

INVESTIGATING THE RELATIONSHIP BETWEEN ADULT ATTENTION DEFICIT AND HYPERACTIVITY DISORDER (AADHD) AND PERSONALITY CORRELATES RELATED TO SENSATION SEEKING

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ABSTRACT

The scientific literature is proliferated with discussions regarding childhood ADHD and there is great awareness for it in the population. In the last 20 years, however, increasing evidence has emerged to suggest the rising and unremitting persistence of ADHD well into adulthood. Due to its chronic nature, researchers are interested in the possible personality correlates that may underlie the way in which the disorder manifests. The current research examined whether the personality trait of Sensation Seeking, and its accompanying sub-dimensions of: (i) Boredom Susceptibility; (ii) Disinhibition; (iii) Experience Seeking; (iv) Thrill and Adventure Seeking; (v) Novelty; and (vi) Intensity of stimuli can explain a statistically significant amount of adult ADHD variance. In addition to the Sensation Seeking Scale form V (SSS-V), participants were also required to complete the adult ADHD Self-Report Scale (ASRS). Significant positive correlations with adult ADHD were found for the Sensation Seeking sub-dimensions of Disinhibition and Experience Seeking. Thrill and Adventure Seeking on the other hand was found to be unrelated to ADHD in adults. Furthermore, a multiple regression analysis revealed that sensation seeking dimensions can explain a small, yet statistically significant amount of adult ADHD variance. Despite these findings, additional research is necessary to identify other possible factors that could

explain adult ADHD variance. The empirical evidence regarding the role of it is scarce and inconsistent. These gaps in our understanding of the relationship between adult ADHD and personality may benefit from the identification of a moderator variable on which these relationships are contingent and that help to predict and understand when these relationships are positive and negative.

Keywords: ADHD; emotion-regulation; impulsivity; inhibition; personality; risky behaviour; self-regulation; sensation seeking;

‘My frustration with work left me irritable with my family. Often I would explode in unpredictable anger. Thankfully, they kept their faith in me long enough for me to discover the possibility that I had ADD’ (George F. as cited in Wender & Tomb, 2010, p.22).

Despite the rich tradition of inquiry into the subject, human nature remains one of the most tenacious and enigmatic phenomena ever faced by philosophers and psychologists. Human behaviour, as a joint interest of sociology, psychology, and economics, has been extensively investigated during the last few decades (Gibbins, Weiss, Goodman, Hodgkins, Landgraf & Faraone, 2010). However, due to the complexity and diversity of our behaviours, an in-depth understanding of human behaviour is still a long-standing challenge thus far. In the Judeo-Christian view, humans were created by God and endowed with the knowledge of right and wrong, as well as the ability to choose between them. Following this line of thought, intellectual and volitional powers are seen as arising from the soul rather than the body. Modern contemporary advancements, however, have illustrated that a comprehensive account of human nature requires an explication of our bodily nature as well. The past few decades have produced important advances in our understanding of how the brain regulates emotion, cognition and behaviour. By establishing an understanding of the brain processes underlying normative self-regulation in development, as well as the neuropsychological patterns that characterise emergent clinical trajectories, modern science has been able to effectively diagnose and treat a wide range of psychopathologies as they have emerged. However, the gaps and discrepancies in the literature, despite these large deposits of empirical evidence and knowledge, are numerous, and ADHD, particularly adult ADHD (aADHD), poses no exception in this regard. Adult ADHD is indeed, in many ways, a diagnosis that has caused clinicians and researchers alike to scratch their heads.

As adults, whether consciously or unconsciously, we regulate our emotions and behaviour with the purpose of furthering our goals in time by formulating and applying a range of simple and elaborate strategies. Yet, we are not born with this ability. Or are we? The philosophical analogy ‘*tabula rasa*’ is an epistemological theory (Wall, 2001) that posits that the human mind, at birth, possess no particular identity or innate predispositions and conceptions (Wall, 2001). Instead, it is infinitely malleable and shaped by empirical experiences. In other words, it is the unique

socio-cultural, political, economic and cultural milieu that enfold an individual that imprints complex patterns and plays a fundamental role in the way in which the human mind develops (Wall, 2001).

For the most part, many scholars have posited that we begin life as tightly stimulus-bound; reacting from one moment to the next based on the perceived pleasantness or unpleasantness of events. All the while, the capacity for self-regulation develops slowly, by means of experience and socialization (Todd & Lewis, 2006). Levels of regulatory skills and strategy become increasingly more elaborate with cognitive development, facilitating progression from limited stimulus-bound and temporally immediate responses to more deliberate and flexible strategies aimed at increasingly more temporally distant goals (Zelazo & Cunningham, 2006 as cited in Todd & Lewis, 2006). To a certain extent, each level of regulatory skill is thought to be dependent on development of the previous level (Barkley, Murphy, & Fischer, 2008). As such, the brain of developing children mature in such a way that they can support increasingly more complex strategies in the service of more abstract and distant goals. In other words, with cognitive and social development we become more adept at being able to focus on distant goals (Barkley, 1997); we become more playful, intentional, mindful, and better able to choose responses in a contextually appropriate manner.

Certain types of clinical pathology are associated with the failure to develop effective self-regulation skills. Adult ADHD has been identified as such a countless number of times in the scientific literature. It is, however, also increasingly being identified and confirmed as a *neuro-genetic* disorder (Barkley, 2009). Such a characterisation has stimulated contentious discussions and debate regarding the nature of self-mastery and how we are best able to make sense of a phenomenon that for many years we have come to understand as a product of socialisation. As a world renowned author and researcher in the field of ADHD, Barkley (2009) suggests that self-control, as understood within these terms, is not a learnt behaviour. Perusal of this claim has profound philosophical implications and conclusions: it essentially purports that our capacity, as human beings, for regulating ourselves actively operates within us – not as a socially constructed phenomenon, but a neurobiological trait (Barkley, Murphy & Fischer, 2008). The personality trait of Sensation Seeking (SS) has also been shown in a plethora of research to play a fundamental role in maturation and development of disinhibited behaviours; so much so that delineating aADHD from SS has been called into question. The rationale, therefore, for this research investigation is to evaluate the extent to which aADHD can be described in terms of personality. More specifically, this research endeavour seeks to contribute to this field by investigating the personality trait of SS as it relates to aADHD. The primary aim is to test whether a model that uses the SS dimensions of: (i) Boredom Susceptibility (BS); (ii) Disinhibition (Dis); (iii) Experience Seeking (ES); (iv) Thrill and Adventure Seeking (TAS) and (v) Novelty and (vi) Intensity of stimuli,

can explain a statistically significant amount of aADHD variance. In addition to this, the secondary objective was to inferentially discern whether aADHD and SS potentially represent different points in time of the same latent process; are separate, yet strongly related constructs; or if they are the same constructs that, scientifically, have wrongly been given different clinical labels.

THEORETICAL BACKGROUND

Traditionally, ADHD has primarily been recognised as a paediatric disorder (Barkley & Murphy, 2005). However, the rapid increase in ADHD diagnoses, particularly amongst adults in the latter two decades, had created opposition to its historical classification as a childhood disorder. ADHD is not a simple diagnostic term and understanding this surge in diagnoses is no straightforward matter. Despite the relative progress regarding the diagnosis and treatment of ADHD, clinicians and researchers are still grappling with the bewildering complexity that the disorder presents. ADHD is a multifaceted disorder with immense variability in its clinical symptom expression, levels of adaptive functioning, psychiatric co-morbidity, and behavioural and emotional problems, as well as impairment in cognitive functioning (Cloninger, Svrakic & Przybeck, 1993). In addition to this, not only does ADHD symptomatology substantially overlap with various other externalizing psychopathologies, but an equally large number of conditions seem to mimic its core symptoms and appear to masquerade as the disorder.

