

**THE RELATIONSHIP BETWEEN SYMPTOMS OF
ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND
RISK TAKING BEHAVIOURS IN ADOLESCENTS**

by

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DECLARATION

I, Morongwa Caroline Makwela, declare that the dissertation hereby submitted to the University of Limpopo as partial fulfilment for the degree of Master of Arts in Clinical Psychology, has not been previously been submitted by me for a degree at any other university, that it is my own work in design and execution, and that all the material contained therein has been duly acknowledged.

Signature

Date

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TABLE OF CONTENTS

	<i>Page</i>
Declaration.....	ii
Acknowledgements	iii
Table of contents	iv
List of tables.....	vii
List of Figures.....	viii
List of Appendices.....	ix
Abstract.....	x
Chapter 1: General Introduction	1
1.1 Introduction	1
1.2 Objective of the study	2
1.3 Purpose and significance of the study	2
1.4 Definition of concepts	3
1.5 Delineation of the study.....	4
Chapter 2: Attention-Deficit/Hyperactivity Disorder In Adolescents	6
2.1 Introduction	6
2.2 Clinical Features of ADHD	8
2.2.1 Inattention	8
2.2.2 Hyperactivity	9
2.2.3 Impulsiveness.....	9
2.3 Diagnostic criteria and Primary Symptom.....	10
2.3.1 Diagnostic Criteria	10
2.3.1.1DSM-IV-TR-Criteria	11
2.3.1.2 ICD Diagnostic Criteria for Hyperkinetic Disorder	14
2.4 Prevalence.....	16
2.4.1 ADHD in Different Cultures	17
2.5 Gender Difference	18
2.6 Aetiology	19
2.6.1 Neurobiological Theories	19
2.6.1.1 The role of Dopamine of ADHD.....	19
2.6.1.2 Neuroanatomy.....	24
2.6.1.2.1 Structures of The Brain During Adolescents	24
2.6.1.2.2.Gender Difference in Adolescence	25
2.6.1.2.3 Behavioural and Cognitive Changes	25
2.6.2 Genetics	28
2.6.3.Environmental factors.....	30
2.6.4 Psychosocial Factors.....	31
2.7 Comorbid Disorder	32
2.8 Assessment	33

2.9 Treatment	34
2.9.1 Psychopharmacology.....	35
2.9.2 Multi Systemic Therapy	35
2.9.3 Cognitive Behavioural Psychotherapy	36
2.9.4 Psychosocial Intervention.....	36
2.10 Prognosis	37
Chapter 3: Risk Taking Behaviours in Adolescents	38
3.1 Introduction	38
3.2 Risk taking behaviours	38
3.3 The Psychology of risk taking behaviour.....	39
3.4 Risk taking behaviours mostly engaged in by adolescents.....	40
3.4.1 Substance use.....	40
3.4.1.1 Safety	40
3.4.1.2 Alcohol use	41
3.4.1.3 Tobacco use	43
3.4.1.4 Dagga use	44
3.4.1.5 Other drug use.....	45
3.4.1.6 Sexual behaviour	46
3.5 Other Risk Taking Behaviours	47
3.5.1 Bullying	48
3.5.2 Suicidality	48
3.5.3 Violence	49
3.5.4 Body Modification	51
3.6 Factors Implicated in Risk Taking Behaviours.....	53
3.6.1 Peer pressure and Adolescent Risk Behaviour.....	53
3.6.2 Demographics and Risk Taking Behaviours.....	53
3.7 Summary	54
Chapter 4: Relationship Between ADHD and Risk Taking Behaviours....	55
4.1 Introduction	55
4.2 Biopsychosocial Model of Impulsiveness.....	56
4.3 Structural abnormalities in the brain.....	57
4.4 Executive Function Theory and ADHD	58
4.4.1 Barkley's Model of Executive Function and ADHD.....	59
4.4.2 Brown's Model of Executive Function and ADHD.....	60
4.5 Dopamine Dysfunction	61
4.6 The Link Between Risk Taking Behaviours and ADHD.....	62
4.6.1 Safety	62
4.6.2 Substance use.....	64
4.6.3 Risky Sexual Behaviour.....	66
4.7 Other Risk Taking Behaviour	67
4.8 Summary	68
Chapter 5: Problem Statement and Hypotheses	69
5.1 Introduction	69

5.2 Problem Statement.....	70
5.3 Aim of the Study	70
5.4 Research Hypothesis.....	71
5.4.1 Research Hypotheses 1	71
5.4.2 Research Hypotheses 2.....	72
Chapter 6: Research Methodology	74
6.1 Introduction	74
6.2 Research Design	75
6.3 Sample	75
6.4 Measuring Instruments	77
6.4.1 Barkley’s Symptoms Scale for Adolescents.....	78
6.4.2 Youth Risk Behaviour Scale.....	78
6.4.3 Wisconsin Card Sorting Test	78
6.4.4 GoStop Paradigm Task.....	79
6.5 Procedure.....	80
6.6 Data analysis.....	81
Chapter 7: Results	82
7.1 Introduction	82
7.2 Results of the study.....	82
7.3 Hypothesis Testing	93
Chapter 8: Discussion of Results	97
8.1 Introduction	97
8.2 Summary of Results	97
8.3 Integration of Results and Findings.....	112
8.4 Limitations of the Study.....	113
8.5 Clinical Implications	114
8.6 Suggestions for further research.....	114
8.7 Conclusions	115
References	116

LIST OF TABLES

Table 6.1: Mean score for age and ADHD symptoms for the sample	76
Table 7.1: Scores on the risk taking behaviour scale for the YRBS	83
Table 7.2: Results on the Barkley's Symptom Scale for Adolescents	83
Table 7.3: Results of the Psychometric measures (WCST and GoStop Task)	84
Table 7.4: Correlations between ADHD symptoms and Risk Scores	84
Table 7.5: Correlations between risk taking behaviour and test results	85
Table 8.1: The relationship between risk taking behaviours and ADHD symptoms	98
Table 8.2: The relationship between risk taking behaviours and test results	99

LIST OF FIGURES

	<i>Page</i>
Figure 2.1: Diagram of the Dopamine pathways in the brain	20
Figure 2.2: Diagram of the Neurobiological theory of Sagvolden	22
Figure 2.3: Diagram of the Reinforcement gradient	23
Figure 6.1: Age distributions of the sample	76
Figure 6.2: Education level distribution	77
Figure 6.3: Language distribution of the sample	77
Figure 7.1: Graphic representation of the results of Alcohol use and Inattention	86
Figure 7.2: Graphic representation of the results of Dagga use and Inattention	87
Figure 7.3: Graphic representation of the results of Drug use and Inattention	87
Figure 7.4: Graphic representation of the results of Alcohol use and Impulsiveness	88
Figure 7.5: Graphic representation of the results of Dagga use and Impulsiveness	89
Figure 7.6: Graphic representation of the results of Drug use and Impulsiveness	90
Figure 7.7: Graphic representation of the results of Drug use and Non-Perserverative Errors (WCST)	91
Figure 7.8: Graphic representation of the results of Sexual behaviour and Categories Shifted (WCST)	92
Figure 7.9: Graphic representation of the results of Drug use and GoStop Task	93

LIST OF APPENDICES

<i>Appendixes</i>	<i>Page</i>
Appendix A: Letter to the school Principal	137
Appendix B: Barkleys' Symptoms Scale for Adolescents and Youth Risk Behaviour Scale	139
Appendix C: WCST Illustration	150
Appendix D: GoStop Illustration	151

ABSTRACT

Background: Attention Deficit Hyperactivity Disorders (ADHD) is a common neurodevelopmental behavioural disorder among school-age children, which in most cases continues into adolescence and adulthood and is mainly characterized by inattentiveness, hyperactivity and impulsiveness. The aim of the study was to establish the relationship between ADHD symptoms and risk taking behaviours (safety, alcohol use, tobacco use, dagga use, drug use, and sexual activity) in adolescents.

Method: A total of 100 male participants (without a clinical diagnosis) participated in the study. The participants were assessed on a battery consisting of the BSSA (Barkley's Symptoms Scale for Adolescents), YRBS (Youth Risk Behaviour Scale) and neuropsychological tests which measure response inhibition (GoStop Task) and executive function (Wisconsin Card Sorting Test). The ADHD scores on BSSA have been correlated with scores on the YRBS as well as with the scores obtained on the WCST and the Go-Stop Task. The results were analysed using the Pearson- r to show a relationship between ADHD symptoms and risk taking behaviours.

Result:

Conclusion: There is a significant although weak relationship between ADHD symptoms and most risk taking behaviours in a population of non-impaired adolescents.

GENERAL INTRODUCTION AND BACKGROUND

1.1 Introduction

Attention Deficit Hyperactivity Disorders (ADHD) is a common neurodevelopmental behavioural disorder among school-age children, which continues in adolescence and adulthood in most cases (Biederman & Faraone, 2005; Biederman, 2005), and is mainly characterized by inattentiveness, overactivity and impulsiveness (American Psychiatric Association, 2000). According to Biederman (1998), ADHD is predictable and persistent, with up to 80% of diagnosed children continuing to meet diagnostic criteria in adolescence while up to 67% were said to continue to have significant symptoms of the disorder into adulthood (Barkley, Fischer, Smallish & Fletcher, 2002a). The disorder not only affects the person as an individual, to a certain extent it affects all those around them.

ADHD poses a complex problem to parents, caregivers and teachers and to the person suffering from it. ADHD can be seen as a neuro-psychiatric disorder with a great impact on behaviour (Barkley, 1997a; Johansen, Aase, Meyer & Sagvolden, 2002; Sagvolden, Johansen, Aase, & Russel, 2005), which is found to be more prevalent in boys than in girls (American Academy of Pediatrics, 2004; Swanson & Castellanos, 1998; Taylor, Dopfner, Sergeant, Asherson, Banaschewski, Buitelaar et al., 2004). Adolescents with ADHD have been observed to engage in risk taking behaviours as a result of impulsiveness. According to Waslick and Greenhill (2004), impulsiveness means that the person acts without forethought of the consequences, appearing to be unaware of danger or the relationship between cause and effect.

