishing cut-points to differentiate clinical from non-clinical populations have been suggested in the literature (e.g., Jacobson & Truax, 1991). Based on normal distributions and equal variances of the two samples, the cut-point or half way point for the men for the total HBI score would be 50.25 $[(34.2 + 66.3) / 2]$. Based on means and standard deviations, criteria of 1.5σ above the norm mean would be used for the total HBI score creating a cut-off score of 55.95 $[34.2 + 1.5(14.5)]$. We combined the average of these two methods producing a total cut-off score of 53.1 $[(50.25 + 55.95) / 2]$. Because no clinical data was available for women, suggested cut-off scores are based on calculations using 1.5σ above the norm mean for college women.

In the college sample of men, 21 subjects had total HBI scores ≥ 53 suggesting 12.7% of male students in the norming sample would be classified as hypersexual. Among the college women, 12 subjects had scores ≥ 42 placing 8% of female students in a hypersexual category.

Concurrent validity of the HBI. Correlation analyses were used to provide support for the concurrent validity of the HBI in order to determine the degree of association with theoretically related measures. The HBI total scores yielded strong relationships that were positively correlated with the SCS ($r = .82, p \leq .01$), the CSBI ($r = .92, p \leq .01$), and the SAST ($r = .73, p \leq .01$). These correlations provide support for the HBI concurrent validity with similar scales purported to measure a theoretically similar construct.

Incremental validity of the HBI. Despite criticisms of assessment scholars (e.g., Haynes & Lench, 2003; Hunsley & Meyer, 2003), new measures seldom address the issue of incremental validity, yet it is an important issue when considering the arduous challenge of developing a new

scale. Definitions of incremental validity vary (Barnett, Lentz, & Macmann, 2000; Cronbach, 1951; Dawes, 1999; Elliott, O'Donohue, & Nickerson, 1993; Foster & Cone, 1995; Haynes & O'Brien, 2000; Murphy-Berman, 1994; Schwartz & Wiedel, 1981), but one common denominator across most conceptualizations is the notion of increased predictive validity. Incremental validity also captures the degree to which a new measure is more comprehensive or makes additional contributions not present in existing measures.

The HBI is the first measure of hypersexual behavior to be psychometrically validated using rigorous statistics imposed by structural equation modeling on a sample of hypersexual male patients who presented with a broad range of subtypes *and* sexual preference. Although the CSBI used confirmatory factor analysis, it was limited in the sample (e.g., gay males) whereas the HBI used inpatient and outpatient clinical populations from several different regions in the United States. The HBI is also the first measure of its kind to show an acceptable model fit using confirmatory factor analysis for a non-clinical population of college students.

A closer examination and comparison of measures suggest that many may lack the ability to identify patients who limit their hypersexual behavior to solo-sex activities. In other words, alternative measures may fail to identify hypersexual patients whose primary subtype includes pornography and masturbation. That is to say, such scales are vulnerable to Type II errors (β error) wherein they fail to correctly identify individuals that should be part of hypersexual population and subsequently these individuals are at risk for having treatment be withheld, when treatment may be necessary. These individuals are also potentially excluded from research because they do not meet necessary cut-off scores limiting the findings reported in various investigations on hypersexuality. In this analysis, the SCS failed to classify 24% of hypersexual patients because the scale was insensitive to classifying patients who experienced solo-sex

manifestations of hypersexual behavior. Similarly, the SAST was insensitive to 27% of the patient sample.

Although some may argue that solo-sex behaviors do not have as severe as consequences as relational sex (e.g., risk of sexual transmitted disease), these patients reported significant distress over strained marriages, loss of employment (3 patients had lost employment— career jobs with annual incomes greater than \$65,000/year—due to their inability to abstain from pornography in the work place), and 1 patient incurred significant financial debt spending \$14,000 consuming online pornography in a 2-month period. One patient’s masturbation was so pronounced that he self-inflicted lacerations on his penis which required medical treatment.

These findings provide evidence in support of incremental validity for the HBI due to its increased sensitivity in detecting and classifying hypersexuality, especially for those whose subtype involves solo-sex behaviors. This position is further substantiated by the lack of item endorsement by these patients on the SCS questions related to relational sex (e.g., “It has been difficult for me to find sex partners who desire having sex as much as I want to”). Similarly, other measures of hypersexuality such as the SAST, CSBI, SICQ, and the PSCS, contain items about relational sex which may increase their vulnerability to Type II errors.

Associations of Hypersexual Behavior

Studies seeking to understand this phenomenon have linked hypersexual behavior to anxiety, depression (Kafka & Hennen, 2002; Raviv, 1993; Raymond et al., 2003), attention-deficit disorders (Blankenship & Laaser, 2004; Kafka & Prentky, 1998; Reid, Carpenter, Gilliland, & Karim, in press), social phobia, substance abuse (Black et al., 1997; Kafka & Hennen, 2002), obsessive tendencies (Schwartz & Abramowitz, 2003), sexual dysfunction (Butts, 1992), HIV (Kalichman & Rompa, 1995; Lo Conte et al., 1997; Morgenstern, et al.,

2007), and post-traumatic stress disorders (Howard, 2007). Personality traits such as boredom proneness (Chaney & Blalock, 2006), alexithymia, and stress vulnerability have also been observed (Reid et al., 2008). Despite the growing number of studies about hypersexuality, there is a paucity of research using well-established instruments such as the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) among this population, with a few exceptions (e.g., Reid & Carpenter, 2009a, 2009b).

Although many studies investigating HB consist of predominantly male samples, the phenomenon has also been observed among female populations (Elmore, 2005; Ferree, 2001; O'Hara, 2002; Roller, 2004). Researchers have also observed characteristics of hypersexual behavior in other countries including Brazil (Silveira, Vieira, Palomo, & Silveira, 2000), Croatia (Štulhofer, Vukasovic, & Perišic, 2005), Hungary (Gerevich, Treuer, Danics, & Herr, 2001), and Germany (Strauß, 2001). Little work has been done on exploring Axis II personality disorders among hypersexual patients although some theories have been advanced (Montaldi, 2002). Most investigations of hypersexual behavior lack the statistical sophistication needed to move the field from correlation studies to research designs that provide insights about causality. Etiological studies are also required to provide deeper understanding about predisposing and precipitating risk factors associated with hypersexuality.

Definition and Manifestations of Hypersexuality

For the purpose of this study, hypersexuality is defined as difficulty regulating sexual thoughts, feelings, and behavior, to the degree that the individual or others experience negative consequences. Hypersexual patients report significant personal or interpersonal distress related to preoccupation with sex, and their sexual behaviors are often incongruent with their personal values and/or desired goals. As a group, hypersexual patients often use sex as a tension-

reduction behavior (e.g., stress relief, affect regulation) to escape uncomfortable or unpleasant mood states (Reid et al., 2008; Reid, 2010). The conceptualization of hypersexuality as a syndrome requires behavior to persist across a significant period of time (e.g., several months) and assumes that manifestations of hypersexual behavior are non-paraphilic, although it is plausible that these behaviors could exist as a comorbid condition with paraphilic tendencies. It is important to note that excessive sexual behavior itself does not constitute hypersexuality, nor does a preference for sexual activities that fall outside social norms (Muench et al., 2007). Rather, hypersexual behavior can include either socially deviant or normal expressions of sexual preference, and it must also include elements such as disinhibition, psychological distress, or impaired functioning, or it must be ego-dystonic.

Manifestations of hypersexuality can encompass a variety of solo and relational sexual activities, such as compulsive masturbation; pornography dependence; protracted promiscuity; multiple extra-dyadic relationships; online sexual interactions; solicitation of commercial sex workers or use of escort services, sensual massage parlors, strip clubs, or other venues associated with the adult entertainment industry; and telephone sex. Such behaviors are distinguished as manifestations of hypersexuality only to the degree to which a person experiences personal distress, discordance, diminished functioning, and so forth as a result of participating in them.