The genetically transmitted neuropsychiatric disorder is often first recognised in early childhood (Barkley, 2009; Wender & Tomb, 2010), and a substantial amount of research has focused on its symptomatology during this stage. Due to the developmental nature of the disorder, symptoms and behaviours characteristic of ADHD manifest themselves differently in adulthood, in accordance with maturation (Barkley, 2009; Faraone et al., 2006). This changing presentation of ADHD with age makes it one of the most undiagnosed disorders of adulthood (Wender & Tomb, 2010). Symptoms that are key features in childhood are less evident in adulthood, and distinguishing symptoms of the adult stage are not easily recognized. The distinction of subtypes in adulthood, as a result, is not as applicable (Gibbins et al., 2010). Moreover, Barkley et al., (2008) found that impulsiveness, distractibility, problems with working memory, and poor concentration are more useful than hyperactivity in identifying the adult stage of ADHD (Klein & Mannuzza, 2010).

CLINICAL PRESENTATION: ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

During the transition from adolescence to adulthood, success in education and full-time occupation contexts often depend on a number of important interpersonal

abilities associated with the agreeableness and conscientiousness personality dimensions (Cubillo, Halari, Smith, Taylor, & Rubia, 2012). More specifically, academic and occupational achievement often depends on the quality of an individual's time management and multi-tasking skills, particularly when pertinent behaviours are inner-directed (Todd & Lewis, 2006). These skills, it appears, are particularly problematic for individuals with ADHD (Barkley et al., 2008).

Attention and Inhibition

The adult manifestation of the disorder is characterised by three primary areas of neuro-psychological development (Barkley et al., 2008). The first of which is related to problems in the development of attention. Attention, however, is a non-specific syndrome or symptom, and is comprised by a number of different components (Barkley et al., 2008). However, not all of these components are disrupted by the disorder. Therefore, inattentiveness in relationship with ADHD reaches far beyond an inquiry into the construct of attention alone. Research in this domain has shown that ADHD interferes with the following forms of inattentiveness: (i) the ability to persist toward a goal; (ii) the ability to resist distraction in pursuit of an endeavour, and; (iii) the ability to hold in mind what the goal is and the steps to that goal – in order – such that even if you are distracted or interrupted, are able to return to that goal.

Attention, mostly involves the prefrontal cortex. However, there are different ways of paying attention. For the purposes of this research, a distinction between *exteroceptive* and *interoceptive attention* is made. While the prefrontal cortex may, indeed, be specialized for attending to external information, older and more buried parts of the brain including the insula and posterior cingulate cortex appear to be specialised in observing and discerning our internal mental landscape (Todd & Lewis, 2006). *Exteroceptive attention*, on the other hand, relies on the frontal lobes of the neocortex (the evolutionarily newest outer layer of our brains that most distinguishes humans from other species) (Todd & Lewis, 2006). *Interoceptive attention*, however, relies upon brain regions that link the cortex to the limbic system – an evolutionary older brain system that we share in common with many other animals (Malloy-Diniz, Fuentes, Leite, Correa, & Bechara, 2007). These limbic connections may support more direct access to emotions and physical sensations (Malloy-Diniz et al., 2007) while the cortex is more responsible for a conceptual sense of self (Llewellyn, 2008). By recruiting 'limbic-bridge' areas like the insula and posterior cingulate, a person using *interoceptive attention* may bypass the pre-frontal neo-cortex, directly tapping into bodily awareness that is free from social judgment or conceptual self-evaluation. Vigilant analysis of inattention alone, nevertheless, hardly captures what is actually going wrong in the developmental process of individuals diagnosed with ADHD (Barkley, 2009). This brings us to the second domain of functioning that is impaired

in individuals with ADHD: that of inhibition. Inhibition is characterised chiefly in early childhood by problems with hyperactivity, and then later as the child matures, problems with impulsive decision-making, impulsive verbal behaviour, as well as impulsive emotional behaviour (Barkley, 2009). Hyperactivity declines remarkably with age, becoming increasingly more internal in-form (Barkley, 2009). Adults with ADHD commonly report an inner restlessness – both of thought and activity – where they describe themselves as needing to be engaged in multiple activities (Malloy-Diniz et al., 2007).

Emotion Regulation and Executive Functioning

Emotion has also been found to play a fundamental part of the impairments associated with the disorder. Adults diagnosed with ADHD are often described as having low frustration tolerance, quickness to anger and proneness to displaying raw, unregulated and impulsive emotion, making them appear easily excitable (Barkley, 2009). Emotion, according to Barkley (2009), is a motivational state; it prepares us for action. Self-motivation is fundamental for all future-directed behaviour, as well as the execution of behaviour that is in one's long-term behaviour. The relationship, therefore, between emotion and self-motivation is important to establish an understanding of the biology and function of emotions in the way in which we regulate ourselves.

The assumption thought to underlie these impairments is rooted in the understanding that ADHD, fundamentally, is a deficit in behavioural inhibition in four executive neuropsychological functions. Broadly speaking, we think of executive functioning as those mental faculties for self-control that bestow up us – the ability to sustain problem-solving toward a goal, also referred to as goal-directed persistence (Barkley, 2009). These capacities include: self-regulation of affect-motivation, internalization of speech, non-verbal, visual working memory, and behavioural analysis. As such, it is believed that individuals with ADHD, as a consequence of these deficits, seek external stimulation through increased activity and heightened sensory experiences as a means of compensating for low levels of arousal. Individuals suffering with ADHD are severely impaired in this domain and exhibit a failure to assert themselves constructively by engaging in a self-disciplined, self-sustained course of persistent action towards their goals (Barkley, 2009), pointing to their dependence on immediate consequences to sustain action as opposed to generating their own internal motivational states.

CONCEPT CLARIFICATION AND DEFINITIONS

Self-regulation

The most common trait ascribed to executive functioning is self-regulation (Barkley, 2009). Self-regulation is regarded as a more inclusive term, sometimes used interchangeably with emotion regulation, which refers to the regulation of both emotional and behavioural responses (Todd & Lewis, 2006). Emotion regulation and self-regulation are ill-defined constructs that refer to a wide array of processes. The following elucidation is offered by Thompson (1994, as cited in Todd & Lewis, 1996):

‘Emotion regulation consists of the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one’s goals’ (Thompson, 1994, as cited in Todd & Lewis, 1996).

It is broadly considered to be the means by which an individual manages themselves in order to attain their goals, however, it is thought of as having at least three components. According to Barkley (2012), these include:

‘(1) Any action an individual directs at themselves so as to (2) result change in their behaviour (from what they might have otherwise done) in order to (3) change the likelihood of a future consequence or attainment of a goal’ (Barkley, 2012).

Although the scientific literature focuses on the inhibition of negative emotional responses, emotion regulation also involves the enhancement of positive responses. Two types of emotion-regulation have been identified, namely: *extrinsic emotion-regulation* and *intrinsic emotion-regulation*. *Extrinsic emotion-regulation* refers to the regulation processes and socialization processes provided by caregivers (Todd & Lewis, 2006). *Intrinsic emotion-regulation*, by contrast, refers to the inner-directed strategies utilised by an individual to independently modulate his or her own emotional and behavioural responses (Llewellyn, 2008). These strategies, whether voluntary or automatic, can include shifting attention, the suppression of behaviours associated with approach, avoidance, or emotional display, postponing immediate gratification, as well as re-interpretation or appraisal of events in order to modify one’s emotional response, as well as coping strategies and problem-solving (Llewellyn, 2008).