At present there is no known single factor contributing to the disorder. Possible contributions that have been considered in this study are genetic factors, environmental factors,

neuropsychological factors, and sex differences (Bradley & Golden, 2001; Gillis, Gilger, Pennington, & Defries, 1992).

1.2. Objectives of the study

The main goal of the study is to explore the relationship between ADHD symptoms in adolescents and impulsive and risk-taking behaviour such as a higher incidence of tobacco use, substance abuse, traffic violations, and sexual promiscuity. A diagnosis of ADHD predisposes the individual to an increased vulnerability to drug abuse, anti social behaviour, sexual promiscuity which might lead to HIV/AIDS and sexual transmitted infections, traffic offence, personality disorder, later delinquency, recklessness, accident proneness, premature responding, and gambling (Johansen et al., 2002) and thus lower quality of life for these individuals (Brown, 2000; Pary, Lewis, Matuschka & Lippmann, 2002).

The study will explore the relationship between ADHD symptoms in adolescents and poor performance on tests of executive functioning (poor response inhibition – which is underlying impulsive behaviour). According to Sergeant (2000), the concept executive functioning is explained as the ability to maintain an appropriate problem-solving set for the attainment of a future goal. The researcher in this study will make use of two measurements, i.e. firstly a questionnaire that will be given out directly to the participants and secondly the participants will undertake two neuropsychological tests which measure executive functioning, and have been proven sensitive to ADHD symptoms and impulsiveness.

1.3. Purpose and significance of the study

The study will be focusing on adolescents between the age of 16 and 20 in and around the Mankweng (University of Limpopo) area. The reason for targeting this population is that criminal and maladaptive behaviour, as well as behaviours such as accident proneness, unsafe sexual activity, recklessness, and substance abuse are the key symptoms of behaviour common in young adults (Kahn, Kaplowitz, Goodman, & Emans, 2002).

The study will establish the relationship between impulsiveness and inattention and risk taking behaviour because research findings (Barkley, Murphy, O'Connell, & Connor, 2005; Hechtman, Weiss, Perlman, & Tuck, 1981; Johansen et al., 2002; Sagvolden & Sergeant, 1998; Sonuga-Barke, 1996), associate this kind of behaviour with impulsiveness, which is a core symptom of ADHD. Some of the risk taking behaviour such as alcohol use, drug use, tobacco use and sexual behaviours that may result in sexually transmitted infections (STI) infection or unintended pregnancy; were observed to be common in these adolescents and they were likely to display a deficiency in Executive Functions when administered psychometric tests.

There is no known major documented work done that looks into the correlation of maladaptive behaviour reflected by this age and population group and behaviours manifested in adolescents with ADHD symptomatology.

The results will be seen as confirmation of the assumption that there is a relationship between ADHD symptoms, especially impulsiveness and risk taking behaviours.

1.4. Definition of concepts

1.4.1. ADHD – Attention Deficit Hyperactivity Disorder: a common behavioural disorder among children and adolescents, which is mainly characterized by inattentiveness, overactivity and impulsiveness (American Psychiatric Association, 2000).

1.4.2. Impulsiveness – Excessive or developmentally inappropriate level of activity (Barkley, 1990b), characterized by behavioural, cognitive and emotional behaviours (Robin, 1998).

1.4.3. Adolescent – A young person between childhood and adulthood i.e. beginning at age 12 to 20 years.

1.4.4. SUD – Substance Use Disorder

1.4.5. DSM IV TR – Diagnostic and Statistical Manual of Mental Illness, Text Revised, a manual used by clinicians to diagnose disorders in both children and adults.

1.4.6. Maladaptive – A behaviour that is regarded as abnormal in accordance with normal behaviour.

1.4.7. Comorbidity – Co-existence of more than one disorder at once, other than the existing disorder.

1.4.8. Conduct Disorder (CD) – Repetitive and persistent pattern of behaviour in which the basic rights of others or major age/ appropriate societal norms or rules are violated.

1.4.9. Oppositional Defiant Disorder (ODD) – Is a recurrent pattern of negativistic, defiant, disobedient and hostile behaviour toward authority figures.

1.4.10. Executive functioning (EF) - The ability to maintain an appropriate problem solving set for the attainment of a future goal.

1.5. Delineation of the study

A general introduction to ADHD is well outlined in chapter two. The chapter gives a description of the historical background of the disorder, diagnostic criteria, symptoms, and the aetiology of the study. A description of co-morbid disorders and secondary deficits will be covered.

In chapter three various risk taking behaviours will be discussed. The chapter provides an overview of the psychology of risk taking behaviour and factors contributing to these risky behaviours.

Chapter four will focus on the relationship between ADHD and risk taking behaviours. It also provides background on other domains of biopsychosocial model of impulsivity, structural

abnormalities in the brain, executive function theory and dopamine dysfunction and their impact on the disorder.

In chapter five, the problem statement will be clearly outlined as well as the research hypotheses. Chapter six will deal with the methodology of the study and chapter seven will discuss the results of the study.

Chapter eight will present the discussion of results and possible areas for future research will be mentioned.

ATTENTION- DEFICIT/HYPERACTIVITY DISORDER IN ADOLESCENTS

2.1. Introduction.

Attention-Deficit/Hyperactivity Disorder in adolescents in this chapter will be clearly outlined with regard to its prevalence, assessment, comorbidity, causes and treatment.

Attention- Deficit/Hyperactivity Disorder (ADHD) is predominantly a prevalent disorder in children and adolescents, characterized by inattentive, hyperactive and impulsive behaviour (American Psychiatric Association, 1994). Importantly, it is essential to take into consideration that not everybody who is overly hyperactive, inattentive, or impulsive has ADHD (National Institute of Health, 2000). Professionals such as psychologists and psychiatrists make use of a guideline, DSM-IV-TR (American Psychiatric Association, 2000) or ICD-10 (World Health Organization, 1993) before they can come to the conclusion of the diagnosis of the disorder.

The history of ADHD in adolescents can be understood by referring to its origin in childhood. ADHD is a most recent diagnostic disorder for children presenting with significant problems with attention, impulse control and overactivity. The disorder has been known since the early twentieth century. Still (1902) and Tredgold (1908) were the first to pay serious medical attention to the behavioural condition in children that present with what is today known as ADHD. Still (1902) observed that the characteristic patterns of these children at a specific age differed significantly from their normal peers, which suggested that age is a predisposing factor and a characteristic marker of ADHD. He further described that impulsive children with significant behavioural problem are a result of a genetic dysfunction and not poor child rearing, that is children born from parents with ADHD will likely have a similar disorder (Barkley, 2006; National Institute of Mental Health, 2003).

In 1917-1918 it was found that encephalitis as a result of brain infection, made an important contribution in the understanding of the disorder ADHD. Those children who survived the condition had some damage to the brain, which then affected their normal mental and behavioural activity. The extent of this damage led to socially disruptive behaviours, conduct problems and defiant behaviour which are some of the characteristics defining ADHD (Barkley, Fischer, Edelbrock, & Smallish, 1990; Barkley, 2006).

Due to this the disorder became known as “postencephalitic disorder as a result of damage to the central nervous system” (Cates, 2002). Subsequently, children who displayed such symptoms were hospitalised with the thought that they may have had some brain damage even though this was not known or established. They displayed similar clinical behaviours as those children who had reported cases of brain damage. This led to the concept of the brain-injured child (Barkley, 1990a). This term later evolved into the concept of “minimal brain damage” and eventually “minimal brain dysfunction” (MBD) by the 1950s and 1960s, which led to the development of the concept of a Hyperactive Child Syndrome (Barkley, 2006; Taylor, 1998).

During preschool age, ADHD and impulsiveness are noticeable and related to factors that complicate behaviour such as cognitive deficit and poor peer relations (Holmes, Slaughter, & Kashani, 2001).

Other noticeable behaviours in children are difficult to with coping in home and school situations, especially if the behaviour affects normal daily functioning and is continuing for a period of six months, whereas in adolescents they may be masked by strange behaviours coinciding with other disorders which might complicated what is known as ADHD. (Holmes et al., 2001) thus stipulate that children that are difficult to manage at age three could be predicted to be anxious, irritable and full of anger, which relate to community crime, when they reach age eleven. Adding to this was a finding that seventy to ninety percent of violent offenders were highly aggressive when

young (Loeber, 1990). As a result of these, children grow up to encounter great difficulties in social functioning.

2.2. Clinical features

2.2.1. Inattention

Inattention comprises of a short attention span, difficulty concentrating, an inability to modulate attention in response to externally imposed demands, a problem in initiating tasks, or trouble selectively attending to relevant stimuli while filtering out unnecessary noise. Carlson (1986) and Robin (1998) state that most young adults with ADHD tend to experience a difficulty in performing tasks, which requires sustained effort. It is further indicated that adolescents with this condition manifest difficulties in the following areas: selecting and focusing on the relevant stimuli in the environment coupled with starting or executing tasks; maintaining concentration and resisting distraction; consistently mobilising effort in a task-orientated direction; organization, forgetfulness and recall of learnt information and making transition from one task to another (Robin, 1998). These individuals as a result of their problem may end up with educational handicaps because of overwhelming pressure and not being able to cope.

According to Robin (1998), teens with ADHD easily get bored and often find a way to exciting experience which eventually leads them to activities such as roller blading, video games, bike racing, and to more risky behaviours such as experimenting with alcohol or drugs, sexual promiscuity, shoplifting, or violence.

Functional mapping of brain electrical activity indicates multilevel deficits in sensory processing (Pliszka, Liotti & Woldorff, 2000). The attention problems of ADHD are typically described as trouble with ‘sustaining attention’ usually occurring in situations where stimuli are widely spaced in time (Douglas, 1983). It might be that the attention problems result from changed motivational processes, as they seem to be evident only when the ability to concentrate is stressed by the task being unwelcome or uninteresting (Taylor, 1998).