In clinical settings, hypersexual patients have been observed, despite numerous warnings from their employers, to continue to pursue pornography at work and are subsequently terminated from their jobs. Some patients patronize commercial sex workers, to the extent that they incur credit card debt well beyond their financial means. Hypersexual college students sometimes pursue sexual interests online to the point that they sacrifice grades, fail classes, or are even expelled from school. Some patients require medical attention due to genital lesions

caused by compulsive masturbation. Risky sexual behavior involving multiple encounters with numerous anonymous partners has placed some hypersexual patients at high risk for sexually transmitted diseases. Additional consequences of hypersexual behavior include legal difficulties and distressed interpersonal relationships. Yet patients often report feeling driven, obsessed, and even compelled with intense preoccupation with and desire for sex despite the constellation of negative consequences or despite a belief that their sexual choices will create unpleasant circumstances in their lives (Reid, 2010).

Construct of Executive Functions (EF)

The term “executive functions” is generally theorized to reflect those mechanisms through which optimal performance is achieved in situations that requires cognitive processes (Baddeley, 1986). Several theories offer slightly different operationalizations of characteristics of EF (Lezak, 2004; Luria, 1980; Shallice & Burgess, 1996). EF represent a complex array of behaviors that are essential to a person’s ability to engage in adaptive responding to novel situations and provide the foundation for a constellation of cognitive, emotional, and social skills. Lezak (2004) has suggested that the components of EF include: (1) volition; (2) planning; (3) purposive action; and (4) effective performance.

Baron (2004) postulated that these higher-level functions consisted of the following: hypothesis generation, problem solving, concept formation, abstract reasoning, planning, organization, goal setting, fluency, working memory, inhibition, self-monitoring, initiative, set shifting, self-control, mental flexibility, attention, and creativity—to name a few.

As one reviews the literature, several different perspectives about functions emerge. A general view considers EF as consisting of a constellation of mental processes that are implicated in adaptive behavior that allows an individual to interact with their environment in an efficient

and acceptable way. The processes in EF include, but are not limited to, (1) inhibition of behavior, impulses, and irrelevant information, (2) nonverbal and verbal working memory, (3) affect regulation, (4) motivation and arousal, (5) planning and organization, (6) decision making and judgment, (7) task monitoring, (8) attention, (9) problem solving and hypothesis generation, (10) abstract thinking, and (11) cognitive flexibility (Papazian, Alfonso, & Luzondo, 2006). The interaction of these complex processes are not fully understood although there is some consensus that EF consist of a consortium mental process that interact and work in concert with each other. These processes, and their interactions are difficult to isolate as they appear to be integrated or overlap with other neurological systems (Delis, Kaplan, & Kramer, 2001; Tucha et al., 2005; Welsh & Pennington, 1988).

Eslinger (1996) conducted a literature review extensively documenting EF. This review found evidence negating previously held notions about EF being limited to higher-level cognitive functions and that the theories about multiple layers of complex systems, both high and lower order, are implicated in EF. Associations of EF with frontal lobe activity was discovered through deficits on performance on EF tests conducted among patients with frontal lobe lesions (Barkley, 1997; Delis et al., 2001; Faraone et al., 2000; Jonsdottir, Bouma, Sergeant, & Scherder, 2006; Luria, 1980; Max et al., 2005; Schweitzer et al., 2000; Woods, Lovejoy, & Ball, 2002).

Much of the research examining EF in the literature focuses on populations with neurological disorders. For example, significant differences in cognitive processes associated with EF has been observed in frontal lobe epilepsy (Adachi et al., 2000), lesion studies (Aron, Sahakian, & Robbins, 2003; Bastin, Van der Linden, Lekeu, Andres, & Salmon, 2006; Berthier, 2001), schizophrenia (Atbasoglu, Ozguven, Saka, & Olmez, 2005; Bersani, Clemente, Gherardelli, & Pancheri, 2004), traumatic brain injury (Bamdad, Ryan, & Warden, 2003),

Parkinson's (Barnes & Boubert, 2008), HIV infection (Basso & Bornstein, 2003), autism (Bebko & Ricciuti, 2000), attention-deficit disorders (Bental & Tirosh, 2007; Berlin, 2003; Biederman et al., 2006; Boonstra, Oosterlaan, Sergeant, & Buitelaar, 2005; Brown, 2006), and mood disorders (Alexopoulos, 2003; Belderbos & Shah, 2003; Borkowska & Rybakowski, 2001). If one considers EF only in the context of psychopathology or neuropsychiatric disorders, it would appear that these findings have implications for their respective populations, but that the majority of the literature does not appear to have direct relevance for patients seeking help for hypersexuality, with some notable exceptions such as EF findings among patients with ADHD and mood disorders which have some comorbidity among hypersexual populations (Reid, 2007; Reid et al., 2010; Reid et al., in press).

Despite the mounting literature about EF, the findings on EF have not gone uncontested. Stuss and Alexander (2000) challenged the construct of EF and criticizing the lack of frontal lesion data to confirm hypothesis about a unitary construct. They did concede there are a number of distinct processes associated with frontal lobes which can be differentiated however but dismissed the idea of a unitary mechanism responsible for orchestrating these processes. They argue that focus on EF should revisit earlier literature which conceptualized an important feature of the frontal lobes, namely that they are implicated in affect regulation, social and personality development, and self-awareness.

Barkley (2001) harshly criticized neuropsychology for their failure to adequately define the construct of executive functions. He further states the tendency to offer descriptions of EF deficits while the construct itself is left undefined. In a scathing attack on neuropsychologists he writes:

... examinations of executive functioning seem to select batteries of tests for three simple reasons: (1) other neuropsychologists, particularly one's mentors, previously used them and said they measured the EFs; (2) scientific papers in clinical journals used them and said they were measures of EFs; and (3) these measures are often poorly performed by patients with injuries to the frontal lobes. This constitutes avoidance of conceptual responsibility that is unhelpful in attempting to fully understand the functional integrity of the EFs in clinical populations. To say that the Wisconsin Card Sort Test, the Tower of Hanoi, Digit Span Tasks, continuous performance tests, the Paced Auditory Serial Additions Task, Self-Ordered Pointing Tasks, the Stroop Color–Word Association Task, the Kaufman Hand Movements Task, the F-A-S Verbal Fluency Test, or other so-called EF tests assess executive functioning is simply circularity of reasoning. The construct is being reified by its measure. This merely sidesteps the issue of what comprises the essential ingredients of executive functioning that would guide clinical decisions as to how they should be assessed. Moreover, no matter how forced their interpretations may be in clinical reports, extant EF measures tell precious little about what is ultimately lost in adaptive functionality in those patients suffering injury to their executive system. This is painfully evident in the low-order correlations of EF tasks with ratings by patients and others of their apparent executive functioning in natural settings. The shared variance between such measurement approaches is often below 10% (Barkley, 2001, p. 4).

Although there is some legitimacy to Barkley's criticisms, the landscape of neuropsychology and the validation of EF instruments are radically changing with increased use of neuroimaging where tests are being correlated with evidence of impaired frontal lobes and behavioral observations in both laboratory and natural settings. Ironically, Barkley criticizes the construct

of EF and its associated measures and in the same year, is listed as the first author on a publication about EF using even an even less reliable measure, a CPT test (Barkley, Edwards, Laneri, Fletcher, & Metevia, 2001) which has been criticized and is highly controversial.

Barkley's comments however, force the confession of the principal investigator to remind the reader that this study is exploratory and will not attempt to draw any conclusions about causality in reporting the results. Furthermore, an attempt is being made to work with the best tools and materials available at a given point in time.