ADHD has been linked to several other psychiatric disorders in children and adults. Increased rates of comorbidity with conduct disorder and oppositional defiant disorder are evident in children as well as adults. An associated outcome of these disorders in adulthood is the development of antisocial personality disorder (Barkley et al., 2008). In a review of different studies on comorbidity, Klein & Mannuzza (2010) found a consistent diagnostic comorbidity of antisocial personality disorder and substance use disorders in adults with ADHD. More specifically ADHD adults are more likely to engage in high-risk behaviours such as tobacco use, alcohol abuse or dependence, drug abuse or dependence, unprotected sex, engaging with more sexual partners, and risky driving. Mental disorders such as depression, anxiety and antisocial behaviours are also more prevalent (Barkley, 2009).

Adult ADHD seems to involve difficulty in the same faculties and mental abilities that are involved in our ability to regulate our own behaviour (Schneider, Rösler, & Retz, 2010). Many books, journal articles, presentations, and research on ADHD also make continual reference to executive functioning as a critical functional area in understanding the dynamics of the disorder and in emotional dysregulation.

SENSATION SEEKING

Researchers have previously assumed that there is a relationship between ADHD and SS. With the literature in this field already being rare, no previous studies have looked at how the different dimensions of SS relate to ADHD. The relationship between ADHD and SS is not widely discussed in the literature. Zuckerman vaguely discusses their association in two of his publications (1994, 2007), indicating that children with ADHD could be characterized as sensation seekers. His assumption of a possible relationship rests on shared concepts such as boredom proneness and the association of both concepts with the long allele of the dopamine receptor gene - DRD4. However, he cautions that because of a lack of research in the field a definite statement cannot be made about the relationship of ADHD with sensation seeking. Previous research validating theoretically informed guesses such as those of Zuckerman has been rare and inconclusive.

Like ADHD, SS has a developmental nature (Rösler, 2010). Behavioural expressions, such as substance abuse, risky sexual behaviour, and risky driving are evident in persons suffering with ADHD as well as high SS (Rosenbloom & Wultz, 2011). Many studies successfully demonstrate that SS is implicated increased alcohol and drug use, promiscuous sexual activities, and speeding (Donohew et al., 2000; Roberti, 2004; Zuckerman & Kuhlman, 2000). Similarly, adults with ADHD are three to eight times more likely to have alcohol or drug related problems (Barkley, 2009). Risky sexual activity (Flory et al., 2006) and risky driving habits (Barkley et al., 2008) are also commonly reported problems. However, although ADHD and SS may look similar, a relationship cannot be assumed on face value.

Realizing the lack of literature examining aADHD and SS exclusively, Garland (1999) conducted a study on the relationship between the two concepts. The ADHD group ($N=43$) was compared with the non-ADHD control group ($N=61$) on two measures of SS, namely the SSS-V and the Impulsive SS subscale of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ). Scores of males and females were analysed separately in both groups to test for effects of gender. Garland found significantly higher SSS-V scores in the ADHD group compared to the control group. However, this was only due to elevated scores in the female ADHD group. In the male group no significant relationship between an ADHD diagnosis and SS was found. The general result of a positive relationship is therefore based only on the female sample ($N=18$) which was by far the subgroup with the least participants. The validity of these results is also questionable on the basis of Zuckerman's (1994) findings that female participants generally score lower on the SSS-V. In terms of impulsive SS, Garland (1999) found a positive relationship. Both male and female ADHD groups scored significantly higher on the Impulsive SS scale. This is not surprising, given the close relationship between ADHD and impulsivity. A separate analysis of the impulsivity and SS parts of the scale would have revealed whether these results actually indicate a relationship between ADHD and SS. Garland (1999), however, did not do such an analysis.

Most recently, Valero and colleagues (2012) also used the ZKPQ to establish a personality profile of aADHD. In line with Garland's (1999) results they found higher scores of impulsive SS for the ADHD group in comparison to a community control group. However, after analysing the components of impulsivity and SS separately they found that only impulsivity distinguished the ADHD group from the control group. On the basis of these results Valero et al. (2012) conclude that 'ADHD subjects are impulsive, but not sensation seekers' (p. 4). In light of this it can be concluded that Garland's (1999) findings regarding impulsive SS and ADHD were most likely due to the impulsivity component of the scale and do not indicate a relationship between ADHD and SS. The relatively large sample of 217 ADHD participants and 434 controls speaks for the strength of this study. Adults from 18 to 93 years were included in this study, making the sample representative of the general adult population. The researchers also implemented a case-control strategy, pairing the participants by age and gender. This design speaks for the validity and generalizability of the results obtained in this study.

Another recent study conducted by Carlotta, Borroni, Maffei and Fossati (2011) indicates that there might be a relationship between ADHD and SS. The authors investigated impulsivity, SS and aggression as mediators between childhood ADHD and antisocial behaviour in adolescence. They found that SS explained a substantial amount of 50% of the total effect. It follows that in the presence of SS, childhood ADHD is a significant risk factor for later delinquency. However, this study only hints towards an interactive relationship between sensation seeking and ADHD. It

also focuses only on children and adolescents, who often differ greatly from adults in aspects of SS and ADHD.

Novelty seeking (NS) is a related concept to SS; sometimes the two are thought to be synonymous (Llewellyn, 2008). Research investigating associations between NS and ADHD has been more conclusive. All five studies included here rely on the conceptualization of NS given by Cloninger (Cloninger, Przybeck, & Švrakić, 1991; Cloninger, Svrakic, & Przybeck, 1993; Svrakic, Whitehead, Przybeck, & Cloninger, 1993). In this framework, a tri-dimensional personality theory encompasses Novelty Seeking (NS), Harm Avoidance (HA), and Reward Dependence (RD). The tri-dimensional Personality Questionnaire (TBQ) was developed to assess these concepts. Cloninger also associated the three dimensions with neurotransmitter levels and personality disorders. RD was associated with low norepinephrine and cluster A personality disorders. Low dopamine levels are characteristic of NS and cluster B personality disorders. HA relates to low serotonin and cluster C personality disorders. Later Cloninger et al., (1993) extended the theory to include another temperament dimension called persistence and three character dimensions, namely self-directedness, cooperativeness, and self-transcendence. The Temperament and Character Inventory (TCI) measures these aspects. The TPQ and the TCI have often been used to describe individual differences in psychiatric disorders.

Downey, Pomerleau and Pomerleau (1996) used the TPQ to assess personality differences in smokers and adults with ADHD. They found smoking and ADHD to be positively related to NS. Smokers who also had ADHD scored highest on NS indicating an additive effect. The finding that ADHD smokers scored significantly higher on NS than smokers without ADHD suggests that the positive relationship between NS and ADHD is not dependent on smoking as a mediator. In a follow-up study Downey, Stelson, Pomerleau and Giordani (1997) investigated purely adult ADHD as it relates to the TPQ. They found significantly elevated scores for ADHD participants on NS and HA. Harm avoidance, which is conceptualized as fearfulness and social anxiousness, seems contrary to the fearlessness and approach behaviours evident in SS, indicating little commonality between ADHD and SS. However, Downey et al., (1996) clarify that high harm avoidance scores in ADHD adults are mainly due to a high comorbidity with depression. According to their research, HA seems to not be a necessary component of ADHD.

More recently, Jacob and associates (2007) assessed comorbidity and personality traits in adults with ADHD. Similar to Downey et al., (1996, 1997) they found significantly higher TPQ, NS and HA scores in adults with ADHD, compared to German reference values. Interestingly, the study also revealed that ADHD comorbidity with personality disorders was mostly found in the cluster B category. Cluster B personality disorders are associated with low levels of dopamine, also found in SS and NS.