2.2.2. Hyperactivity

Hyperactivity can be characterised as a failure to inhibit the impulse for motor movement (Robin, 1998; Taylor, 1998). Teicher, Ito, Glod, and Barber (1996), explain hyperactivity as an excessive level of activity, typically seen in ADHD as restlessness, fidgeting and a general increase in gross body movements. Hyperactivity is seen in some situations such as the classroom, but might not be present in others such as leisure activities (Porrino, Rapoport, Behar, Sceery, Ismond, & Bunney, 1983). The higher-than-usual level of motility makes the person with ADHD appear to be driven, restless and never tiring. Children and adolescents with ADHD also have higher levels of sleep activity than controls without the disorder (Corkum, Tannock & Moldofsky, 1998).

2.2.3. Impulsiveness

Impulsiveness is perceived to be a key-defining characteristic of ADHD (Barkley, 1997a). Different behaviours such as recklessness, accident proneness and rule breaking as a result of poor effort and impetuous behaviours are displayed (Johansen et al., 2002; Sagvolden & Sergeant, 1998; Sonuga-Barke, 1996). According to Barkley (1997a), these characteristics are due to a failure of response suppression or failure in executive functioning. In response suppression, an ADHD adolescent displays an inability to wait for a delayed and conscious reinforcement; shows preference for immediate reward; and difficulty in timing (Sonuga-Barke, Taylor, Senby, & Smith, 1992).

Impulsiveness is characterised by impairment in executive functioning, which are mental processes that enable planning, execution and regulation of goal directed behaviour (Barkley, 1997a; Denckla, 1996; Lezak, Howieson, & Loring, 2004; Robin, 1998). This functioning is mediated by the frontal lobe and in particular the prefrontal cortex and its extended networks (Lezak et al., 2004). Neural imaging research has shown deviation in the size and asymmetry of the dorsolateral prefrontal cortex, putamen, and caudate in children with ADHD (Casey, Castellanos, Giedd, Marsh, Hamburger, & Schubert, et al., 1997).

According to Robin (1998), impulsiveness can be further divided into behavioural, cognitive and emotional components in these individuals: *Behaviourally*, impulsive adolescents have to have things right now, and thus act on a whim (Johansen et al., 2002; Robin, 1998): *Cognitively*, it implies that they quickly rush through tasks, overlooking crucial details, making careless mistakes, and writing sloppily (Robin, 1998): *Emotionally*, adolescents turn to be easily frustrated, agitated, moody, lose temper, violent, outburst followed by aggressive physical and verbal responses. According to Barkley (1997a), it is the deficient impulse control of ADHD that can get an adolescent into serious life difficulties and even lower life expectancy.

2.3. Diagnostic criteria and primary symptoms

2.3.1. Diagnostic criteria

There is no DSM criteria version used specifically for diagnosing ADHD in adolescents. According to Robin (1998), an adolescent who meets four of the nine Diagnostic Statistical Manual for Mental Illnesses (DSM-IV) (American Psychiatric Association, 2000), ADHD hyperactivity-impulsiveness criteria might be classified as having a hyperactive-impulsive behavioural problem. Brown (2000) and Pary and colleagues (2002), emphasized that various methods of assessment should be used in the diagnosis of ADHD since each has its strengths and weaknesses. The use of more than one assessment instrument in this regard will compensate these weaknesses (Brown, 2000).

Currently there are two most important psychiatric classifications used, which are developed by the American Psychiatric Association (APA) and the World Health Organization (WHO) known as DSM-IV (American Psychiatric Association, 2000) and ICD-10 (World Health Organization, 1993). In 1992 the two manuals were made compatible in order to ensure uniformity in reporting of national and international statistics and reimbursement (Sadock & Sadock, 2003). Both manuals use the same coding system (American Psychiatric Association, 2000). According to Swanson, Sergeant, Taylor, Sonuga-Barke, Jensen, & Cantwell, (1998), after decades both manuals

eventually recognise the same problem behaviours for ADHD as the basis in a set of 18 symptoms.

The DSM-IV-TR (American Psychiatric Association, 2000) criteria for Attention- Deficit/ Hyperactivity Disorder and those for HKD (Hyperkinetic Disorder) in ICD-10 (World Health Organization, 1993) are outlined as follows:

2.3.1.1 DSM-IV-TR- Criteria

A. Either (1) or (2):

1) Six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with the developmental level:

Inattention

- a) Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities.
- b) Often has difficulty sustaining attention in tasks or play activities.
- c) Often does seem to listen when spoken to directly.
- d) Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the work place (not due to oppositional behaviour or failure to understand instructions).
- e) Often has difficulty organising tasks and activities.
- f) Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework).
- g) Often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books, or tools).
- h) Is often easily distracted by extraneous stimuli.

i) Is often forgetful in daily activities.

(2) Six (or more) of the following symptoms of hyperactivity- impulsiveness have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity

- a) Often fidgets with hands or squirms in seat.
- b) Often leaves seat in classroom or in other situations in which remaining seated is expected.
- c) Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness).
- d) Often has difficulty playing or engaging in leisure activities quietly.
- e) Is often “on the go” or often acts as if “driven by a motor”.
- f) Often talks excessively.

Impulsiveness

- a) Often blurts out answers before questions have been completed.
- b) Often has difficulty waiting turn.
- c) Often interrupts or intrudes on others (e.g. butts into conversation or games).

B. Some hyperactive-impulsive or inattentive symptoms that cause impairment are present before the age of seven years.

C. Some impairment from the symptoms is present in two or more settings (e.g. at school and at home)

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Development Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another

mental disorder (e.g. Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Three subtypes:

In DSM-IV-TR (American Psychiatric Association, 2000) there are three patterns of behaviour that indicate ADHD. People with ADHD may usually show several signs of being consistently inattentive. They may have a pattern of being hyperactive and impulsive far more than others of their age, or they may show all three types of behaviour. So far there are three subtypes of ADHD recognised and the appropriate subtype should be indicated based on the predominant symptom pattern for the past six months

Attention-Deficit/Hyperactivity Disorder, Combined Type (ADHD-C): this type should be used if six or more symptoms of inattention and six or more symptoms of hyperactivity-impulsiveness are prevalent for a period of six months to a point that they are maladaptive. Children and adolescents presenting with the disorder display both inattentive and hyperactive-impulsive symptoms.

Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type (ADHD-PI): this type should be used if six or more symptoms of Inattention are prevalent for at least six months to a point that is maladaptive and inconsistent with developmental level. This type usually does not show significant hyperactive-impulsive behaviour and referred to as ADD.

Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type (ADHD-HI): this type should be used if six or more symptoms of hyperactivity-impulsiveness (but fewer than six symptoms of inattention) have persisted for at least 6 months. Inattention may often still be a significant clinical feature in such cases. For individuals, (especially adolescents and adults) who currently have symptoms that no longer meet full criteria, "In partial Remission" should be specified (American Psychiatric Association, 2000).

2.3.1.2 ICD diagnostic criteria for Hyperkinetic disorders

At least six of the following symptoms of inattention have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

Inattention:

- (1) Often fails to give close attention to details Often fails to sustain attention in tasks or makes careless errors in schoolwork.
- (2) Often appears not to listen to what is being said to him or her.
- (3) Often fails to follow through on instructions or finish schoolwork, chores.
- (4) Is often impaired in organ organizing tasks and activities.
- (5) Often avoids or strongly dislikes tasks.
- (6) Often loses things necessary for certain tasks or activities.
- (7) Is often easily distracted by external stimuli.
- (8) Is often forgetful in the course of daily activities.

At least three of the following symptoms of hyperactivity have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

Hyperactivity

- (1) Often fidgets with hands or feet or squirms on seat.
- (2) Leaves seat in classroom or in other situations in which remaining seated is expected.
- (3) Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, only feelings of restlessness may be present).
- (4) Is often unduly noisy in playing or has difficulty in engaging quietly in leisure activities.

- (5) Exhibits a persistent pattern of excessive motor activity that is not substantially modified by social context or demands.

At least one of the following symptoms of impulsiveness has persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

Impulsiveness

- (1) Often blurts out answers before questions have been completed.
- (2) Often fails to wait in lines or await turns in games or group situations.
- (3) Often interrupts or intrudes on others.
- (4) Often talks excessively without appropriate response to social constraints.

Onset of the disorder is later than the age of 7 years.

Pervasiveness:

The criteria should be met for more than a single situation, e.g., the combination of inattention and hyperactivity should be present both at home and at school, or at both school and another setting where children are observed, such as a clinic.

The symptoms cause clinically significant distress or impairment in social, academic, or occupational functioning.

The disorder does not meet the criteria for pervasive developmental disorders, manic episode, depressive episode, or anxiety disorders.

Disturbance of activity and attention

The general criteria for hyperkinetic disorder must be met, but not those for conduct disorders.

Hyperkinetic conduct disorders

The general criteria for both hyperkinetic disorders and conduct disorders must be met.

Other hyperkinetic disorders

Hyperkinetic disorder, unspecified

This category should only be used when there is a lack of differentiation between disturbance of activity and attention and hyperkinetic disorder but the overall criteria for hyperkinetic disorders are fulfilled (World Health Organization, 1993).

2.4. Prevalence

Barkley, Fischer, Smallish, and Fletcher (2004), suggest that between 3 -5% of adolescents have Attention- Deficit/Hyperactivity Disorder. The disorder is generally more prevalent in males than in females (American Psychiatric Association, 2000). In adolescents, common symptoms manifest themselves through impulsive behaviour, breaking of rules, and problems with relationships (Brown, 2000). It also puts sufferers at risk for a range of abnormalities in personality development, delinquency, antisocial behaviour and underachievement in school (Taylor et al., 2004).

Barkley and colleagues (2004), state that, of children diagnosed with ADHD, 50-70% will have problems related to social adjustment and functioning and, or psychiatric problems as adolescents and young adults. Of these 20-30% will continue to suffer from ADHD during late adolescence and adulthood (Muglia, Jain, Macchiardi, & Kennedy, 2000). The prevalence of the disorder in adulthood was found to be estimated at 0.3 to 3.3 percent (Johnston, Murray, Hinshaw, William, & Hoza, 2002). This shows that the disorder is common in adults however, it diminishes with maturity. According to Robin (1998), the prevalence of the disorder in adolescents, especially the inattentive subtype, is strongly associated with academic problems, whereas the hyperactive-impulsive subtype is strongly associated with behavioural problems. Moreover, the combined subtype is more likely to manifest in both academic and behavioural problems.