One challenge in exploring EF among hypersexual patients is that a portion of this population functions with some normalcy across most domains in their lives with mild, but noticeable differences in processes often associated with EF. Individuals who present with hypersexual features have been successful and to the untrained eye, their lives might appear very normal (at least they attempt to hide the facet of their lives involving sexual behavior). Many have a college degree, some masters and doctorates. These men are working professionals in business, law, medicine, and even mental health. Many of them function well in civic, church, or family responsibilities and several have received awards recognizing their outstanding accomplishments. Yet, despite these appearances, patterns of behavior reflect impaired judgment, impulse control, and so forth when it comes to their sexual behavior and in some cases, a careful inspection of their activities of daily living will reveal similar patterns of EF deficits.

Exploring Executive Functions and Hypersexuality

In order to examine a hypothesized relationship between EF and hypersexuality there are some precursors that need to be addressed. These include:

1. Identify which associated features of hypersexual behavior parallel cognitive processes implicated in EF.
2. Identify neuropsychological tests that purport to measure these processes.
3. Find research studies that provide evidence for the validity of neuropsychological tests showing that they are sensitive to frontal lobe regions or the EF processes that parallel patterns observed in hypersexual patients.
4. Identify patients with hypersexual behavior and administer neuropsychological tests to determine if deficits exist that are associated with EF processes.

This is somewhat of a daunting task for a few reasons. First, there is controversy in the literature about the constructs of EF and hypersexual behavior. Second, there are mixed findings in the literature regarding the validity of neuropsychological tests sensitive to EF and frontal lobe deficits as will be shown hereafter. With these challenges in mind, we proceed with a review of what the literature does clarify in order to establish a research design to answer the inquiry about relationships between EF and hypersexual behavior.

Hypothesized correlates of hypersexuality and EF processes. There are a number of behaviors exhibited in hypersexual patients that raise questions about EF deficits. A hallmark of hypersexual behavior includes self-reported difficulties in regulating and controlling sexual thoughts, feelings and behaviors. These deficits parallel cognitive processes of inhibition and impulse control. Motivational deficits have been noted in the literature among hypersexual clients who exhibit ambivalence about change and often have difficulty initiating or sustaining a change process for themselves (Reid, 2007). As noted previously, affect regulation among hypersexual patients is common and parallels emotional control in EF. A common characteristic among patients with affect regulation is a tendency to ruminate which may suggest deficits in

cognitive flexibility or a failure to cognitively reappraise their circumstances (Ray, Ochsner, Cooper, Robertson, Gabrieli, & Gross, 2005; Watkins & Brown, 2002). Hypersexual patients also take risks choosing sex despite the possibility of negative consequences which reflects poor judgment, impulsivity, and difficulties making appropriate decisions. Persistent preoccupation (obsession) with sex reveals deficits associated with cognitive flexibility, attention, and behavior inhibition. Unlike motivational deficits in behavior modification, even those who are motivated to change often employ strategies that are unsuccessful or unrealistic which reflects some difficulties in problem solving (e.g., conceptualizing the precipitating or perpetuating risk factors associated with their behavior or identify core issues relevant to their behavior), cognitive flexibility (seeing their problems from multiple perspectives), and planning (organizing

Hypersexuality	Executive Function Process
Difficulties controlling sexual behaviors	Inhibition, impulse control
Motivational deficits to change behavior	Motivation, task initiation, decision making, sustained attention
Problems with affect regulation, rumination	Emotional control, cognitive flexibility
Choose sex despite negative consequences	Decision making, judgment, inhibition, impulse control
Preoccupation with sex, rumination	Attention, behavior inhibition, cognitive flexibility
Inability to change, modify behavior	Planning, problem solving, cognitive flexibility, inhibition

Figure 1. Hypothesized Correlates of Hypersexual Behavior and EF Processes

strategies in ways most likely to produce desired results, including prioritizing components of their change strategies). Even when they develop what seems like a successful strategy, they are unable to execute it when faced with the choice of acting out their sexual desires in a given situation reflecting deficits in behavior inhibition. These characteristics of hypersexuality that parallel EF processes are noted in Figure 1.

Neuropsychological Tests Measuring Executive Functions

Choosing appropriate measures for assessing executive functions poses several challenges. Because a literature review was conducted on each of the measures used in this study, some information about the measures will be discussed in this section (although brief psychometric data about each measure will be noted in the section on instrumentation for the research design in the next chapter of this work).

Researching some tests and their rationale for use in EF or frontal lobe studies was in some cases, almost comical. It's not uncommon to find one article state that a given neuropsychological test is a "widely used and a well establish test" of frontal lobe pathology or EF and then follow the chain of references only to find the cited source repeat the same statement. One such chain of references finally led to a study that took the liberty of modifying and creating a computerized version of the Tower of London test for use in an MRI study (Lazeron, Rombouts, Machielsen, Scheltens, Witter, Uylings, & Barkhof, 2000). They reported in their conclusions "The Tower of London test was successfully adapted for functional MR imaging" and further stated that it activated areas such as the "prefrontal cortex" (p. 1413). Yet, nowhere in their study did they ever show evidence of concurrent validity between the manualized version of the test and their adapted computerized version. One would almost need to conduct a separate concurrent validity study to demonstrate test equivalency between the two versions before doing the MRI study.

Other common mistakes in the research literature included a lack of control for cognitive abilities (e.g., IQ) or failure to recognize possible gender differences affecting performance on a given test such as those that have been noted in the literature (e.g., Weiss, Ragland, Brensinger, Bilker, Deisenhammer, & Delazer, 2006). Despite these limitations, several tests were chosen,

in part, because of their availability and because some data was already collected on these tests as part of another ongoing study. A brief review of each of these tests follows.

Wisconsin Card Sorting Test (WCST). The WCST requires respondents to place a series of cards to one of four stimulus or target cards (Figure 2). Participants are not given instruction about how to sort the cards, however, following the placement of each card they receive feedback indicating whether their match was right or wrong. Participants can sort based on the *number, color, or form*. The rules shift throughout the test and respondents must adapt by recognizing a different category has emerged and modified card placement will be necessary in order to obtain correct placements. Perseveration occurs when respondents continue to place cards based on a rule that has been superseded by a new category shift. Successful performance on the WCST requires cognitive flexibility, working memory, problem solving (hypothesis generation), sustained and selective attention, and response maintenance (Baldo, Shimamura, Delis, Kramer, & Kaplan, 2001; Barcelo, 2001; Barcelo & Knight, 2002; Barcelo & Rubia, 1998; Barkley, 1996; Burgess, Alderman, Ernsly, Evans, & Wilson, 1998; Denckla, 1996; Dunbar & Sussman, 1995; Greve et al., 2002; Manly & Robertson, 1997; Miyake et al., 2000; Pennington, Bennetto, McAleer, & Roberts, 1996; Rabbitt, 1997; Sergeant, Geurts, & Oosterlaan, 2002; Stuss et al., 1998; Stuss, Floden, Alexander, Levine, & Katz, 2001; Troyer, Moscovitch, Winocur, Alexander, & Stuss, 1998; Welsh, 2002; Zelazo, Carter, Reznick, & Frye, 1997).

The WCST is used widely in neuropsychological assessment as a measure of executive function and frontal lobe pathology. Despite the prevalence of its use, it has been criticized by several researchers and conflicting studies have diminished confidence in the tests ability to demonstrate specificity of executive dysfunction in patients with frontal lobe lesions (Demakis, 2003; Milner, 1963). For example, some studies have failed to find evidence showing

successfully discrimination by the WCST of frontal vs. non-frontal damage (e.g., Anderson, Bigler, & Blatter, 1995; Anderson, Damasio, Jones, & Tranel, 1991). This finding has not been consistent as other studies have found the WCST a clinically useful tool for discriminating between frontal and non-frontal lesion patients (Robinson, Heaton, Lehman, & Stilson, 1980). The differences in these results may be attributable to the non-uniformity of lesion location or the severity of damage related to the cortical deficits. (Demakis, 2003; Lombardi, Andreason, & Sirocco, 1999).