Two more studies assessed personality differences in adults with ADHD using the TCI. Anckarsäter, Stahlberg, Larson, Hakansson, Jutblad, Niklasson, Nydén, Wentz, Westergren, Cloninger, Gillberg, & Rastam, (2006) examined personality aspects in ADHD and autism disorder. Elevated NS and HA scores and high comorbidity with cluster B personality disorders were reported for ADHD adults. Faraone et al. (2009) also found higher TCI, NS and HA scores for ADHD participants. In terms of HA however, they found that the comorbidity of anxiety disorders and depression do not account for group differences. It follows that HA seems to be a subclinical part of ADHD and that this aspect of the disorder is incompatible with the conceptualization of SS.

In conclusion, it can be said that the concept of NS has been consistently related to ADHD in adults. The results of the studies presented here indicate that ADHD might also be associated with the related concept of SS. However, none of the studies presented here considered subscales of NS, such as impulsivity, separately. It is therefore possible that the relationship between novelty and ADHD is based on impulsivity, as it was found to be the case with impulsive SS. It follows that literature on links between ADHD and SS is inconclusive and it seems that Zuckerman's (2007) conclusion still stands: "No definite statement can be made about the relation between ADHD and sensation seeking" (p. 203).

SENSATION SEEKING AND ADHD IN RELATION TO PERSONALITY

Impulsivity

Impulsivity presents itself as a major link between ADHD and SS, as it is closely associated with both concepts. It is defined as a 'predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others' (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Impulsivity is also listed as one of the three main symptom categories of ADHD (American Psychological Association, 2013) although some researchers suggest that symptoms of hyperactivity as well as impulsivity decline in adulthood (Biederman, 2000), other studies prove that it persists in adults and manifest in cognitive, attentional, and motor domains (Malloy-Diniz, 2007). In a recent study on personality aspects of ADHD, Valero and colleagues (2012) found that impulsivity significantly discriminates the ADHD group from the control group. It follows that impulsivity is not just related to ADHD but can be seen as a defining symptom of the disorder in both children and adults.

Researchers in the past have proposed that impulsivity is a multivariate trait. Eysenck & Eysenck (1977), for example, conceptualise SS as a sub-trait of impulsivity. According to Zuckerman (1994), impulsivity, although not a

supraordinate, is closely related to SS, theoretically and empirically. Together with his colleagues he combined the two concepts into a supertrait called *Impulsive Sensation Seeking* (Zuckerman, 1993). A comprehensive study among high school students, done by Donohew and associates (2000), further support the relationship between impulsivity and SS. By investigating the implications of SS and impulsive decision making for risk-taking they found that those participants who were high in both aspects were most likely to engage in risky behaviours (Rosenbloom, 2003). Both impulsivity and SS are linked with participation in risk-taking behaviours such as promiscuous sex and alcohol use (Llewellyn, 2008). But the findings of Donohew et al., (2000) show that when brought together the two factors support each other, which implicates similar underlying mechanisms. However, that is not to say that the relationship between impulsivity and SS is uni-dimensional. Magid, MacLean, and Colder (2007) analysed the relationship between the two concepts in relation to alcohol use and problems. Confirmatory factor analysis of SS and impulsivity revealed that a two-factor model fits the data better than a combined model. This suggests that impulsivity and SS should be seen as unique traits. Taking drinking motives into account, they also found that SS was strongly related to alcohol use and not, however, to alcohol problems, which are consistently found in individuals high in impulsivity (Magid et al., 2007). They found these results to be in line with the theory of optimal level of arousal. Individuals high on SS consume alcohol to achieve optimal levels of stimulation and may try to avoid negative consequences by planning ahead. Impulsivity, on the other hand leads to more alcohol-related problems. Impulsive decision makers often cope with distress by using alcohol while disregarding long-term negative consequences. It follows that although sensation seekers and individuals high in impulsivity engage in similar behaviours the two traits seem to have underlying differences. In their examination of ADHD, Valero et al. (2012) also stress the conceptual and empirical difference of the two traits (Fischer & Smith, 2004; Magid et al. 2007).

Given the close relationship of impulsivity with ADHD and its moderate association with SS, one might conclude that aADHD and SS are also somewhat related. Garland (1999) investigated the relationships in this triad and found significantly higher mean scores on the Impulsive Sensation Seeking scale of the ZKPQ for the ADHD group in comparison to the non-ADHD group. To substantiate this finding he also examined whether the concept of impulsivity is used in the same way in relation to ADHD and SS. A significant positive relationship was found between the Impulsive Sensation Seeking Scale of the ZKPQ and the Impulsivity scale of the Adult Attention Deficit Disorders Evaluation scale. These findings suggest that ADHD and SS might be related on the basis of their relationship with impulsivity.

Valero and associates (2012) conducted a comprehensive study on personality aspects of aADHD, using the Alternative Five Factor Model (AFFM). In line

with Garland's (1999) conclusions they also found significantly higher scores of Impulsive Sensation Seeking in the ADHD group in comparison to the control group. However, a separate analysis of impulsivity and SS revealed that the Impulsivity trait alone distinguishes the ADHD group from the control group. Three conclusions can be drawn from the above mentioned results. Firstly, the assumption that adults with ADHD are also sensation seekers (Zuckerman, 1994) should be challenged. Secondly, there are fundamental differences between impulsivity and SS which can confound results when analysed together as one trait. Thirdly, one could expect those individuals who are high on sensation seeking, that are also impulsive, to be more likely to also have ADHD. In other words, the presence or absence of impulsivity in sensation seekers may determine its relationship with aADHD.

Risk taking

Another concept that may present as a link between SS and aADHD is risk-taking, which is closely associated with impulsivity. More specifically, impulsivity is related to health related risk-taking, such as unprotected sex. Risky behaviour evident in sports for example seems to be unrelated to impulsivity (Llewellyn, 2008). Similarly, Fischer and Smith (2004) found that the trait of deliberation, which is the opposite of impulsivity, may be a factor in differentiating maladaptive from adaptive risk-taking. Maladaptive risk-taking was found to be influenced by the level of deliberation. In other words, high impulsivity increases the likelihood of participation in risky behaviours with negative outcomes but is not associated with adaptive risk-taking. ADHD is mainly associated with maladaptive risk-taking behaviours (Barkley et al., 2008; Matthies, Philipsen, & Svaldi, 2012) whereas sensation seekers participate in risky activities with positive and negative outcomes (Llewellyn, 2008). This difference gives insight into the relationship between aADHD and SS.

Risky behaviours, such as substance abuse, risky driving, and risky sex, are consistently observed in adults with ADHD. In their comprehensive study of 146 self-referred adults with ADHD in comparison to a clinical ($N=97$) and a community ($N=109$) control group, Barkley et al. (2008) found increased use of tobacco, marijuana, cocaine, LSD, and/or prescription drugs in the ADHD group. Other studies also found ADHD to be a major risk factor for developing substance use disorders. When dependence on nicotine is included, 50% of ADHD adults show problems with substance abuse (Wilson, 2007). In a review of cross-section and prospective follow-up studies Klein and Mannuzza (2010) found that substance use disorders are consistently co-morbid with aADHD.

The area of driving has been widely evaluated in individuals with ADHD and was found to be significantly impaired (Barkley et al., 2008; Rosenbloom & Wultz, 2011; Thompson, Molina, Pelham, & Gnagy, 2007). Driving is an activity that requires high levels of attention, which, by definition, is impaired in persons with ADHD.

It is not surprising that a significantly higher number of car accidents were found among drivers with ADHD in comparison to controls. Other factors associated with ADHD that increase driving risks are substance use, aggression, and the presence of psychological impairments (Barkley & Cox, 2007).