2.4.1. ADHD in different cultures

The disorder (ADHD) in the past was predominantly known to be common among children in Western Countries. However, it is found to be the most prevalent psychiatric disorder also on the African continent (Kashala, Tylleskar, Elgen, Kayembe, & Sommerfelt., 2005; Meyer, 1998; Meyer, Eilertsen, Sundet, Tshifularo, & Sagvolden., 2004; Ofovwe, Ofovwe, & Meyer, 2006) and is among the most frequent, intensely researched and yet diagnostically controversial disorders (Dwivedi & Banhatti, 2005). According to Meyer and Aase (2003) and Meyer and colleagues (2004), little is known about the disorder on the African continent, however a research study done among the heterogeneous group in Limpopo indicated similarities in prevalence, sex ratios and subtypes in South African children when compared to US and European countries (Meyer et al., 2004).

Mako (2002), in a study conducted in Gauteng, South Africa, observed a significant correlation in the prevalence of ADHD symptoms in those children who were referred to a clinic for diagnosis and treatment and those in the community, except for the older girls (> 10 years of age). This shows that ADHD is not a culturally influenced disorder; rather it affects individuals across all spectrums. Margalit (1998) shows that the syndrome is stable across different cultures until it can be explain what is meant by impulsive behaviour.

Dwivedi and Banhatti (2005) emphasize that cross-cultural studies need to base on other better means of identifying the disorder rather than using the clinical diagnosis. In order to understand the phenomenon of ADHD, it is important to explore the complex interaction between organic, environmental, and cultural factors

Therefore, it seems that ADHD-like behaviour is caused by the same fundamental neurobiological processes, probably caused by genetic factors expressed independently of cultural differences (Johansen et al., 2002; Sagvolden, Johansen, Aase, & Russel, 2004). However, cultural differences may affect the performance on psychometric measures. There is, therefore, a need for

assessment methods that are culturally valid for different ethnic groups. Thus, systematic research to identify and develop the instruments required to assess ADHD symptomatology are greatly needed in developing countries.

2.5. Gender differences

It has been shown that girls with ADHD are identified and referred less frequently than boys with ADHD (Abikoff, Jensen, Arnold, Hoza, Hechtman, & Pollock, 2002). However, ADHD does affect both sexes at relatively equal intensities and similar age groups (Rhee, Waldman, Hay, & Levy, 1999). Literature has based this on the fact that boys display many externalising behaviour of ADHD symptoms such as rule breaking, frequent disruptive behaviours, and hyperactivity (Tannock, 2004), whereas girls had significant high rates of language and verbal aggression to other children such despite being somewhat less symptomatic in terms of salient ADHD symptoms and externalizing behaviour.

Females with ADHD are equally impaired as males with ADHD in terms of cognitive function, teasing, name calling and neurological disorders (Brown, Madan-Swain, & Baldwin, 1991; Robin, 1998) as well as cognitive and academic problems than boys. These behaviours are not easily seen by parents or teachers compared to physical behaviours which girls tend to show less frequently. When parents were asked about the hyperactivity of their ADHD children, most parents significantly noticed this condition equally in boys than in girls, whereas a non-family member such as teachers noticed and identified this condition more frequently in boys than in girls (Ackerman, Dykman, & Oglesby, 1983). Thus it is not known whether the difference in sex of ADHD is due to either, actually observable behaviours or gender specific biases and expectations (Abikoff et al., 2002).

External behaviours are less observable and socially less acceptable in girls, since they easily mask them than would in boys. Therefore, this suggests that males are more likely to be affected by ADHD than are females because they are socially allowed to express the symptoms of the disorder

ADHD (Rhee et al., 1999). However females with ADHD are equally impaired as their male counterparts as far as cognitive functioning is concerned (Tannock, 2004) .

2.6. Aetiology

There are many different factors that influence the development of ADHD. According to Bradley and Golden (2001), there are various factors contributing to the aetiology or cause of ADHD, including genetic factors, environmental factors and neurological factors. Klassen, Miller, and Fine (2004), explain that having ADHD might have a significant impact on the health-related quality of life in most individuals (Harpin, 2005). In this section various causes of ADHD will be discussed.

2.6.1. Neurobiological theories

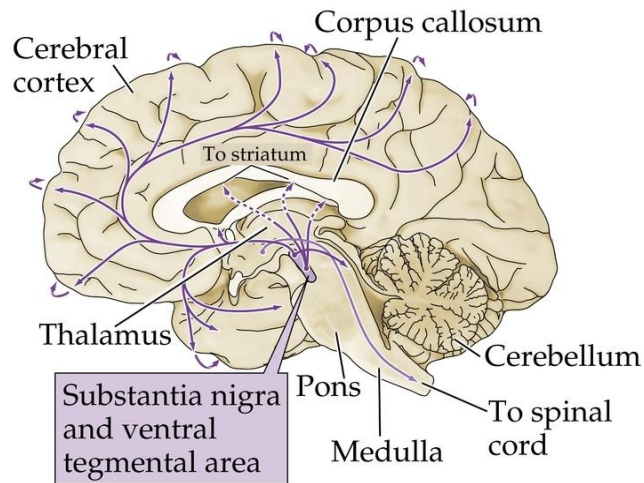
2.6.1.1. The role of dopamine in ADHD

Castellanos (1999) indicates that an imbalance of certain chemical compounds in the brain plays an important role in ADHD. ADHD is associated with changes in dopamine functioning, which may interfere with the adolescent's ability to focus, sustain attention or with memory formation and retrieval (Johansen et al., 2002; Sagvolden et al., 2005).

Dopamine is a brain chemical or neurotransmitter involved in inhibiting the activity of other cells in the brain. The chemical is known to be involved in motivation and reinforcing behaviour; also it is active most particularly in teens (Giedd, Molloy, Castellanos, Jeffries, Blumenthal, Neale, et al., 2004).

Dopamine is found richly in the areas of the brain known as orbital frontal regions, and its many connections through pathways of nerve fibres into a structure known as the caudate nucleus including the striatum, which itself connects further back into a deeper area of the brain called limbic system. These brain areas are those that help to inhibit behaviour, sustain attention, and inhibit our responses (Castellanos, 1997), (See Figure 2.1).

Figure 2.1 Dopamine pathways in the brain (Purves et al., 2001)



These scientific findings are very consistent with many scientific views that a problem with inhibition or self-control is the hallmark of ADHD and that this arises from a lower level of activity in the regions of the brain responsible for these human abilities (Barkley, 2006; Johansen et al., 2002; Sagvolden & Sergeant, 1998; Sagvolden et al., 2005).

A study outlined in Giedd and colleagues (2004), found that rapid changes in dopamine-rich areas of the brain can be seen as a factor in making adolescents vulnerable to stimulating and addictive effects of drugs and alcohol.

Behaviour explained by dysfunction dopamine systems

The dopaminergic system is divided into three branches: the meso-limbic, the meso-cortical, and nigro-striatal, which are responsible in the transmission of dopamine (Johansen et al., 2002; Sagvolden et al., 2005). If dopamine transmission in the branches becomes inhibited, it may affect other neurotransmitter systems and behaviour that is dependent on these systems will also be affected.

Meso-limbic system

When dopamine transmission in this system is dysfunctional it affects both the reinforced and extinction signals (Douglas & Parry, 1983; Douglas & Parry, 1994). A dysfunctional meso-limbo-cortical dopamine branch is also found to be having an impact on the behavioural level, i.e. in giving rise to deficient sustained attention, hyperactivity, increased behavioural variability, and impulsiveness. (Johansen et al., 2002; Sagvolden et al., 2005).

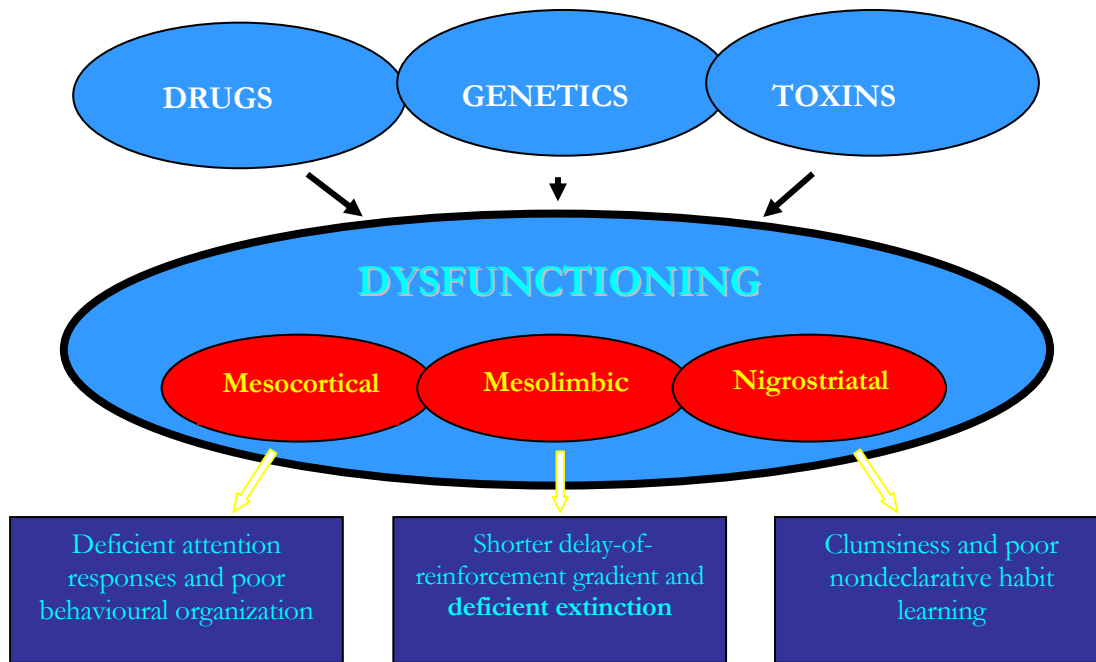
The nigro-striatal dopamine branch

Several motor functions exist in ADHD children such as poor motor control (clumsiness, longer reaction time, poor response timing, abnormal control of eye saccades; poor handwriting, poor correlation of the activity) of different body parts (Gillberg, 2003; Meyer & Sagvolden, 2006b; Sergeant et al., 2006). These problems are now attributed to impaired motor functions with dopamine dysfunction in the nigro-striatum (Sagvolden, Piek, & Oosterlaan., 2005).