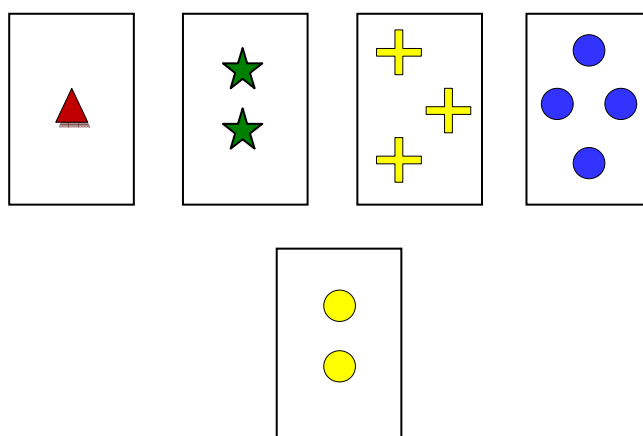


Figure 2. Example of WCST target cards and a placement card.

Results from the WCST have also been sensitive to interference from other constructs such as depression (Martin, Oren, & Boone, 1991). The data from this latter finding however, have been explained as support for the WCST indicating that executive impairments are correlated with depressed mood states (affect regulation being mediated by frontal lobes) and therefore evidence supporting the validity of the WCST as a frontal lobe test (Ilonen et al., 2000).

Mixed results for the WCST have also been found in psychometric studies. Bowden, Fowler, and Bell (1998) failed to find support for the factor structure of the WCST scores and recommended it not be used in clinical settings. Sullivan, Mathalon, & Zipursky (1993)

however, found evidence supporting a 3 factor model for the WCST consisting of perseveration, inefficient sorting, and nonperseverative errors in a sample of schizophrenic and alcohol dependent patients. A 3-factor model was also supported in another independent study using data from 473 clinical cases, although the authors conceded despite evidence for rationally interpretable factors that the cognitive processes associated with WCST performance remain poorly understood (Greve, Ingram, & Bianchini, 1998).

Neuroimaging studies have provided additional perspectives on cortical activation associated with the WCST although results have also been inconsistent. In normal subjects, some single photon emission computed tomography (SPECT) procedures have found activation of the left dorsolateral prefrontal cortex (Rezai, Andreasen, Alliger, & Cohen, 1993; Kawasaki, Maeda, & Suzuki, 1993), however, others have failed to find evidence supporting significant prefrontal activation (Cantor-Graae, Warkentin, Franzen, & Risberg, 1993). Some studies have found an overall right prefrontal and temporal activation (Lui, Tam, Xie, & Zhao, 2002) and right anterior dorsolateral prefrontal activation (Marenco, Coppola, & Daniel, 1993)

In a group of elderly demented patients, stuck-in-set perseverative errors on the WCST were linked with the reduced rCBF in the rostradorsal prefrontal cortex and recurrent perseverative errors were related to left parietal activation but not to prefrontal activity suggesting that stuck-in-set perseverative errors might be truly indicative of frontal dysfunction (Nagahama, Okina, Suzuki, Nabatame, & Matsuda, 2005).

Computerized Axial Tomography (CT) with the WCST in a lesion study failed to find significant differences between frontal vs. non-frontal patients (Anderson et al., 1991).

Similarly, magnetic resonance imaging (MRI) has also been used in studies employing the WCST. Volz, Gaser, and Häger (1997), in a functional (fMRI) study, found evidence of right

lateralized frontal activation. Also, right prefrontal cortex and increased left temporal activity during execution of the WCST was also noted in controls, compared to chronic schizophrenics on stable neuroleptic medication.

In summary then, studies using the WCST have produced some inconsistencies in their results. Differences between subject groups, their lesion location and severity, and comorbidity with other psychopathology (e.g., depression) appear to have accounted for some of these differences. Nevertheless, frontal-lobe proficiency does appear to be a central feature of successful performance on the WCST.

Verbal Fluency Test. This test requires random generation of words based upon parameters such as words beginning with the letters F, A, and S. The D-KEFS also includes a categorical fluency test, such as generating boys names and animal names, and a switching task requiring respondents to alternate between giving the name of a fruit and a piece of furniture (Delis et al., 2001). The test purports to tap into cognitive flexibility, response inhibition, and verbal fluency (Baldo, et al., 2001; Benton, 1968; Bornstein, 1986; Milner, 1964). Associations with frontal lobe anatomical structures have been confirmed in both lesion studies (Baldo et al., 2001; Miller, 1984) and imaging (Baldo, Schwartz, Wilkins, & Dronkers, 2006; Frith, Friston, Liddle, & Fracknowiak, 1991; Parks et al, 1988). In an extensive review of fMRI studies on tasks of verbal fluency, significant differences were noted in the left inferior frontal gyrus (Costafreda et al., 2006).

Verbal fluency is usually subdivide into two types of tasks: phonemic and semantic. Phonemic fluency tasks require subjects to say (or write) as many words as possible that begin with a certain letter within a time limit (usually 60 seconds). Semantic fluency tasks require subjects to say (or write) as many words as possible within a particular category (e.g., animals,

boys names). The literature suggests that individuals with frontal lobe damage show impaired phonemic fluency while their semantic fluency appears to remain relatively intact (Troyer et al., 1998).

Evidence of sustained attention was found in a study that noted increased task demand on verbal fluency correlated with increased activation of the anterior cingulate as well as the left and medial frontal regions (Fu et al., 2002, 2006). Using fMRI, the switching aspect of semantic fluency appears to activate the anterior cingulate cortex bilaterally, the left inferior frontal gyrus, the middle frontal gyrus bilaterally, and the frontal operculum bilaterally. Additionally, recruitment of the superior posterior parietal region was evident (Gurd et al., 2002).

Individuals with left frontal lesions frequently perform significantly worse than any other brain-damaged group (Baldo et al., 2001; Pendleton, Heaton, Lehman, & Hulihan, 1982; Perret, 1974; Stuss et al., 1998; Troyer et al., 1998), but right frontal (Bornstein, 1986; Miceli, Caltagirone, Gainotti, Masullo, & Silveri, 1981; Miller, 1984; Pendleton et al., 1982; Perret, 1974; Troyer et al., 1998) and bilateral frontal (Benton, 1968; Janowsky, Shimamura, Kritchevsky, & Squire, 1989) lesions also diminish phonemic verbal fluency performance. Although nonfrontal and right-sided lesions have been found to interfere with phonemic verbal fluency, impaired verbal fluency typically is a function of left-sided lateralization of frontal lobe damage.

In general then, the verbal fluency task does appear to recruit processes that show activation in the frontal lobe, and more specifically, the phonemic fluency tasks show activation of the anterior cingulate and the left prefrontal cortex. These regions have also been correlated with sustained and selective attention, working memory, and cognitive appraisal.

Color-Word Interference Test (CWIT). The CWIT is based on the original Stroop Color Word Test and purports to measure response inhibition, selective attention, vigilance, and cognitive flexibility. Over one thousand articles have been published on the original Stroop effect over the past 67 years (Alvarez & Emory, 2006). The test consists of four conditions. Conditions 1 and 2 assess color naming and word reading. Condition 3 introduces a distracter as respondents must state the color of the ink and inhibit the natural response to read the word which is presented in a different color than what the word states (e.g., the word blue is in the ink color red). Condition 4 includes the directions in Condition 3 with the exception that if a word appears inside a box, the respondent should read the word, instead of naming the color of the ink. The tendency to read the words, rather than the color of the ink in which the words are printed, elicits a significant decrease in reaction time which has been referred to as the “Stroop effect” or the “interference effect.”