Risky sexual activities, which are especially likely to result in health related problems, are often evident in adults with ADHD. In a study on children with ADHD followed into adulthood, Barkley, Fischer, Smallish, and Fletcher (2006) report the following risky sexual behaviours: early initiation, more sexual partners, and reduced contraception use. As a result, rates of teen pregnancy and sexually transmitted diseases were significantly higher than those of the control group. Similarly, Flory and colleagues (2006) also associated ADHD with 'earlier initiation of sexual activity and intercourse, more sexual partners, more casual sex, and more partner pregnancies' (p. 571). In summary, adults with ADHD often make disadvantageous, risky decisions which can have serious negative consequences for their health and daily living. The association with maladaptive risk-taking offers further support for the close relationship between ADHD and impulsivity, which also correlates with negative risk taking behaviours.

SS has often been linked to a wide range of risk-taking behaviours (Llewellyn, 2008). Similarly, risk takers tend to be higher on the trait of SS than non-risk takers (Zuckerman, 1993). Sensation seekers are more likely to engage in risky activities because they generally appraise a new situation as being less risky, than non-sensation seekers would do. They also anticipate less anxiety if they were in a certain risky situation (Zuckerman & Kuhlman, 2000). Roberti (2004) suggests that the worldview of high sensation seekers is not perceived as dangerous, risky, or threatening. According to the definition provided by Zuckerman (1994) SS includes 'the willingness to take physical, social, legal, and financial risks' (p. 27) in order to experience novel, complex, and intense sensations. This definition indicates that sensation seekers do not seek out risky activities for their own sake. Rather, they are willing to accept that risk is an inevitable component of the behaviour that offers positive arousal. Risk-taking is therefore not a primary motive in sensation seeking behaviour (Roberti, 2004; Zuckerman, 1994).

Risky behaviours that are associated with sensation seeking are alcohol and drug use, risky sexual behaviours, sports that are considered extreme, and dangerous driving (Donohew et al., 2000; Roberti, 2004; Zuckerman, 2007; Zuckerman & Kuhlman, 2000). Alcohol use was found to be twice as high in high sensation seekers in comparison to those low in the trait (Donohew et al., 2000). High sensation seekers also tend to engage in more unprotected sex, have more permissive attitudes towards sex, engage with more sexual partners, and seek intercourse under the influence of alcohol. In order to achieve an adequate level of arousal sensation seekers also engage in adventurous sports such as scuba diving, rock climbing, hang gliding, and parachute jumping (Roberti, 2004). Risky driving habits of sensation seekers

include speeding, not using seatbelts, driving under the influence of alcohol, and aggressive driving (Jonah, Thiessen & Au-Yeung, 2001). Some of these behaviours are also found in persons with ADHD which may indicate a relationship between the two concepts. However, more subtle, underlying differences have to be kept in mind. Firstly, sensation seekers engage in increased alcohol consumption, however substance dependence disorders are more evident in adults with ADHD. Secondly, while problems with attention in drivers with ADHD leads to more automobile accidents, high sensation seekers were found to process road information more effectively and engage in risky driving as a result of a trust in their driving abilities (Rosenbloom, 2003). Thirdly, sensation seekers engage in a wide range of risky activities that are both adaptive and maladaptive (Fischer & Smith, 2004). Risky behaviours that do not have negative outcomes, such as adventure sports, are not significantly associated with impulsivity or ADHD. In fact, adults with ADHD were found to exercise less than controls (Barkley et al. 2008). It follows that while some risky behaviours are found in sensation seekers as well as adults with ADHD which indicates that the two may be related, underlying differences between ADHD and SS are evident.

Greater clarity concerning the relationships of SS to impulsivity, risk-taking and ADHD may be achieved through a differentiation between two different groups of sensation seekers. Within the broad category of sensation seekers there are those who engage in risk-taking that have negative consequences and there are those that do not. There are also those that are impulsive and those that carefully plan ahead. In a study on the role of SS and impulsive decision-making in maladaptive risk-taking, Donohew and colleagues (2000) found support for these differences within the group of sensation seekers. They found that the group of high sensation seekers that were also impulsive decision makers most likely participate in risky sexual behaviours. Furthermore, Fischer and Smith (2004) found that a lack of deliberation distinguishes sensation seekers that engage in maladaptive risks from those that do not. From these findings and the close association of ADHD with impulsivity and maladaptive risk behaviours it can be hypothesized that ADHD relates to the impulsive and negative risk-taking aspects of SS. As a result, a relationship between adult ADHD and sensation seeking is most likely based on those sensation seekers who are also impulsive and participate in risks with negative outcomes.

Boredom Susceptibility

Both sensation seekers and persons with ADHD often seem easily bored. According to Zuckerman (1994), hyperactive children as well as adult sensation seekers become easily bored and restless in non-stimulating environments. Boredom can be defined as a 'negative, dissatisfying emotional state that is mitigated by individual cognitive capabilities or tendencies' (Kass, Wallace, & Vodanovich, 2003, p. 83).

An association with attention control indicates a relationship with ADHD. Boredom prone people often have trouble with focused attention, are easily distracted, and suffer from increased higher cognitive failure (Kass et al., 2003). Kass et al., (2003) investigated links between boredom proneness and adult ADHD and found them to be significantly related. The boredom proneness subscale of internal stimulation, which indicates the inability to create activities, was found to be a predictor of inattention. Hyperactivity was mainly predicted by the subscale of external stimulation, which measures the lack of environmental stimuli.

SS is also associated with boredom proneness, especially when adequate environmental stimulation is absent. More specifically, SS is correlated with the boredom proneness subscale of external stimulation (Kass & Vodanovich, 1990). Furthermore, the BS subscale of the SSS-V indicates that high sensation seekers dislike repetitive experiences because they are considered less stimulating and can quickly become 'a bore' (Zuckerman, 1994). There are aspects of boredom proneness that are evident in individuals with ADHD and high sensation seekers. Both seem to be prone towards boredom when faced with a non-stimulating situation. This might be indicative of a link between ADHD and SS. However, inattention, which is the most common symptom in adults with ADHD, is more closely related to aspects of boredom which are not linked with SS. Again, there seem to be underlying differences between SS and aADHD.

Research Aims

The primary thrust underlying this research endeavour lies in the potential value of attempting to describe the structure of aADHD in terms of personality, and the promises it holds for increasing our understanding of the diathesis and structure of the disorder, as well as the disruptive patterns of behaviour that accompany it. It is not just the interest of the present study to discern whether a relationship between aADHD and SS exist, but also to understand how they interact. The aim of this research was firstly to establish whether there is a relationship between aADHD and the SS dimensions of TAS, ES, Dis, BS, and novelty and intensity of stimuli. Secondly, it was of interest whether a model that uses TAS, ES, and Dis can be used to explain a statistically significant amount of variance in aADHD scores. The following research hypotheses can be stated for the research question:

Hypothesis 1:

H_0 : There is no relationship between SS dimensions and aADHD.

H_a : A positive relationship exists between sensation seeking dimensions and aADHD.

Hypothesis 2:

H_0 : The model that uses all three independent variables does not explain a statistically significant portion of variance in the dependent variable (aADHD).

H_a: The model that uses all three independent variables explains a statistically significant portion of variance in the dependent variable (aADHD).

Hypothesis 3:

H₀: The model that uses ES and Dis as independent variables does not explain any statistical significant amount of variance in the dependent variable (adult ADHD).

H_a: The model that uses ES and Dis as independent variables can explain any statistical significant amount in the dependent variable (adult ADHD).