Meso-cortical dopamine branch

Changes in the structure of the right frontal cortex have been noticed in ADHD children (Oades, 1998; Solanto, 1998). This area is sensitive to dopamine, which comes from the ventral tegmental area. Thus adolescents with ADHD can be cognitively impulsive with a lack of planning, organisation and failure to remember important things. All these occur due to delayed reinforcement resulting from a dysfunctional meso-cortical dopamine branch. Because of their impulsiveness these individuals are inclined to act without forethought. According to Johansen and colleagues (2002), factors such as genetic transmission, environmental pollutants, or drug abuse may lead to a dysfunctioning dopamine system (see Figure 2.2).

Figure 2.2 The Neurobiological theory of Sagvolden et al. (Johansen et al., 2002)



Altered Reinforcement Process

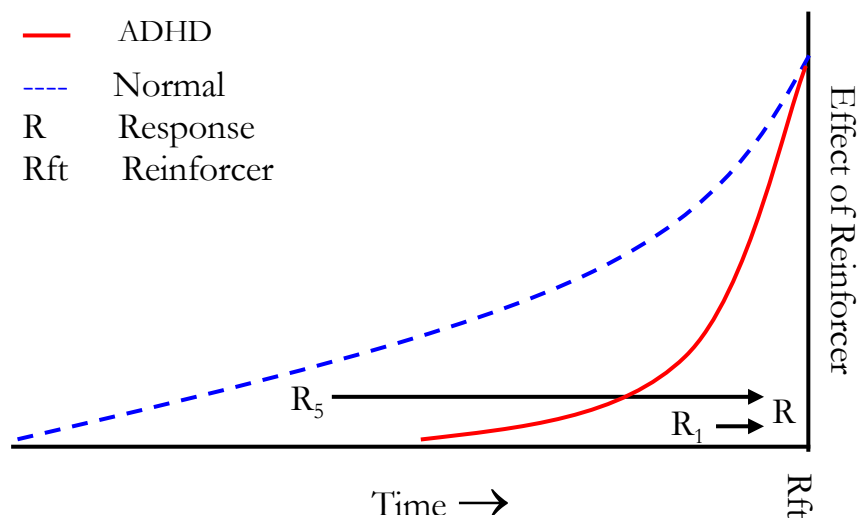
Individuals with ADHD need more frequent reinforcement (Aase, Meyer, & Sagvolden., 2006; Johansen et al., 2002; Sagvolden et al., 2005). Clinical observations indicated that individuals with ADHD have a “motivation” problem, therefore, stronger and more salient reinforcement will be essential to control their behaviour (Kollins, Lane, & Shapiro, 1997; Luman, Oosterlaan, & Sergeant, 2005). Reinforcement does reduce impulsiveness in the ADHD individual, as these individuals are not always cognitively impulsive as they manage to plan ahead, organise themselves and remember important things (Douglas, 1999).

Impaired executive functions are usually associated with frontal dysfunctions (Denckla, 1996). There are also other neuromodulators affecting the frontal lobe activity and thus imbalances in more of these systems will impact on problems with organising and controlling own behaviour (Rapport, Van Voorhis, Tzelepis, & Friedman, 2001). Motor impulsiveness is predominant in infants and young toddlers, while cognitive impulsiveness is more prevalent in older children and

adolescents. This implies that ADHD impulsiveness can be understood as a maturational lag (Johansen et al., 2002; Sagvolden et al., 2005).

Sagvolden and colleagues (2005) and Sonuga-Barke (2002) argue that the key symptoms of ADHD i.e. sustained attention, overactivity, and impulsiveness, can be viewed as a result of altered reinforcement mechanisms and a shorter delay of reinforcement gradient (see figure 2.3).

Figure 2.3 Reinforcement gradient (from Sagvolden et al., 2005)



Studies have shown that children with ADHD need an increased release of dopamine for responses to occur. Thus, such children require stronger reinforcers to control their behaviours than normal children (Aase et al., 2006; Johansen et al., 2002; Sagvolden et al., 2005).

Altered Extinction Process

In ADHD children and adolescents, hyperactivity continues to occur as a response without a specific reinforcer or when extinction as a result of withdrawing a reinforcer had occurred (Sagvolden, Aase, Zeiner, & Berger, 1998; Sleator & Ullman, 1981). Overactivity in ADHD patients is seen to be due to lack of extinction and happens in the presence of scheduled and unscheduled reinforcers, with excess motor activity without reinforcers (Sagvolden, 1999). The behaviour of individuals with ADHD is variable depending on situations as compared to non-ADHD individuals, and this is also attributed to delayed reinforcement and failing extinction (Aase

& Sagvolden, 2005; Aase et al., 2006; Castellanos, Sonuga-Barke, Scheres, Di, Hyde, & Walters., 2005; Mook, Jeffrey, & Neuringer, 1993; Oosterlaan & Sergeant, 1998). These individuals have difficulties in withholding responses as compared to their counterparts without the disorder. Their behaviour can be clinically observed when administering tests such as Wisconsin Card Sorting tests, Go Stop tasks and other tests which examine their driving ability. Individual's behaviour in this regard can be seen as driven or being controlled (Lezak et al., 2004).

2.6.1.2. Neuroanatomy

It is important to look at the physical and social cognition change of the brain in adolescents and how that affects their behaviour and thinking. Research studies found that some areas of the brain such as the prefrontal cortex continue to develop beyond childhood (Blakemore & Choudhury, 2006) and that during puberty and adolescence it goes through significant change. Studies further revealed two changes in the structure of the brain before and after puberty, firstly the formation of myelin sheaths, which act as an insulator and increases the speed of electrical impulses from one neuron to the other. Also, axons in the frontal cortex become fully myelinated into adolescence. Secondly, neurons' growth leading to change in wiring and synapses between neurons through which synaptic elimination (pruning) takes place (Blakemore & Choudhury, 2006).

It shows that when neurons are fully myelinated and well-tuned in adolescents, they increase one's ability to think and learn in an abstract manner unlike in young children (Blakemore & Choudhury, 2006).

2.6.1.2.1. Structures of the brain during adolescence

Studies using MRI were able to show maturation of the frontal cortex into adolescence and adulthood. They consistently found that there is a steady increase in white matter in the frontal cortex, parietal cortex, and also in the right internal capsule and left arcuate fasciculus of adolescents compared to grey matter, which was increased in young children (Sowell, Thomson,

Holmes, Bartth, Jernigan, & Torga., 1999). The increase in white matter was due to the increase in myelination of those brain areas.

There was a non-linear decrease in grey matter in certain areas of the brain. The volume of grey matter increases in the frontal lobe and in the parietal lobe during pre-adolescence and peaked well into adolescence but declined during post-adolescence, while the temporal and occipital lobes had linear development of grey matter (Giedd, Blumenthal, Jeffreys, Castellanos, Liu, & Zijdenbos, et al., 1999). An increase in grey matter during adolescence shows an increase in a number of synapses (Blakemore & Choudhury, 2006).

2.6.1.2.2. Gender difference in adolescence

During puberty increased hormonal secretion such as testosterone results in a significant increase of grey matter volume in the inferior frontal gyrus in boys (Blakemore & Choudhury, 2006). Boys were also found to have a greater cortical grey matter volume than girls.

There is a continual increase in grey matter beyond adolescence well into the age of sixty with a non-linear decrease in grey matter in certain areas of the brain such as parietal and temporal cortex (Sowell, Thomson, Tessner, & Torga., 2001).

2.6.1.2.3. Behavioural and cognitive changes

During adolescence the parietal and frontal cortex undergo a significant development and thus cognitive changes are expected. Executive functioning skills rely heavily on the frontal lobes and, therefore, improve during adolescence. Studies have also shown a linear improvement in executive functioning (selective attention, problem solving, and working memory) and age during puberty (Anderson, Anderson, Northam, Jacobs, & Catroppa., 2001).

Studies have shown that cognitive performance is decreased in pre-puberty compared to young children and it then peaks later during puberty and during adolescence. These were associated with the onset of synaptic pruning during pre-puberty and the latest specialised and

efficient synaptic network seen with adolescence (McGivern, Andersen, Byrd, Mutter & Reilly, 2002).

The prefrontal cortex is also involved in cognitive capabilities such as self-awareness and theory of mind (Frith & Vargha-Khadem, 2001). During this time social cognition also changes as the social world around adolescents changes.

Research studies point to various anatomical abnormalities in the central nervous system of children and adolescents with ADHD (Castellanos, 2002). Studies using either computerized tomography (CT) or magnetic resonance imaging (MRI) found some evidence of structural brain volume abnormalities among ADHD patients. The most common findings identified smaller volumes in regions of the corpus callosum, smaller hypoactivation of prefrontal brain, basal ganglia and cerebellum. Durston, Tottenham, Thomas, Davidson, Eigsti, Yang and colleagues (2003), reveal that individuals with ADHD were found to have abnormal brain activation in the fronto-subcortical cerebellar circuits compared to non-ADHD individuals. They also showed a diffused network mostly in the posterior and dorsolateral prefrontal regions (Durston et al., 2003).

The subcortical structures implicated by imaging studies (caudate, putamen, and globus pallidus) are part of the neural circuitry underlying motor control, executive functions (EF), inhibition of behaviour, and the modulation of reward pathways. However, other studies still argue that specific abnormalities relating to the disorder have not yet been convincingly demonstrated (Baumeister & Hawkins, 2001). It was hypothesized that individuals with ADHD when exposed to stimulants such as drugs, would have smaller brain regional volumes especially in caudate nucleus, cerebellum and frontal lobe similar to those unmedicated individuals with ADHD.