A few studies have found that persons with frontal lobe lesions perform worse than a group of healthy controls (Stuss et al., 2001; Vendrell et al., 1995). One study found evidence that bilateral medial frontal lesions increase vulnerability to the Stroop effect (Holst and Vilkki, 1988). It appears that Stroop performance is correlated with lateral and superior medial, not orbitofrontal regions. Two studies found significant differences between frontal and non-frontal groups with left frontal lobe lesions performing worse on incongruence color naming than subjects with right frontal, left frontal, and left non-frontal damage (Perret, 1974; Stuss et al., 2001). Although these findings suggest that the test is sensitive to lateral and superior medial frontal lesions, it did not appear to be specific to overall frontal lobe functioning.

Neuroimaging studies of the Stroop test showed a consistent finding of increased activation in the anterior cingulate cortex which is critical for selective attention (Bench et al.,

1993; Carter, Mintun, & Cohen, 1995; Pardo, Pardo, Janer, & Raichle, 1990; Posner & Dehaene, 1994; Posner & Petersen, 1990). Additionally, imaging studies have found that Stroop performance activates the medial frontal gyrus (Banich et al., 2000; Bush et al., 1998; Leung, Skudlarski, Gatenby, Peterson, & Gore, 2000; Taylor, Kornblum, Lauber, Minoshima, & Koeppel, 1997), motor regions (Bush et al., 1998; Pardo et al., 1990), parietal lobe areas (Brown et al., 1999; Bush et al., 1998; Carter et al., 1995; Leung et al., 2000; Peterson et al., 1999; Taylor et al., 1997), and temporal lobe regions (Bush et al., 1998; Carter et al., 1995; Leung et al., 2000; Pardo et al., 1990).

Tower Test. The Tower Test has its origins in several earlier tests such as the Towers of Hanoi, London, and Toronto, but the D-KEFS Tower Test extended score ranges by including easier and more difficult items in order to improve the overall psychometrics of the test (Delis et al., 2001). In this test, respondents are presented with a varying number of discs of different sizes in a specific array and are asked to reorganize or arrange the discs on the board so that they match the stimulus picture presented. They are also instructed to do so in as few moves as possible and they must abide by rules throughout testing procedures such as moving one ring at a time and refraining from placing a larger disc on top of a smaller one. In each level, the number of discs and the complexity of the moves required to successfully complete the task increases. This test is hypothesized to tap into spatial planning, rule learning, inhibition of impulsive responding, inhibition of perseverative responding, and establishing and maintaining instructional set (Delis et al., 2001).

Using PET imaging, increased complexity of planning on the Tower of London test was correlated with relative regional cerebral blood flow (rCBF) in the dorsolateral prefrontal and rostral anterior cingulate cortices (Dagher, Owen, Boecker, & Brooks, 1999).

These findings are consistent with other studies (Baker et al., 1996; Owen, Doyon, Petrides, & Evans, 1996). Presumably, the activation of the ACC was a function of increased need for selective attention in the test as complexity increased (Paus, Petrides, Evans, & Meyer, 1993; Picard & Strick, 1996).

In summary, neuropsychological tests have limitations, however, there appears to be some tolerable level of sensitivity to frontal lobe activation across the tests, although many of them lack specificity.

Neuropsychological Tests, Anatomical Correlates, and EF Abilities Measured

Given what has already been mentioned above, caution should be exercised when making inferences from scores on neuropsychological tests to deficits in anatomical cortical structures. Nevertheless, a number of studies have produced findings based on correlations between results on neuropsychological tests and anatomical correlates. From these, hypothesis have been generated regarding the executive functions purported to be measured by these tests. A summary of these findings is noted below.

Wisconsin Card Sorting Test. *Anatomical Correlates:* Neuroimaging studies in healthy subjects show increased activation in the inferior and superior dorsolateral prefrontal cortex during performance on the WCST (Parellada, Catafau, Bernardo, Lomeña, Catarineu, & González-Monclús, 1998). Dorsolateral prefrontal cortex, orbitofrontal, and ventromedial prefrontal cortex activation in a sample of 40 healthy subjects (Berman, et al., 1995). These findings are similar to lesion studies (Alvarez & Emory, 2006). *Executive Functions:* The test appears to measure skills associated with cognitive flexibility, sustained attention, working memory, hypothesis generation, and decision making.

Verbal Fluency Test. *Anatomical Correlates:* Subjects showed activation of prefrontal cortex, left inferior frontal and anterior cingulate (Phelps, Hyder, Blamire, & Shulman, 1997). Activation of left premotor cortex and left dorsolateral prefrontal cortex (Cuenod, Bookheimer, Hertz-Pannier, Zeffiro, Theodore, & Le Bihan, 1995). In a systematic review and quantitative appraisal of fMRI studies, 22 experiments showed distinct dorsal-ventral left inferior frontal gyrus activation across 197 healthy subjects for both phonological and semantic verbal fluency (Costafreda, et al., 2006). Semantic switching on verbal fluency was associated with significant activation in the left inferior frontal gyrus (Hirshorn, & Thompson-Schill, 2006). A group of 48 left-hemisphere stroke patients were assessed on tasks of phonological and semantic fluency using voxel-based lesion symptom mapping which revealed that temporal cortex subserves word retrieval constrained by semantics, whereas, frontal cortices were more critical for strategic word retrieval constrained by phonology (Baldo et al., 2006). Persons with frontal lobe damage generally demonstrate impaired phonemic fluency, while performance of semantic fluency remains relatively intact (Troyer et al., 1998). *Executive Functions:* The test appears to measure verbal fluency, sustained attention, task monitoring, cognitive flexibility, working memory, and organization.

Color-Word Interference Test. *Anatomical Correlates:* Frontal lobe lesions subjects produced significant impairment. Diminished performance associated with left dorsolateral frontal lobe damage and resulted in increased errors and diminished processing speed in response for color naming. Bilateral superior medial frontal lobe damage was associated with increased errors and diminished processing speed in response for incongruent condition. (Stuss et al., 2001; Vendrell et al., 1995). In an fMRI study of a different task that incorporated some associated demands of the Stroop, bilateral frontal regions were activated in monitoring and detecting errors

and both cingulate regions appeared activated for sustaining attention during interference (Carter, Braver, Barch, Botvinick, Noll, & Cohen, 1998). The test appears sensitive to lateral and superior medial lesions of the frontal lobe, but not specific to overall frontal lobe functioning.

Executive Functions: The test appears to measure response inhibition, selective attention, vigilance, and cognitive flexibility.

Tower Test. *Anatomical Correlates:* In an fMRI study of the planning aspect of the test in 9 healthy individuals showed activation in the dorsolateral prefrontal cortex and the anterior part of the cingulate cortex. (Lazeron, et al., 2000). Evidence of gender differences exist in an fMRI study with females activating more than males in dorsolateral prefrontal cortex and right parietal cortex, whereas males showed higher activity in precuneus (Boghi, et al., 2006).

Executive Functions: The test appears to measure response inhibition, problem solving, cognitive flexibility, and planning.

Trail Making Test. *Anatomical Correlates:* Patients with lateral prefrontal cortex lesions showed diminished processing speed and significantly more errors than controls (Yochim, Baldo, Nelson, & Delis, 2007). Subjects with significant errors showed dorsolateral frontal lesions (Stuss et al., 2001). Patients with frontal lobe epilepsy showed greater impairment on the set-shifting task when compared to a group of patients with temporal lobe epilepsy (McDonald, Delis, Norman, Tecoma, & Iragui-Madoz, 2005). *Executive Functions:* The test appears to measure complex visual scanning, sequencing, attention, cognitive flexibility, and maintaining a response set.