METHOD

Participants

The sample for this study was drawn from a population of third year students at the University of Johannesburg using non-probability sampling. The questionnaires were loaded onto WebCT (Web Course Tools) – commonly used by universities and colleges across the globe to deliver online learning. Students were given a period of two weeks to respond to the questionnaires, voluntarily and online, after which the link was closed and the data collated and assembled for analyses. Incomplete questionnaires were excluded, such that 568 responses out of 579 completed questionnaires were included in the statistical analyses. Since the primary focus of this study is aADHD, an important criterion for inclusion in the study was that participants be over the age of 18 years.

Instruments

The key constructs were operationalised by means of the: (i) the Zuckerman Sensation Seeking Scale V (SSS-V) and the Adult ADHD Self-Report Scale (ASRS). A brief elaboration of each follows in the sections which follow.

Sensation Seeking Scale form V (SSS-V)

SS dimensions were measured by the SSS-V developed by Zuckerman (Zuckerman, 1979). Form V is the most widely used of the six versions of this scale. The SSS-V is subdivided into 4 different subscales: (a) Thrill and Adventure Seeking (TAS), which focuses on physically risky and unusual activities, (b) Experience Seeking (ES), which emphasises the seeking of novel experiences through the mind and the senses, (c) Disinhibition (Dis), which describes the seeking of sensations through social experiences, and (d) Boredom Susceptibility (BS), which indicates an aversion to repetitive experiences. Each subscale consists of 10 dichotomous forced-choice items. The different subscales can be scored separately with a higher score indicating a greater preference for novel and intense sensations. The reliability and validity of

this measure has been established repeatedly in many different samples. Roberti, Storch, and Bravata (2003) report the following Cronbach's alpha reliabilities: .80 for TAS, .75 ES, .80 for Dis, and .76 for BS. Convergent validity has also been established for the SSS-V. The scale correlates with the Impulsive Sensation Seeking Subscale of the ZKPQ as follows: TAS (.49), ES (.61), Dis (.51), and BS (.43) (Roberti et al., 2003).

Adult ADHD Self-Report Scale (ASRS)

The ASRS was used to measure ADHD symptoms. This scale was developed in conjunction with the World Health Organization (WHO) World Mental Health (WMH) Initiative surveys (Kessler et al., 2005). The 18 items of the scale match the 18 DSM-IV TR Criterion A symptoms for adult ADHD, indicating the frequency of these symptoms over the last six months. Participants were asked to rate themselves on a five point likert scale from 0 (never) to 4 (very often). A maximum score of 72 is possible for the scale. The first six items on the scale were found to be especially predictive of ADHD symptoms and are marked as part A. The remaining 12 items fall under part B. Kessler and colleagues (2005) carefully assessed the reliability and validity of the ASRS. They used Cohen's κ to assess concordance between the ASRS responses and clinical symptom ratings. A κ of .58 was reported indicating moderate concordance. A high total classification accuracy (TCA=96.2) also indicates that this instrument is reliable. A reliability analysis has also been done for the sample in the present study. A Cronbach's α of .82 was found indicating very good internal consistency. Finally, Kessler and associates (2005) report on the area under the receiver operator characteristic curve (AUC) which indicates the probability that a higher score is found for a randomly selected clinical case in comparison to a non-case. A value of .77 supports the validity of the ASRS.

Procedure

A quantitative approach was selected for this study. This investigation made use of a correlational design in exploring the relationships between SS variables and ADHD. Multiple regression analyses were also applied in order to further make sense of the correlations. The data was collected through an online survey after which the facility was shut down. A total of 579 responses were received, of which 568 could be utilized for this study.

STATISTICAL ANALYSIS

In addition to descriptive statistics the study made use of several inferential statistics to test the three research hypotheses. Pearson product-moment correlations were used to test the first hypothesis, which states that sensation seeking dimensions significantly

correlate with adult ADHD. Hypothesis two and three were tested using standard multiple linear regression. This statistical technique can provide information on how much variance in the dependent variable can be explained by various independent variables. It also reveals the unique contribution each independent variable makes. In hypothesis two TAS, ES, and DIS served as predictor variables and it was tested whether these sensation seeking dimensions explain a statistically significant amount of variance in adult ADHD. In the third hypothesis the variable of TAS has been removed. A model using just ES and DIS was used to explain the variance in adult ADHD. A significance level of $\alpha=.05$ has been identified for this study.

ETHICAL CONSIDERATIONS

This study adhered to the ethical requirements of the American Psychological Association (APA) and it implied no risks for participants. Since all participants were over the age of 18 years, no parental consent was required. Participation in the online survey was voluntary and by participating in it, students gave their informed consent. Furthermore, the information obtained by means of the assessments was kept confidential.

RESULTS

Preliminary Statistical Analysis and Descriptive Statistics

Table illustrating Normality and Parametric Assumptions

Table 1: Descriptive Statistics

		ASRS	TAS	ES	Dis
N	Valid	567	568	568	568
	Missing	1	0	0	0
Mean		28.90	5.23	4.99	3.66
Median		28.00	5.00	5.00	3.00
Mode		25	4 ^a	4	3
Std. Deviation		8.887	3.007	1.997	2.474
Skewness		.397	-.054	-.010	.398
Std. Error of Skewness		.103	.103	.103	.103
Kurtosis		.430	-1.165	-.130	-.653
Std. Error of Kurtosis		.205	.205	.205	.205

a. Multiple modes exist. The smallest value is shown

Prior to the multiple linear regression analysis preliminary statistical analyses were conducted in order to ensure the validity of the data for interpretation. All the variables have been found to be normally distributed. The highest value for skewness and kurtosis was found for TAS (kurtosis=-1.165). Secondly, the assumption of no multicollinearity must be met. Findings illustrate that the three predictor variables do not correlate very highly with each other and this assumption has therefore been met. Thirdly, autocorrelation is assumed. The Durbin-Watson test assesses this assumption, with a value of two indicating that the residuals do not correlate (Field, 2009). A Durbin-Watson value of 1.952 indicates that this assumption has been met. Lastly, the assumption of homoscedasticity has also been met. It follows that in the data of this research none of the assumptions of correlation and multiple linear regression have been violated.

In the collection of the data used in this study gender was not controlled for. As a result females were overrepresented in the sample (443 females and 125 males). To determine whether gender significantly influenced the results, an independent samples t-test was conducted. Statistically significant differences in means were only found for the variables of TAS ($t(566)=3.64$, $p<.001$) and Dis ($t(566)=4.26$, $p<.001$). aADHD and ES were not found to be influenced by gender. Caution should be used in generalizing the results of this study to predominantly male populations. Ages ranged from 18 to 52 years with a mean age of 24.9 years in the sample. In terms of ethnicity the sample approximated the distribution in the South African population, although White people were overrepresented in comparison to Africans. Seven participants had previously received a diagnosis of ADHD in childhood and 11 people had been diagnosed with aADHD. Further descriptive statistics for the four variables in the study. The mean for ASRS ($M=28.9$) is higher than the mean reported by Harvard Medical school (2005) for a sample of the US general population ($M=17.19$). For the three SS dimensions (TAS, ES, and Dis) the means found in this study ($M=5.23$, 4.99, and 3.66) are comparable to those previously reported by Zuckerman (1994) ($M_{\text{males}}=7.7$, 5.2, and 6.5, $M_{\text{females}}=6.4$, 4.8, and 5.1).