Another study showed that groups of ADHD children had slightly smaller areas of brain matter in the right frontal region than did control children while the corpus callosum (rostrum and splenium) was smaller in children with ADHD than in children without ADHD. Barkley (1995), Castellanos (1996), Faraone and Biederman (1998), and Sonuga-Barke (1998) suggested that such

differences in corpus callosum volume, particularly in the posterior regions, may be more related to learning disabilities, which are often found in a large minority of ADHD children.

Thus structural defects with decreased activity of parts of the brain responsible for normal functioning have been shown to be related with ADHD leading to predicted behaviours as seen with ADHD patients.

Prefrontal lobes of the brain are responsible for executive functioning such as behavioural inhibition, regulation of emotional impulses and motivation, planning behaviour, and using external feedback in organising behaviour across time (Tripp, Ryan, & Peace, 2002). Damage to this area of the brain can cause a disruption in many other areas of behaviour regulation (Bradley & Golden, 2001).

According to Kolb, Gibb and Gorny (2000), these individuals were observed to have failure in complying with tasks instructions, making more errors, risk taking, and rule breaking. Studies argued that a dysfunction of the frontal lobes of the brain, especially the fronto striatal networks underpins the symptoms of ADHD. Individuals diagnosed with ADHD were observed to be presenting with unusual behaviour (i.e. hyperactivity and impulsivity) similar to those with frontal lobe damage particularly the prefrontal cortex (Bradley & Golden, 2001; Tripp et al., 2002).

Other parts of the brain found to be involved in the development of ADHD were the subcortical structures (Castellanos & Tannock, 2002), the connective pathways (Alexander & Warren, 1988; Baumgardner, Singer, Denkla, Robbin, Abrams, Colli, et al., 1996) the temporal lobe (Millichap, 1997), and the parietal lobe (Roberts, 1998).

Magnetic resonance imaging (MRI) studies have shown that some regions of the basal ganglia, culate nucleus and globus pallidus are about 10% smaller in ADHD groups than in control groups (Swanson & Castellanos, 1998). Other research findings showed a decreased volume (4%) in those regions and widespread cortical abnormalities through out the brain (Biederman & Faraone, 2004; Castellanos, Lee, Sharp, Jeffreys, Greenstein, Clasen, et al., 2002).

Hence the cerebellum and corpus callosum were said to be smaller in volumes in ADHD sufferers (Seidman, Valera, & Bush., 2004; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005).

Bradley and Golden (2001) state that cerebral blood flow in adolescents with Predominantly Inattentive Type (ADHD- PI) showed hypoperfusion of the right striatum and increased blood flow to the occipital lobe, the left sensorimotor region and the left primary auditory regions. They were also said to have experienced pre- peri-, or postnatal trauma.

Bradley and Golden (2001) indicate that adolescents with ADHD- Predominantly Hyperactive-Impulsive Type (ADHD-HI): were observed to have decreased blood flow (hypoperfusion) of both striatal regions and decreased blood flow (hypoperfusion) of the occipital lobe. This means they suffer less traumatic incidence and thus have less blood flow in localised regions of the brain.

2.6.2. Genetics

Understanding the genetic contribution of ADHD was made possible by the large amount of research into the similarities of the symptoms of ADHD observed in families, adopted children and monozygotic (MZ) versus dizygotic (DZ) twins. Within an immediate family, an ADHD affected child will share the symptoms in the following order: 32% with another sibling, 25-30% with the father and 15-20% with mother (Bradley & Golden, 2001).

Other studies have shown that genetic factors play a role when adopted parents bring up an ADHD child in that the child would share the symptoms of ADHD with the biological parents and not the adoptive parents (Bradley & Golden, 2001). It is then shown that heritability does not imply neurological determinism. Other factors such as interaction with the environment may, however, have an effect on behaviour (Biederman, Faraone & Monuteaux., 2002). Several studies on MZ and DZ twins revealed the importance of genetic factors in the aetiology of ADHD. The disorder was found to be more prevalent between MZ (50-80%) than among DZ (0-33%) twins (Gilger, Pennington, & DeFries, 1992; Gillis et al., 1992; Gjone & Stevenson, 1997; Stevenson,

1992). However, there is a speculation that there might be a slight association between ADHD and a polymorphism near the DRD5 gene in certain ADHD families (Tahir, Yazgan, Cirakoglu, Ozbay, Waldman, & Asherson, 2000), which might be the cause to this disorder.

The genetic base of ADHD is rather complicated because there is no single gene that can be depicted as a potential candidate (Sagvolden et al., 2005). Various research works have shown that dopamine is elevated in the cerebrum of adults and children with ADHD (Madras, Miller, & Fischman, 2002; Seeman & Madras, 2002). Using molecular genetic tools, researchers have identified an elevated dopamine transporter gene of varying lengths, due to polymorphism (Madras et al., 2002). Other researchers have shown a possible link between genes coding for dopamine receptors and ADHD (Sagvolden et al., 2005). Variations in gene for dopamine receptors 4 (DRD4 7-repeat allele and 5 (DRD5 148 bp- allele), and the dopamine transporter (DAT1 10-repeat allele) were all associated with ADHD (Curran, Mill, Tahir, Kent, Richards, Gould, et al., 2001).

The 10 – repeat allele of DAT1 is said to be associated with an increased expression of the transporter (Curran et al., 2001), while the 7-repeat allele of DRD4 encodes a receptor that is subsensitive to dopamine (Taylor et al., 2004).

Taylor and colleagues (2004) also indicate that each of the risk alleles will increase the risk for ADHD by a slight ratio of 1.2- 1.9. This could mean that complications in either of the alleles may result in other disorders such as Tourettes, autism, and learning disabilities. Therefore, it has been suggested that all these disorders as well as ADHD share genetic susceptibility factors (Bakker, van der Meulen, Buitelaar, Sandkuijl, Pauls, Monsuur, et al., 2003; Hawi, Lowe, Kirley, Gruenhage, Nothen, Greenwood, et al., 2003; Smith, Daly, Fischer, Yiannoutsos, Bauer, Barkley, et al., 2003 ;). Willcutt, DeFries, Pennington, Olson, Smith, & Cardon (2003) on the other hand, elaborate that ADHD when associated with learning disabilities and poor academic performance is

shown to be associated with dopamine-beta-hydroxylase (DBH) enzyme converting dopamine into norepinephrine.

2.6.3. Environmental Factors

According to Bradley and Golden (2001), genetic factors contribute about 30-40% in ADHD manifestation whereas 60% is due to environmental factors. Certain environmental factors may affect the child before, during and after pregnancy.

Prenatal (before birth) and perinatal (during): The role of pre-natal and perinatal smoking on ADHD children was studied by Mick, Biederman, Faraone, Sayer, & Kleinman (2002) and Thapar, Fowler, Rice, Scourfield, Thomas, et al (2003). They observed that maternal smoking during pregnancy led to the development of ADHD symptoms in the children after birth and this was associated with the toxic effects of nicotine in causing hypoxia (low oxygen) and the effect of nicotine on dopamine (Mick et al., 2002). Research work done indicated that male offspring of nutritionally deprived pregnant women during the first and second trimester, were observed to be 2.5 times the normal rate of antisocial personality disorder when they become adults (Castellanos et al., 2002; Neugebauer, Hoek, & Susser., 1999). These children tend to have low IQ levels.

Postnatal (after birth): Low birth weight is another environmental factor that has been linked with elevated rates of ADHD in children (Bradley & Golden, 2001). Most children born with extreme low birth weights (> 1, 5 kg) were prematurely born and due to hypoxia and ischemia, developed ADHD before or at ages of four (Astbury, Orgill, & Bajuk, 1987). Andersen, Thomson, Krenzel, and Teicher's study (2000), showed that malnutrition at the age of three predisposes children to neurocognitive deficits which eventually predispose to persistent aggression and hyperactivity. Andersen and colleagues (2000) mention that during postnatal development, overproduction of synaptic connections and receptors take place, which is followed by pruning or elimination of synapses during adolescence.

Other environmental factors responsible for ADHD are high levels of family problems and emotional stress during pregnancy (23%), early injurious accidents (7%), surgery within the first month of life (5%) and trauma during delivery (2%) (Bradley & Golden, 2001). Exposure to toxic substances such as nicotine, alcohol, and lead can be harmful to developing brain tissue and may have sustained effects on the behaviour of the children exposed to these substances at early ages and thus causing ADHD (Biederman, Faraone, Keenan, Knee, & Tsuang, 1990).

2.6.4. Psychosocial Factors

ADHD thus far has been linked to various factors in the family environment that correlate significantly with childhood mental disturbances (Biederman & Faraone, 2005). Factors such as severe marital discord, low social class, large family size, paternal criminality, maternal mental disorder, and foster placement may predispose individuals into developing ADHD and may impair childhood development. ADHD defining symptoms such as overactivity and inattentiveness develop in children who are deprived of emotional support as in those confined to institutions (Sadock & Sadock, 2003). These symptoms tend to disappear when a child is removed from the institutions and placed in a foster home. However, these will depend on a child's temperament, genetic factors and socio environment (Sadock & Sadock, 2003). Other risk factors associated with ADHD are, low maternal education and single parenthood (Barkley, 1998). Biederman, Faraone, Monuteaux and Feighner (2002a), on the other hand reveal that chronic conflict; reduced family cohesion and exposure to parental psychopathology-especially maternal psychopathology, were common in ADHD families compared with control families.

Klassen and colleagues (2004) mention that parents of children with ADHD reported problems of emotional behaviour, mental health and self esteem. They further state that the ADHD condition of their children affected the parents' emotional health and time to meet their own needs and interfere with family activities and family cohesion. Health related quality of life (HRQL) in adolescents with ADHD showed clinical significant deficits in HRQL in almost all

psychosocial domains such as family activities, family cohesion, and psychosocial health (Klassen et al., 2004).