Rationale for Study Based on Literature

Because hypersexual behavior appears to reflect behaviors that include components of poor judgment, impulsivity, delayed gratification, multiple unsuccessful attempts at change, and

difficulties to see things from various perspectives, the construct of executive functions parallel many of these associated features and may be implicated in patients who experience hypersexuality. Spinella, Yang, and Lester (2004) for example, found evidence of frontal lobe dysexecutive syndrome among individuals displaying similar characteristics as those with hypersexual behavior but who struggled to regulate behavior around credit card spending. As no published study to date has explored the relationships between EF and hypersexual behavior, this study attempts to investigate possible associations. The rationale to this study assumes that deficits in EF would act as predisposing, precipitating, and perpetuating risk factors for hypersexual behavior. If evidence for this hypothesis exists, it might suggest some different course of treatment such as neurofeedback. In the interim, much has to be done still to explore the etiology of hypersexual behavior and this dissertation represents a small part of that work.

Research Hypothesis

The null hypothesis purports there will be a no relationship in the data for scores on executive function measures (as measured by neuropsychological testing) and the severity of hypersexual behavior (as measured by the HBI and the Control subscale of the Compulsive Sexual Behavior Inventory). This is to say that X and Y are linearly independent and there is no relationship as denoted $H_0: \rho = 0$. The alternative hypothesis, $H_A: \rho \neq 0$ will provide some empirical evidence of a linear relationship between the variables of interest and more specificity, if this is true, the relationship will be assessed with a post hoc examination of the analysis of variance between sub-categories of executive functions.

Hypothesis: It is anticipated the hypersexual patients will perform more poorly as a group on tasks of cognitive flexibility, behavior inhibition, sustained attention, problem solving, and vigilance when compared to controls. Specifically, the following subtests will exhibit the

greatest degree of difference between the patient group and controls: Trail Making Test, Condition 4 Number-Letter Switching (cognitive flexibility); Letter-Fluency, Total Correct (sustained attention, vigilance); WCST: Total Errors (sustained attention, vigilance); Color-Word Interference, Condition 3 and Condition 4 Inhibition/Switching (response inhibition, vigilance, cognitive flexibility); Tower Test, Total Achievement (problem solving, cognitive flexibility, and planning/organizing).

Method

Participants

The patient sample recruited for this study consisted of men ($n = 30$) seeking treatment for hypersexual behavior at outpatient mental health clinics in Provo, Utah and Los Angeles, California. Ethnic representation among the sample included Caucasian ($n = 28$) and Asian/Pacific Islanders ($n = 2$), and participants ranged from 19 to 49 years of age ($M = 33.0$, $SD = 8.0$). Education ranged from 12 to 19 years ($M = 15.6$, $SD = 2.2$). Relationship status included never married ($n = 12$), first marriage ($n = 13$), separated ($n = 3$), and divorced ($n = 2$). Sexual preferences included heterosexual ($n = 26$) and gay ($n = 4$). Self-reported presenting sexual behaviors among participants included compulsive masturbation (50%), pornography dependence (70%), habitual solicitation of commercial sex workers (20%), multiple extra-dyadic affairs (23%), and unprotected sex with multiple anonymous partners (30%).

Subjects in the control group were recruited from Utah and California and were matched as carefully as possible to the patient sample based on age, years of education, and income. Ethnic representation among the control sample was exclusively Caucasian ($n = 30$) and participants ranged in age from 22 to 57 ($M = 27.8$, $SD = 6.8$). Relationship status included never married ($n = 12$), first marriage ($n = 16$), separated ($n = 1$), and cohabitating ($n = 1$).

Sexual preferences included heterosexual ($n = 29$) and gay ($n = 1$). Subjects were sexually active but reported no patterns of hypersexual behavior as per the criteria used in this study.

Procedure

At the beginning of enrollment, all participants received and signed informed consent. Following consent, participants completed a demographic survey, cognitive ability testing, the hypersexuality inventories, and the neuropsychological tests of executive functioning. They also received a diagnostic clinical interview where they were assessed for Axis I disorders including adult ADHD.

In the clinical interviews, participants were asked about the degree to which they use sex to cope, consequences they've experienced as a result of their sexual choices, and ways in which they may have felt unable to control their sexual behavior. Participants who meet the following criteria and had elevated scores on the hypersexuality measures were included in the patient group: (1) reported a pattern of hypersexual behavior persisted for at least 6 months, (2) reported a pattern of preoccupation with sexual thoughts, urges, and the pursuit of sexual activities that interfered with at least *two* aspects of their daily life such as academic or scholastic goals, work, a relationship with a significant other, the ability to parent their children, or personal hobbies or interests, and (3) reported a pattern of sexual behavior that resulted in at least *one* significant consequence including: contraction of an STD, loss of employment, significant financial debt, marital/relational discord, poor grades in college, academic probation, excommunication from a religious faith group, a sense of demoralization, depression, loss of self-confidence, or other psychological distress due to the inability to inhibit sexual activities, or legal consequences such as an arrest (e.g., solicitation of sex from a commercial sex worker).

Testing was conducted at the outpatient clinics by two fourth-year doctoral students trained in clinical psychology and neuropsychological testing. Exclusion criteria included clients or controls with any history of head injury, concussion, color-blindness, cortical neurotoxins, stroke, or history of alcohol or drug abuse. Clients or controls with any history of a neurological or neuropsychiatric condition will also be eliminated from the study. Additionally, any participant meeting diagnostic criteria for adult ADHD was eliminated.

Measures

The measures used in this study include those hypothesized to capture elements of executive functions and hypersexual behavior as mentioned previously in this manuscript.

Wisconsin Card Sort Test (WCST). The WCST was administered to all participants using the computerized research edition (WCST-4; 128 cards). Individuals sorted cards into categories based on color, shape, or number. When 10 consecutive cards were successfully sorted the criterion was changed and subjects had to deduce the new sorting rule. The computer would display “right” or “wrong” to indicate whether the subject placed a card correctly. Scores used in this study included the T-scores for Total Errors and Perseverative Errors and norms were chosen based on age and education demographically corrected scores.

Hypersexual Behavior Inventory (HBI). The HBI is a 19-item self-report measure that yields a 3-factor solution which was extracted in an initial clinical sample ($N = 324$) and later confirmed in a second clinical sample ($N = 203$) consisting of patients from treatment clinics across several states including Utah, California, Pennsylvania, Kentucky, Texas, and Arizona. The measure purports to capture the extent to which respondents use sex to cope with emotional discomfort, the degree which they feel unable to control their sexual thoughts, feelings, and behavior, and negative consequences experienced as a result of their sexual activities.

Respondents endorse items on a 5-point Likert scale ranging from 1 (never) to 5 (very often). The scale has demonstrated high overall reliability ($\alpha=.95$) and subscale reliability values of $\alpha=.91$ for the *Control* factor, $\alpha=.91$ on the *Coping* factor, and $\alpha=.89$ on the *Consequences* factor. Confirmatory factor analysis (CFA) supported the factor structure showing an acceptable goodness of fit with RMSEA of .057 and a CFI of .95. The HBI also showed an acceptable goodness of fit using CFA with a mixed college sample ($N = 450$) from Utah, Texas, and Kentucky yielding an RMSEA of .06 and a CFI=.95. Test-retest reliability was derived from a sample of college students ($n = 81$) over a two week time period. The total HBI score ($r = .85, p < .001$), the Control subscale ($r = .87, p < .001$), the Coping subscale ($r = .87, p < .001$) and the Consequences ($r = .88, p < .0001$) all showed high correlations between the first and second administrations suggesting excellent test-retest reliability over a two week time interval. A recommended total scale cut-off score to classify clinical populations was statistically calculated at 53 or higher for male populations. The HBI has shown strong concurrent validity with the Compulsive Sexual Behavior Inventory ($r = .916, p < .01$), the Sexual Compulsivity Scale ($r = .820, p < .01$), and the Sexual Addiction Screening Test ($r = .732, p < .01$). The scale also shows excellent sensitivity (.92) and adequate specificity (.62) classifying hypersexual patients (Reid & Garos, 2007).