Inferential Statistics

Table 2: Displaying Pearson Correlation Matrix

Correlations					
		ASRS	TAS	ES	Dis
ASRS	Pearson Correlation	1	.073	.174	.160
	Sig. (2-tailed)		.084	.000	.000
	N	567	567	567	567
TAS	Pearson Correlation	.073	1	.440	.237
	Sig. (2-tailed)	.084		.000	.000
	N	567	568	568	568
ES	Pearson Correlation	.174	.440	1	.425
	Sig. (2-tailed)	.000	.000		.000
	N	567	568	568	568
Dis	Pearson Correlation	.160	.237	.425	1
	Sig. (2-tailed)	.000	.000	.000	
	N	567	568	568	568

Correlations

To test whether aADHD significantly correlates with SS dimensions each of the subscales of the SSS-V were separately correlated with scores from the ASRS. Small but significant positive correlations were found for ASRS and ES ($r=.174$, $N=567$, $p<.001$) and ASRS and Dis ($r=.16$, $N=567$, $p<.001$). The positive correlation between ASRS and TAS however was not significant ($r=.073$, $N=567$, $p=.084$). H_0 was therefore only rejected for the SS variables of ES and Dis. It follows that higher levels of aADHD were associated with higher levels of experience seeking and disinhibition. Thrill and adventure seeking on the other hand seemed to be unrelated to aADHD. The level of statistical significance that will serve as a frame of reference in the interpretation of the findings is 5%. In other words, $\alpha=.05$.

Multiple Linear Regression Model 1

Table 3: Model 1 Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,199 ^a	,040	,035	8,732	1,952

a. Predictors: (Constant), TAS, ES, Dis

b. Dependent Variable: ASRS

Table 4: Model 1 ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1774,907	3	591,636	7,760	,000 ^b
	Residual	42926,362	563	76,246		
	Total	44701,270	566			

a. Dependent Variable: ASRStotal

b. Predictors: (Constant), TAS, ES, Dis

The second hypothesis asked whether the three SS dimensions of TAS, ES, and Dis are able to significantly explain the variance in ASRS scores. The model was found to be significant $F(3,563)=7.76$, $p<.0001$, and accounted for 4% of the variance in ASRS scores (adjusted $R^2=.035$). H_0 was therefore rejected for the second hypothesis. ES and Dis were found to be significant unique contributors of aADHD with ES making the strongest contribution. TAS, on the other hand, did not make a statistically significant unique contribution. The variable was therefore removed for the third hypothesis.

Multiple Liner Regression Model 2

Table 5: Model 2 ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1770,695	2	885,347	11,631	,000 ^b
	Residual	42930,575	564	76,118		
	Total	44701,270	566			

a. Dependent Variable: ASRStotal

b. Predictors: (Constant), Dis, ES

Table 6: Model 2 Coefficients^a

Model		Unstandardized Coefficients		Unstandardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	24,600	1,0008		24,408	,000 ^b
	ES	,581	,204	,130	2,854	,004
	Dis	,380	,164	,106	2,321	,021

a. Dependent Variable: ASRS

To test the third hypothesis the two predictor variables of ES and Dis have been entered simultaneously into the regression model. A second model that excluded the third SSvariable of TAS was found to be significant in explaining the variance in aADHD scores, $F(2,564)=11.63$, $p<.001$. A total of 4% of variance in aADHD could be explained by a model which uses ES and Dis as predictor variables (adjusted $R^2=.036$). On the basis of these findings H_0 was rejected for this hypothesis. These results also reveal that this model is better in explaining aADHD levels than the model tested in hypothesis 2.

DISCUSSION

Correlations

Firstly, these findings are in line with some previous research reporting a positive relationship between sensation seeking and ADHD (Carlotta et al., 2011; Garland, 1999; Hines & Shaw, 1993; Shaw & Giambra, 1993; Shaw & Brown, 1990). However, these studies did not distinguish between the different dimensions of sensation seeking. Their results could therefore be due to the influence of Dis and ES, which seem to share commonalities with ADHD. From the results of this study, and in line with previous research, it follows that SS is related to ADHD at least on some levels. Secondly, the positive relationship found in the present study confirms the parallels between SS and aADHD which can be identified in different domains. Various personality traits such as impulsivity, risk-taking, and boredom susceptibility relate to ADHD as well as SS. Impulsivity is one of the three main symptoms of ADHD and a characteristic that some but not all sensation seekers share (Fischer & Smith, 2004). Similarly, maladaptive risk-taking is associated with ADHD (Barkley et al., 2008), but sensation seekers engage in risky behaviour with positive as well as negative outcomes (Fischer & Smith, 2004). It can therefore be said that the presence or absence of impulsivity and maladaptive risk-taking in sensation seekers determines its relationship with aADHD. In other words, those

sensation seekers who are also impulsive and engage in risky activities with negative outcomes are also most likely to present with ADHD symptoms. The statistically significant correlation for disinhibition and experience seeking found in the present study is in line with this framework. Dis and ES are conceptually part of a factor called impulsive, unsocialized sensation seeking (ImpUSS). TAS on the other hand defines the factor of non-impulsive, socialized SS (Roberti, 2004). It follows that the presence of impulsivity in the variables of Dis and ES may be responsible for the positive relationship with aADHD. However, if impulsivity is separated from the concept of SS, as was done by Valero and colleagues (2012), no relationship is found. This explains the non-significant correlation found for TAS in the present study. This variable is characterized by risk taking activities which have a positive outcome, such as adventure sports. Such risk taking was found to be unrelated to ADHD (Barkley et al., 2008) and it is therefore not surprising that the dimension of TAS does not show a significant correlation with aADHD.

Some parallels between symptoms and behaviours of SS and aADHD have also been identified in different areas of impairment. Adults with ADHD often have impairments in different domains of major life functioning, such as education, occupation, home responsibilities, dating and marriage, and social activities (Barkley et al., 2008). Research also identifies several areas of impairment evident in sensation seekers. However, these negative outcomes are most often related to the SS dimension of Dis. Zuckerman (2007) found this dimension of SS to be most related to maladaptive outcomes. A high score on the subscale of Dis was also found to be responsible for the impairment in occupational functioning found in sensation seekers (Faraone, Kunwar, Adamson, & Biederman, 2009). In light of this it is easy to see why the results of this present study show a significant positive correlation for Dis with aADHD. However, this link in the domain of impairment can also be linked with the impulsivity factor. Magid and associates (2007) note that 'impulsivity may be a particularly impairing trait' (p. 2048). It is therefore very likely that those sensation seekers who are high on the subscale of Dis also act more impulsively and therefore present with a higher score on aADHD.

Thirdly, in addition to many commonalities between aADHD and SS, numerous areas of difference are also evident. Not all sensation seekers are impulsive and many carefully plan ahead (Magid et al., 2007). Sensation seekers also engage in a type of risk taking that does SS can lead to both positive and negative outcomes (Jackson, 2011). On the other hand, for a diagnosis of ADHD to be made the person has to experience significant impairment in everyday life functioning (American Psychiatric Association, 2000). Furthermore, biological factors associated with ADHD and SS reveal only small overlapping areas. In many aspects of genetics, biochemistry, and neuro-imaging, differences between aADHD and SS are evident. The correlations found in the present study, although statistically significant, are very weak. Considering the many areas of difference between the two concepts such weak correlations should be expected.

Multiple Linear Regression Model 1

This model contributed positively to the research findings. Thus, the trait of SS influences the likelihood of one displaying symptoms and behaviours of ADHD.

Although the model was found to be statistically significant it has to be kept in mind that it only explains a small amount of variance in adult ADHD (4%). This means that 96% of the variation in adult ADHD cannot be explained by the three sensation seeking dimensions of thrill and adventure seeking, disinhibition, and experience seeking. Therefore, there must be other variables that also play a significant role in influencing the course of aADHD. From what is known about the aetiology of ADHD, such variables are likely to be linked to a genetic predisposition, because the disorder is highly familial (Faraone, Biederman, Spencer, Wilens, Seidman, Mick & Doyle, 2000).