2.7. Comorbid disorders

The diagnosis of Attention- Deficit/Hyperactivity Disorder suggests a significant risk for other coexisting psychiatric disorders (Barkley, 1998). This is an important determination because many of these conditions may pretend to be ADHD look-alikes (Robin, 1998). In adolescents, symptoms of ADHD, which may be associated with conduct problems, are substance abuse, traffic offences, and promiscuity (Waslick & Greenhill, 2004). Some of the comorbid disorders are:

Conduct Disorder (CD)

Conduct Disorder is explained as an enduring set of behaviours characterized by aggression and violation of the rights of others (Sadock & Sadock, 2003). The disorder is associated with many other psychiatric disorders including ADHD, depression, and learning disorders. Other studies are of the idea that ADHD and CD are associated with deficits in the executive functioning (Banaschewski, Hollis, Oosterlaan, Roeyers, Rubia, Willcutt, et al., 2005). ADHD is also associated with psychosocial factors such as low socio economic level, harsh, punitive parenting, family discord, and a lack of social competence (Sadock & Sadock, 2003).

Oppositional Defiant Disorder (ODD)

Oppositional Defiant Disorder and Attention- Deficit/Hyperactivity Disorder (ADHD) especially impulsiveness are among the most common comorbid psychiatric disorders in the majority of adolescents with substance use disorders (Bukstein, 2000). The disorder is characterized by a stable pattern of negativistic, disobedient and hostile behaviour towards authority figures as well as an inability to take responsibility for actions leading to placing blame on others. Individuals displaying ODD were also reported to have a deficit in the EF (Banaschewski

et al., 2005). These children are often defiant, stubborn, -compliant, have temper outbursts, or become belligerent (National Institute of Mental Health, 2003).

Bipolar disorder

According to the National Institute of Mental Health (2003), differentiating between ADHD and bipolar disorder in childhood can be difficult. Bipolar disorder is characterized by mood cycling between periods of intense highs and lows. But in children, bipolar often seems to be a rather chronic mood dysregulation with a mixture of elation, depression, and irritability. Moreover, there are symptoms that can be present both in ADHD and bipolar disorder, such as a high level of energy and a reduced need for sleep (National Institute of Mental Health, 2003).

Tourette Syndrome

A very small portion of people with ADHD has a neurological disorder called Tourette syndrome. People with Tourette have various nervous tics and repetitive mannerisms, such as eye blinks, or facial twitches or grimacing. Others may clear their throats frequently, snort, sniff, or bark out words. While very few children have this syndrome, many of the cases of Tourette syndrome have been associated with ADHD. In this case individuals with both disorders often require treatment that may include medication for effective functioning (National Institute of Mental Health, 2003).

2.8. Assessment

In assessing ADHD it is always important that the assessment is done properly and by an appropriate and qualified mental health practitioner. Since impulsiveness has been described as the key symptom of ADHD, various measures have been associated with the symptom and have been used to measure key aspects of impulsiveness (Moeller, Barratt, Dougherty, Schmitz & Swann, 2001). Proper assessment should be done in order to have a proper diagnosis and treatment plan.

To diagnose ADHD clinicians should always document specific, impairing symptoms of the disorder in at least two settings. Information can be obtained from a reliable source such as

parents and teachers who best understand the child's functioning in a home and school setting (Swanson, Lerner, March & Gresham, 1999). Direct interview and observation of the child should be done in order to acquire more information. Lastly, psychological testing is considered when indicated to warrant diagnosis.

Various assessment methods are used in assessing children and adolescents. Tests such as Barkley's Symptoms Scale for Adolescents (BSSA) (Barkley & Murphy, 1998), should also be done. The test is used to assess the presence and degree of ADHD symptoms of the participants. The Youth Risk Behaviour Scale (YRBS) is mainly used to assess and monitor health risk behaviours associated with social problems among youth and adults (Centres for Disease Control and Prevention, 1990).

The Wisconsin Card Sorting Test (WCST) was first developed by Grant and Berg (1948), to test frontal lobe functions. The WCST is a neuropsychological test used to measure abstract ability and sustain attention. The GoStop Impulsive test was developed by Dougherty, Mathias and Marsh, (2003) and the test basically measures inhibited response and impulsivity or motor activity in the participants. More information on these tests will be given in Chapter 6 of the study.

It is essential to take into consideration that most tests were established and used in the Western countries and when administered to our African country they should be used with caution and sensitivity.

2.9. Treatment

Physicians often recommend that ADHD be treated asymptotically with stimulants, special education and counselling. A multimodal treatment approach such as positive behaviour intervention and psychological strategies have also been seen to be playing an important role (Aslop, 2003). Treating ADHD is essential in order to decrease symptoms, enhance functionality, and improve well-being for the individual and his or her close contacts (Miller, Johnston, Klassen, Fine, & Papsdorf, 2005).

2.9.1. Psychopharmacology

Medication has been the treatment of choice for a number of years (Brown, 2000). Research has indicated atomoxetine, a nonstimulant chemical that has beneficial effects on children and adolescents with ADHD (Kratochvil, Heiligenstein, Dittmann, Spencer, Biederman, Wernicke, et al., 2002). Its mechanism of action includes the blockade of the presynaptic norepinephrine transporters in the prefrontal cortex so that there is an increase in extracellular dopamine and norepinephrine levels in this cortex. This drug has minimal activity at histaminic, serotonergic, cholinergic or adrenergic (α -1 and α -2) receptor sites. Atomoxetine does not have side-effects such as tics, euphoria or a withdrawal syndrome like other drugs.

Currently, there are only minimal studies comparing it to other established medications for ADHD and none showing superior efficacy to the less expensive stimulants (Kratochvil et al., 2002). According to Newcorn, Spencer, Biederman, Milton, and Michelson (2005), adolescents between the ages of 8-18 with ADHD, showed improvements on ADHD, ODD symptoms and the quality of social and family functioning. He further indicates that those with co-morbid disorders will require a higher dose of 1.2 or 1.8 mg a day.

Other types of medication have been used in the treatment of impulsiveness, with various rates of success. These include lithium for aggression in adolescents and young adults (Malone, Delaney, Luebbert, Cater & Campbell, 2000), selective serotonin reuptake inhibitors (SSRIs), anticonvulsants, and Fluoxetine.

2.9.2. Multi- Systemic Therapy

Multi-systemic therapy (MST) is a family and home based treatment that aims to change how youths function in their natural settings, namely home, school and neighbourhood, in ways that promote positive social behaviour while decreasing antisocial behaviour. The approach views individuals as being surrounded by a network of interconnected systems that encompass

individuals, and extrafamilial factors and recognise that intervention is often necessary in a combination of these systems.

The main goal of MST is to reduce youth criminal activity, reduce other types of anti social behaviour such as drug abuse and to achieve these outcomes at a cost of saving by decreasing rates of incarceration and out of home placement (Aslop, 2003). According to Aslop (2003), early diagnosis and intervention in these children help reduce the likelihood in them to develop a co-morbid condition and to do well for themselves in the long run.

2.9.3. Cognitive Behaviour Psychotherapy

The approach uses behaviour therapy techniques to achieve behaviour change through modification of cognitive processes that lead to problem behaviours (Moeller et al., 2001). CBT is also important in assisting those with impaired problem solving abilities, drug abusers and juvenile delinquents in order to develop appropriate interpersonal skills.

Another type of structured cognitive behaviour therapy is known as dialectical behavioural therapy. The therapy is effective for individuals with personality disorders. It also provides a skills training manual for teaching patients general problem-solving skills, emotional regulation strategies, and distress tolerance (Moeller et al., 2001).

2.9.4. Psychosocial intervention

According to Sadock and Sadock (2003), medication alone is often not enough to satisfy the therapeutic needs of persons with the disorder and is usually only one factor of a multimodal intervention. Non-pharmaceutical therapies are recommended in addition to medication (Pary et al., 2002). Mostly therapies include individual psychotherapy, behaviour modification, parenting classes, parent support groups, school involvement, and education about Attention Deficit/Hyperactivity Disorder. When applied in preschool children, intensive parent management training may be as effective a medical treatment in reducing symptoms of ADHD, in addition to

reduce depression in mothers and increasing parents' experience of themselves as successful (Sonuga-Barke, Daley, Thompson, Laver-Bradbury, & Weeks, 2001).

Behavioural therapy programmes for children with Disruptive Behaviour Disorders have been increasingly well developed during the past two decades (Meyer & Aase, 2003). These programmes aim to teach parents and teachers behaviour management skills based on sound behavioural learning principles, particularly the systematic use of reinforcement contingencies.

It is important that an appropriate form of treatment be selected for each case individually following through diagnostic assessment and taking into account the potential of the parents, the educational system, and the culture of the individual.

2.10 Prognosis

Having ADHD does not mean disaster (Swanberg, Passno & Larimore , 2005), hence with proper instructions, skills and mentoring sufferers can lead a normal life. According to Sadock and Sadock (2003), the outcome of ADHD in childhood seems to be related to the amount of persistent coexisting psychopathology, especially conduct disorders and social disability. Thus, improvement of an individual will depend on the optimal functioning of the situation that one finds himself or herself in. Research has shown that sufferers of ADHD when using medication and various therapy approaches to regulate their behaviour may eventually lead a normal life.

RISK-TAKING BEHAVIOURS IN ADOLESCENTS

3.1 Introduction

Adolescence can be seen as a transition between childhood and adulthood. It is a time for trying new experience. During this phase adolescents are more likely to engage in risk taking because it can be exciting and it is also a way to gain new experiences, perhaps fulfil the wish to grow up quicker (Aslop, 2003). The most unfortunate part is that adolescents often do not see the link between their actions today and the consequences tomorrow. However, they usually are aware of the risk they are undertaking (Wild, Flisher, Bhana & Lomard, 2004b). Risk taking behaviours such as alcohol, cigarette smoking, dagga use, other drugs, and sexual promiscuity, which form part of this study, will be outlined briefly.

3.2. Risk taking behaviour

Risk-taking in adolescence is an essential part of learning and personality development. Taking risks is part of the assertion of independence and self-testing behaviour that every healthy teenager goes through (Corben, 2001). According to Sharmanesh (2005), risk-taking behaviour involves acting out without fear of consequences on health, emotions, life, or the future. A study done by Wild, Flisher, Bhana, and Lombard (2004a), found that prevalent risk taking behaviours among adolescent boys of senior high school grades were smoking, drug use, alcohol use, bullying and risky sexual behaviour. This was also observed by others (King, Schwab-Stone, Flisher, Greenwald, Kramer, Goodman, et al., 2001; Sharmanesh, 2005), all these consequences may lead to depression, anxiety and delinquent behaviour (Klassen et al., 2004). By using these substances for pleasure purposes, adolescents do not realise how they rob themselves of their quality of life. Therefore, it becomes clear that without risk, no growth and development are taking place (Corben, 2001).