Compulsive Sexual Behavior Inventory (CSBI). The CSBI is a 28-item self-report 5-point Likert-type scale developed to measure control, abuse and violence. A 3-factor solution was extracted using principal components with varimax rotation. Items were retained based on factor loading exceeding .60, visual examination of the scree criteria, and face validity of items. Cronbach's alpha for the three subscales ranged from .88 to .96. Using linear discriminant function analysis, the scale correctly classified 92% of cases when combining a pedophiles ($N =$

35) with non-paraphilic sexually compulsive individuals ($N = 15$) compared to controls ($N = 42$). The measure appears to discriminate sexually compulsive individuals from controls. Limitations include a small sample size used in the initial sample (Coleman et al., 2001). Recently, additional psychometrics were established using a confirmatory factor analysis on a sample of Latino gay men ($N = 1026$) from data collected online. Prior to administration, 6 items were removed (items related to childhood abuse). The scale yielded a 2-factor structure of control and violence. An additional change was made to reverse score items so higher scores would indicate higher levels of sexually compulsive behavior. The measure showed acceptable goodness of fit with an RMSEA of .045 and a CFI of .99 after correlating one item that loaded on both factors. A test-retest reliability test was also performed on a small subset ($N = 29$) across a 7-10 day period yielding good results ($r = .86, p \leq .001$). For the purpose of this study only the control subscale will be used. The rationale for this decision was based data collected from a previous sample of hypersexual patients at the clinic who completed the full 28-item version and did not endorse any of the items on the violence subscale.

The D-KEFS. The D-KEFS is a neuropsychological battery of tests designed to measure aspects of executive functions. The D-KEFS tests produce standard scores with a mean of 10 and a standard deviation of 3. Several reviews have favorably commented on the large and nationally stratified representative standardized sample used in constructing the tests ($N = 1750$; sample stratified based on the 2000 U.S. Census figures), the attention to careful and concrete development, and the tests promotion of innovative interpretation (Homack, Lee, & Riccio, 2005). The D-KEFS battery contains 10 tests theorized to capture aspects associated with executive functions. The tests composing the D-KEFS are: Trail Making, Verbal Fluency, Design Fluency, Color-Word Interference, Sorting, 20 Questions, Word Context, Tower, and

Proverb. As noted by Homack and her colleagues (2005) the Split-half reliability coefficients corrected by the Spearman-Brown formula are reported in the technical manual and overall, split-half reliability estimates were significantly varied across tests, conditions within tests, and age groups. For example, moderate to high split-half reliabilities with relatively less variability across age groups were reported for the Verbal Fluency Test – Letter Fluency Condition (.68–.90), the Color-Word Interference Test (.62–.86), the Sorting Test- Sort Recognition (.62–.81), the Twenty Questions Test-Initial Abstraction (.72–.87), and the Proverb Test (.68–.80). For other tests, reliabilities ranged from the moderate to good range (approximately .50–.80 depending on age groups and tests). Low to moderate split-half reliabilities (depending on age groups) were reported for the Verbal Fluency Test – Category Switching Total Correct (.37–.68) and the Twenty Questions Test – Total Weighted Achievement (.10–.51). Thus, many overall achievement scores of the tests have adequate to good reliability coefficients, whereas some of the optional process measures have lower reliabilities.

D-KEFS: Color-Word Interference Test. This test was developed based on the foundation of the original Stroop Color Word test and measures verbal production, response inhibition, and cognitive flexibility. Examinees are required to quickly name colors in which words are printed (e.g., red, blue, green) while inhibiting the more automatic task of reading the words. A subsequent condition requires switching between naming the dissonant ink colors and reading the words only if they are framed in a box.

D-KEFS: Tower Test. This test measures spatial planning, rule learning, and inhibition of impulsive and preservative responding, and the ability to establish and maintain an instructional set. The examinee is required to move disks of varying size across three pegs to

build a designated tower using the fewest number of moves possible. The Total Achievement score represents the number of disk moves required to correctly reproduce the designated towers.

D-KEFS: Trail Making Test. This test is a modification of the original test developed by Partington in 1938 except the DKEFS test has 5 different conditions that provide more specificity in assessing functions and controlling for skills that may covary with the examinees abilities. It captures motor speed, sequencing, cognitive flexibility and inhibition of perseverative responding.

D-KEFS: Verbal Fluency Test. This test requires examinees to spontaneously generate words beginning with the letters F, A, and S. Each letter is allotted 60 seconds. The DKEFS also has introduced a categorical fluency test requiring examinees to generating boys names, animal names, and a switching task where the respondent alternates between giving the name of a food and a piece of furniture. The areas of executive function assessed with this test include cognitive flexibility, response inhibition, and verbal fluency.

Results

Data Preparation

Prior to analysis, equivalence of the variance-covariance matrix was examined using Box's M which was not significant ($p = .47$) suggesting it is appropriate to proceed with interpretation of the results. Had it been significant however, Tabachnick and Fidell (2001) suggest some guidelines for interpreting significance and recommend proceeding with multivariate analysis when sample sizes are equal as is the case in this data set. Levene's test of homogeneity of variance across the dependent variables was unremarkable except for the Inhibition/Switching condition of the Color-Word Interference Test ($p \leq .01$). This finding

suggests examination of group differences on this subtest is contra-indicated given the significant difference in variance for this dependent variable among the two groups.

Group Comparisons

Measures of hypersexual behavior. Comparisons for group differences on both measures of hypersexual behavior were computed simultaneously using multivariate statistics (MANOVA) and yielded significant differences between the groups (Wilks' $\lambda = .885$, $F[7,52] = .968$, $p = .464$) with the patients scoring higher than controls. Group means, standard deviations, and effect sizes for the Hypersexual Behavior Inventory and the Control subscale of the Compulsive Sexual Behavior Inventory are presented in Table 1. As can be seen, the effect sizes were large and reflect distinct differences between the groups for hypersexual behavior as measured by these two instruments which were also highly correlated with each other ($r = .91$, $p \leq .001$). These results were not altered when computing the same analysis with age, years of education, and FSIQ scores as covariates.

Measures of executive functions. The overall MANOVA for the subscales of the executive function tests failed to reveal significant differences between the two groups (Wilks' $\lambda = .885$, $F[7,52] = .968$, $p = .464$) across all subscales. Group means, standard deviations, and effect sizes are presented in Table 1.

Although both groups were approximately equal on years of education (~ 15.6 years) and income, they showed a modest, but significant difference ($p \leq .01$) in age with the hypersexual group ($M = 33$ years) being slightly older than the control group ($M = 27.8$). The groups also exhibited a significant difference ($p \leq .01$) on Full Scale IQ scores with the controls (FSIQ: $M = 126.8$) being slightly higher than the hypersexual group (FSIQ: $M = 119.47$). In order to rule out any differences unexplained by variables that might have covaried with the constructs of interest,

the analysis was recomputed with age, FSIQ, education, and income as covariates, however, the overall results were unaltered.