In addition to the overall significance of the first model, the variables of Dis and ES were found to be significant unique contributors. TAS on the other hand, did not make a significant contribution on its own. Again, it appears that TAS has little to do with ADHD and as a result does not influence the expression of the disorder. Interestingly, Zuckerman (1994) states that this variable 'probably represents what most people believe sensation seeking is' (p.32). In our minds, sensation seekers are people who get some kind of thrill out of risky and adventurous sports such as bungee-jumping, hang-gliding, or snowboarding. According to the results in this study and previous research it is, however, unlikely that sensation seekers of this kind have increased ADHD scores. TAS often carefully plan ahead and engage in safety precautions. They are therefore not particularly impulsive in their actions (Fischer & Smith, 2004; Llewellyn, 2008). Again the conclusion of Valero and colleagues (2012) that 'ADHD subjects are impulsive, but not sensation seekers' (p. 4) seems to be supported. The concept of SS in their research is a form that does not contain impulsivity. The variable of TAS comes closest to a non-impulsive form of SS (Roberti, 2004) and it that way this dimension of SS does not uniquely influence the variance in aADHD. Dis and ES on the other hand contain aspects of impulsivity (Roberti, 2004), which is why they were found to explain a significant amount of the variance in aADHD.

Multiple Linear Regression Model 2

Since TAS failed to make a unique significant contribution in the first model, it was excluded in Model 2. Although this model still only explains 4% of the variance in adult ADHD, the removal of TAS has improved the model slightly. This is evident in the values of the F-ratio: $F(3,563)=7.76, p<.001$ for model 1 and $F(2,564)=11.63, p<.001$ for model 2. A larger value for F indicates that there is a higher improvement of the explanation of the outcome (adult ADHD) compared to the inaccuracy of the model (Field, 2009). On the basis of the above discussion on TAS and its non-

impulsive nature, such results should not be surprising. A removal of the variable that is unrelated to ADHD should improve a model that is trying to explain the variance in the disorder.

The present research investigated the relationship between aADHD and SS in detail by analysing the sub-dimensions of SS separately. This analysis has offered great insight into the interaction between the two concepts. However, it raises the question of what SS actually is. Theoretically, all four subscales of the SSS-V are part of the bigger construct of SS and as such they moderately correlate with each other (Zuckerman, 1994). Still, aADHD relates to some of the scales but not to others. This seems to be due to the part that impulsivity and negative risk-taking play in Dis and ES.

There are two conceptual ways in which this dilemma can be solved. Valero (2012) and colleagues suggest a complete separation between the concepts of impulsivity and SS. According to this conceptualization SS should be 'free' of aspects of impulsivity. Hence they conclude that aADHD is associated with impulsivity but not with SS. Zuckerman's (1994) definition of sensation seeking and the scales he developed do not fit into this framework because impulsivity is theoretically interlinked with some sub-dimensions. Similarly, the results of this present study also do not agree with sensation seeking that is free of impulsivity. However, the relationships that were found here could be due to the presence of impulsivity in sensation seeking dimensions.

Another conceptualization rests on a distinction between two groups of sensation seekers: those who are impulsive and those who are not. Such a distinction between two groups of people is supported by Donohew et al. (2000) and Fischer and Smith (2004). Donohew and associates (2000) found that those sensation seekers who are also impulsive decision-makers are more likely to engage in risky behaviours such as risky sex. Fisher and Smith (2004) also found that the concept of deliberation distinguishes between those sensation seekers who engage in maladaptive risk-taking and those who do not. Such a distinction between two groups of people is supported by Donohew et al. (2000) and Fischer and Smith (2004). Donohew and associates (2000) found that those sensation seekers who are also impulsive decision-makers are more likely to engage in risky behaviours such as risky sex. Fisher and Smith (2004) also found that the concept of deliberation distinguishes between those sensation seekers who engage in maladaptive risk-taking and those who do not. They state that 'one can be a deliberative sensation seeker' (p. 535). The results of this present study can be interpreted using this framework. It seems that those sensation seekers who scored high on Dis and ES are more impulsive and are more likely to have symptoms of aADHD. From this viewpoint it can be said that there is a relationship between SS and aADHD, but that this relationship is mainly due to the impulsivity aspects of the trait.

CONCLUSION

Adult ADHD correlates with SS on some levels. More specifically, the variables of Dis and ES were found to be related to aADHD. Furthermore, a model that includes TAS, Dis, and ES could explain a statistically significant amount of variance in aADHD scores. However, a model that excluded the variable of TAS, however, was found to be slightly better in explaining aADHD variance. In an interpretation of these results, the concept of impulsivity seems to play a major role. Dis and adventure seeking both include some aspects of impulsivity whereas TAS does not. From this perspective, previous research is being confirmed in that aADHD actually relates to the impulsivity aspects of SS. Non-impulsive SS, on the other hand, appears to have very little in common with aADHD symptoms and behaviours. However, more research is needed in support of this theory.

From previous research on aADHD and SS, it becomes evident that impulsivity plays an important role in determining relationships between the two. Future research should therefore work towards clarifying the interactions within this triad. This can be done by distinguishing between impulsive sensation seekers and non-impulsive sensation seekers. It would be very valuable to investigate these two groups separately to determine how they relate to ADHD. Disentangling these dynamics could offer valuable insight into the personality profile of aADHD. Much more research is also needed in identifying other variables that can possibly explain ADHD variance. SS presents as just a small contribution and a large amount of variance still remains to be explained.

LIMITATIONS

Several limitations of this study can be identified. Firstly, the research was conducted in a relatively uncontrolled manner. Questionnaires were loaded onto Web CT and the researchers had no influence on how, when and where participants responded. Hence, there could have been confounding factors during data capturing. Secondly, this research study used convenience sampling which resulted in a sample which is not representative of the population. The sample consisted of much more females than males. Gender plays a role in ADHD as well as sensation seeking. Males usually are higher in sensation seeking and are also more likely to be diagnosed with ADHD (Garland, 1999; Zuckerman, 1994). The fact that the sample in this study consisted mainly of females can be a reason for concern. Lastly boredom susceptibility, which is the fourth dimension of sensation seeking, was not included in this research study. This limits the possibility of making definite statements about the relationship between the sensation seeking concept as a whole and adult ADHD.

RECOMMENDATIONS AND FUTURE RESEARCH

From previous research on aADHD and SS it becomes evident that impulsivity plays an important role in determining relationships between the two. Future research should therefore work towards clarifying the interactions within this triad. This can be done by distinguishing between impulsive sensation seekers and non-impulsive sensation seekers. It would be very valuable to investigate these two groups separately to determine how they relate to ADHD. Disentangling these dynamics could offer valuable insight into the personality profile of adult ADHD. Much more research is also needed in identifying other variables that can possibly explain ADHD variance. Sensation seeking presents as just a small contribution and a large amount of variance still remains to be explained.

BIOGRAPHICAL NOTES



NAKITAH GEEMOOI is a Registered Psychometrist in independent practice. She is currently registered at the University of the Witwatersrand where she is completing her Master's Degree in Social Science and Psychological Research by coursework and dissertation. Her research thesis involves a discursive analysis of the ways in which Apartheid struggle music intersects with the negotiation, management and construction of Post-Apartheid identities. Furthermore, she co-founded a pro-education NGO - Adopt-A-Vision - where she serves the executive committee. Her interests additionally include: philosophy of language and science; the psychology of space and place; and the anthropology of religion, culture and cities.

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