Table 1. Group differences among scores for executive functions and hypersexuality

Study Variables	Controls <i>n</i> = 30		Patients <i>n</i> = 30		<i>F</i>	Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
<u>Hypersexuality</u>						
HBI: Total Score	32.93	11.74	74.70	11.47	194.27*	3.60
CSBI: Control Subscale	26.73	9.81	48.07	5.75	105.65*	2.74
<u>Executive Functions</u>						
<i>WCST (T-scores)</i>						
Total Errors	54.37	8.72	51.40	8.85	1.71	0.20
<i>D-KEFS (Scaled Scores)</i>						
Trails-4 Letter-Number Seq.	12.17	1.49	11.47	1.33	3.69	0.06
Trails-4 Errors	0.37	0.56	0.40	0.72	0.04	0.84
Letter Fluency	13.30	3.59	12.23	3.87	1.23	0.27
Color-Word Condition 3	11.80	2.39	11.00	2.84	1.38	0.25
Color-Word Condition 4	11.83	1.76	11.00	2.99	1.73	0.19
Tower Test Total Score	12.27	2.42	11.13	2.24	3.54	0.07

* $p \leq .001$

Clinically Meaningful Elevations

In practice we are usually interested in clinically meaningful elevations to determine whether patients fall within various groups. That same principle can be applied to understand how frequently hypersexual participants produce elevations that are diagnostically significant (usually regarded as 1.5 standard deviations from the mean). To better understand how often such elevations are found in patients versus the control group, frequencies of participants falling above and below the threshold of 1 standard deviation from the mean (a more liberal standard of only 1 standard deviation was used instead of 1.5 which failed to produce any subjects) on two or

more tests of executive functioning were examined. This approach identified 4 patients among the hypersexual group whose scores suggested they might have some deficits in executive functioning. In one of these cases, the patient exhibited impaired performance on 4 of the executive functioning tests with the other three patients showing deficiencies on 2 of the tests. Descriptively, all of these patients had obtained at least a bachelors degree (one with a masters) and were successful in their fields of employment. The patient exhibiting the most significant impairment on the tests was a gay man employed as a fashion designer (FSIQ = 102) and diagnosed with bipolar I disorder; the other three were employed as an accountant (FSIQ = 117) with no Axis I disorder, a professor (FSIQ = 125) diagnosed with major depressive disorder, and a business store owner (FSIQ = 114) in the furniture industry with no Axis I disorder. This same approach among the control sample failed to produce any subjects with deficient scores across 2 or more tests of executive functioning.

Discussion

Summary of Findings

The current investigation examined differences across scores on objective neuropsychological tests of executive functioning in a group of hypersexual male patients ($n = 30$) compared with a non-hypersexual community sample ($n = 30$) of men. Best efforts were made to match subjects on age, years of education, income, and cognitive ability as measured by FSIQ. Elimination criteria included subjects in either group with a significant history of head trauma, current psychoactive substance abuse, seizures, color-blindness, concussion, cortical neurotoxins, stroke, or history of alcohol or drug abuse. Additionally, subjects in either group were eliminated if they met diagnostic criteria for adult ADHD.

Using multivariate statistics, group comparisons were examined yielding significant differences on measures of hypersexuality. Surprisingly however, the groups failed to exhibit significant differences across all of the neuropsychological tests of executive functioning. These results were unexpected based on a recent finding that reported executive deficits among hypersexual men measured by self-report (Reid et al., 2010).

There are a number of plausible explanations about why executive deficits did not emerge among the patient sample in this study. It is possible that the objective neuropsychological tests of executive functions were not sensitive to subtle deficits that may have existed in the patient sample. Evidence for this position has emerged from substantial criticism of objective neuropsychological tests for their lack of ecological validity, which raises doubts as to whether they would accurately reflect deficits in real-world environments (e.g., Chaytor, Schmitter-Edgecombe, & Burr, 2006; Gioia & Isquith, 2004; Manchester, Priestley, & Jackson, 2004).

Another viable explanation is that apparent “executive deficits” among hypersexual patients are domain specific. That is to say, hypersexual men may be impulsive, show poor judgment, lack behavior inhibition, and so forth, only in contexts where opportunities for sex are present but not manifest these traits in other domains of their life (e.g., finances, driving, etc.). This position could be strengthened if future studies explored coexisting evidence of impulse control among hypersexual patients in domains such as substance use, spending patterns, driving habits, and food consumption.

It should be remembered that this study excluded hypersexual patients diagnosed with adult ADHD. Research exploring executive functioning in subjects diagnosed with adult ADHD have consistently produced findings showing deficits across scores on both self-report and

objective neuropsychological testing measures. Thus, it is likely that hypersexual patients who also are diagnosed with adult ADHD would show compromised executive functioning. It is important to be mindful of this given recent findings suggesting a 23% prevalence rate of comorbid adult ADHD among hypersexual patients (Reid et al., in press).

Limitations

This study was limited in several ways. First, this study is correlational and therefore does not address issues of causality or interactive effects on hypersexual behavior. This study also possesses the limitations commonly associated with and found in studies in which subjects self-select for research participation. Inferences about the findings beyond those listed in this study should be made with caution, in part because this sample consisted of male subjects who were mostly heterosexual with limited ethnic representation. This sample was also void of patients with comorbid substance-related disorders (a common comorbidity noted in other studies, e.g., Kafka & Prentky, 1994), although the lack of such subjects in the present study afforded the opportunity to investigate hypersexuality while minimizing substance-abuse confounds. Similarly, the findings from this study can only be generalized to hypersexual male patients void of comorbid adult ADHD. Finally, this study was also limited as the hypersexual patients were treatment seeking and recruited from outpatient mental health clinics. Thus, it is possible that these findings would not be generalizable to non-treatment seeking hypersexual men.

Recommendations for Future Research

The findings from this study have several implications for future research. First, if replication studies are considered, a more diversified sample should be examined including hypersexual women, non-treatment seeking subjects, and greater ethnic representation.

Subgroup comparisons might also be interesting such as group differences in executive functioning between gay and heterosexual men, or hypersexual individuals at greater risk for HIV-infection. Similarly, concerted efforts should be made to explore more global subtypes among hypersexual populations. Although the objective neuropsychological battery in this study failed to yield differences in the group, other instruments should be considered in future exploration of possible cortical structures associated with hypersexuality. For example, the field would greatly benefit from neuroimaging studies highlighting neuroanatomical characteristics of hypersexuality such as the recent work of Miner, Raymond, Mueller, Lloyd, & Lim (2009) or biophysiological data generated from brain maps using quantitative electroencephalography.

Conclusion

Recently, classification criteria for a “Hypersexual Disorder” has been proposed by the DSM-V Work Group responsible for examining Sexual and Gender Identity Disorders (Kafka, 2010). The proposed criteria parallel much of that which was used in the present study and includes repetitive engagement in sexual fantasies, urges, or behaviors in response to dysphoric mood states such as anxiety, depression, boredom, and so forth (Kafka, 2010). Although the results of this study do not provide direct support for the DSM-V criteria, they discount the possibility of alternative associations (e.g., executive deficits) for hypersexual behavior.

While much remains to be learned and understood on the topic of hypersexuality, the growing number of clients seeking help for this issue will likely influence future research that can inform clinicians about the most effective treatment interventions for this population. As noted in previous research, hypersexual populations are not a heterogeneous population and not all primarily characterized by personality traits such as impulsiveness or neuroticism nor do they all present with comorbid disorders such as substance-abuse or adult ADHD (Reid et al., 2010;

Reid & Carpenter, 2009a, 2009b). These findings should lead researchers to begin exploring typologies and subtypes of hypersexual populations so efforts can be made to understand this unique population with greater specificity. The findings from this dissertation offer a modest contribution and help advance the field by providing some preliminary evidence that executive deficits are unlikely in treatment seeking men void of comorbid substance related disorders and adult ADHD.

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