3.3 The psychology of risk taking behaviour

Risk taking behaviours particularly in adolescents, is one of the most confusing problems in the field of psychology (Llewellyn, 2003). Psychoanalysts at the turn of the 20th century concluded that risk-taking behaviour was, in fact, evidence of a diseased mind, rather an expression of suicidal tendencies or a death wish or repressed feelings of masculine inadequacy (Llewellyn, 2003). Recent research findings have given a different perspective on these behaviours. However, it seems that normal people are motivated to take risks as a result of their psychological make-up and the nature of the situation they find themselves in (Rolison & Scherman, 2002).

Individuals who engage in risk taking behaviour are characterized as having a risk-taking personality which, according to Llewellyn (2003), is brave and inquisitive. Research studies thus far have shown that sensation seeking is another influential factor for risk-taking behaviour. Adolescents are seen to have a desire for new exciting experience, hence they engage in risk-taking behaviours (Llewellyn, 2003). He further explains four sub-dimensions of the Sensation Seeking trait: (1) Thrill and Adventure Seeking, which relates to the willingness to take physical risks and participate in high risk sports, (2) Experience Seeking, which relates to the need for new and exciting experiences and is associated with all types of risk taking, (3) Disinhibition, which relates to a willingness to take social risks and engage in health risk behaviours (e.g. binge drinking or unprotected sex), and (4) Boredom Susceptibility, which relates to an intolerance for monotony.

The fact that different types of risk taking are both associated with the Experience Seeking sub-dimension adds weight to the argument that different types of risk taking may all be associated with a universal risk-taking personality, which can be seen as part of their nature in most adolescents (Llewellyn, 2003).

Rolison and Scherman (2002), on the other hand state that sensation seeking could be influential in the adolescent's ability to take a decision in risk taking. Sensation-seeking behaviour, through involvement in sports with a high risk of injury or even death, has become an important

issue to be looked at (Pain & Kerr, 2004). A study conducted by Rolison and Scherman (2002), revealed that adolescents have a high tendency of sensation seeking that was associated with risk-taking behaviour. They further showed that adolescents with high sensation seeking tendencies appeared to be at higher risk of injury compared to low sensation seekers. Moreover extreme risk takers are likely to continue taking part in high risk sports even after serious injury (Pain & Kerr, 2004). Individuals in this regard are always up to new challenges; hence they keep on engaging in high-risk activities.

The focus of the present research study is on various risk-taking behaviours that adolescents are likely to engage in as well as the psychosocial impact of these risky behaviours.

3.4. Risk taking behaviours mostly engaged in by adolescents

3.4.1. Safety

Reckless driving includes illegal driving of a vehicle without a licence, employing bad driving habits, not wearing safety belts, driving at increased speeds, and causing accidents while being the driver of the vehicle (Barkley et al., 2002; Barkley et al., 2005). Corben (2001) states that 60% of adolescent deaths are caused by accidents and many of these are as a result of risk-taking. A research study showed that speeding, drunken driving, and using mobile phones were found to be the riskiest behaviours amongst adolescents (Corben, 2001). Evans (2004), states that over involvement in crashes relates to a whole host of other unhealthy behaviours, such as smoking.

The increase in driving speed has a significant increase in the incidence of death and road accidents. In his study Evans (2004), documented that high-risk drivers have personality disorders such as being emotionally unstable, unhappy, asocial, anti-social, impulsive, increased aggression, low tension tolerance, increase sensation-seeking, poor self-esteem and under-stressed. Cars are seen by adolescents as a sign of independence, used for rebellion and peer acceptance. These issues seem to be linked with problems of reckless driving and breaking the law.

Reckless driving and violation of laws from an early age continue to persist to an older age. This persistent behaviour is likely to influence the driving behaviour of the children of the older driver (Junger, West & Timman, 2001). Research, on the other hand, has shown that involvement in crashing is related to a criminal act (Corbett, 2001).

3.4.2. Alcohol use

One of the most leading risks taking behaviours is the use of alcohol. It is usually the preferred substance that adolescents experiment with. Its use however, leads to the abuse of other substances such as smoking and other drug use (Kim, Park, Hwang, Shin, Hong, Cho, et al., 2006). According to Kaye (2004), substance abuse is an extensive use of illicit substances with negative consequences. It is a powerful drug that enters the brain and spinal cord, where it acts as a depressant. This means that it reduces anxiety, but also makes one less co-ordinated and slow. Reduced anxiety removes inhibitions. This can make it easier to socialise and make friends, which is why individuals prefer to drink. It can also make one vulnerable to risks of using other substances (Sharmanesh, 2005).

Psychological effects

Alcohol intake may lead to psychological effects such as acute psychotic reactions. Individuals in this regard experience temporary loss of contact with reality. Full-blown symptoms in this alcoholic psychosis are disorientation of time and place. Individuals experience vivid hallucinations, particularly of small, fast moving animals such as snakes.

Individuals may also experience blackouts, which are discrete episodes of anterograde amnesia that occur in association with alcohol intoxication. During this episode people has relatively intact remote memory but experience a specific short-term memory deficit, in which they are unable to recall events that happened in the previous 5 to 10 minutes (Sadock & Sadock, 2003).

Intoxication leads to slurred speech, loss of co-ordination, and slower reaction time. With severe alcoholic poisoning, the individual will feel very sick, vomit, sleep and eventually become

unconscious. One serious risk is that an unconscious person can occasionally breathe in their vomit and die. The hangover symptoms the next day can be extremely unpleasant, with headache, feeling sick, burning in the stomach, and difficulty in concentrating (Sadock & Sadock, 2003).

Psychosocial effect

Alcohol does have a psychosocial impact, particularly on behaviour and personality. General personality disorganization and deterioration may be reflected in loss of employment (Carson, Butcher, & Mineka, 2000). Alcohol increases other risk-taking behaviours such as risky sexual behaviour, drunken driving, fights, violence, and the use of other drugs (Sharmanesh, 2005). One in three young people in long-term detention centres were under the influence of alcohol when they committed their crime and 40% of drowning accidents were found to be alcohol related (Sharmanesh, 2005). Drinking at a young age, may eventually result in alcoholism later in life (Sharmanesh, 2005).

Physical effect

An adolescent growing up in a family where parents drink alcohol is prone to depend on the use of that particular substance. In such cases, both alcohol and drug use are prevalent in adolescents. This risk taking behaviour is suspected to be due to a genetic predisposition that will be triggered by environmental events such as parental substance use disorder and poor parenting (Biederman et al., 2000a). The use of alcohol and other substance before age of fifteen years, poor family background and peer pressure all influence adolescents not only to risk behaviour of substance use but also to substance disorder (Kaye, 2004). A variety of negative health outcomes associated with alcohol abuse include traumatic brain injury, major organ damage (lungs and liver), and sexually transmitted infections (HIV and hepatitis b virus- HBV) (Parry, Morojele, Saban, & Flisher, 2004).

In a study done in a township in Gauteng, it was found that alcohol use was linked to sexual risk behaviours with casual partners (Morojele, Kachieng'a, Mokok, Nkoko, Parry,

Nkowane, et al., 2006). The risk of drunkenness among adolescents was associated with exposure to public drunkenness on a daily or weekly basis and lack of attendance of religious services (Parry et al., 2004).

Alcohol during pregnancy can affect the developing foetus, causing foetal alcohol syndrome. These babies are born with some physical impairment characterized by spaced eyes, short broad nose, under developed upper lip, and receding chin (Carson, Butcher, & Mineka, 2000).

3.4.3. Tobacco use

Nicotine in the tobacco is addictive and is the most addictive of all drugs (Sharmanesh, 2005). This substance is commonly used amongst adolescents and may continue into adult life. Nicotine intoxication may result in substance dependence, which is mostly associated with cigarette smoking (Sharmanesh, 2005).

Nicotine has physical effects such as respiratory paralysis, lung cancer, and cerebrovascular diseases when taken in high doses (Sadock & Sadock, 2003). In a low dose it may result in a feeling of nausea, vomiting, salivation, abdominal pain, diarrhoea, dizziness, and headache. According Sadock and Sadock (2003), the substance is associated with a decrease in REM (reticular eye movement) sleep. The use of tobacco during pregnancy results in low birth weight babies and persistent pulmonary hypertension (Carson et al., 2000). Even when having serious physical disorders such as emphysema, which is exacerbated by tobacco use, some individuals still cannot resist tobacco smoking (Carson et al., 2000).

Smoking has a carcinogenic effect on most users and another risk is that it can lead to other substance use (Galera, Fombonne, Chastang, & Bouvard, 2005). Tobacco use becomes difficult to stop and abstinence from it may lead to withdrawal symptoms such as irritability and difficulty in concentrating (Pomerleau, Downey, Snedecor, Mehringer, Marks, & Pomerleau, 2003).

The use of cigarettes in adolescents may lead to severe tobacco dependence in adulthood and early users are said to be at high risk for later substance abuse, aggression and delinquency, which may eventually result in a drug problem. A study done by Pomerleau and colleagues (2003), has shown that nearly 1 in 5 high school seniors in the USA smokes every day, hence less than 90% of 17 years olds have already experiment once with tobacco (68%), alcohol (88%), marijuana (53%), and other drugs (31%). It becomes clear that the use of substance among this age group is increasingly becoming a habit whereby the use of one substance leads to the other (Pomerleau et al., 2003).

3.4.4. Cannabis use

Marijuana (dagga) is the most widely used illegal drug. It is often known as grass, hash, pot or ganja. It comes from the cannabis plant and looks like dry herbs. The stronger form (hashish) is a brown or black, solid or rarely an oil. It is smoked in a 'joint' (marijuana cigarette) or pipe. Some people cook it in food (e.g. hash cookies) or brew it like tea (Sharmanesh, 2005).

Marijuana intake has a psychological effect, in that users experience a feeling of euphoria, tranquillity, and passivity. Adolescents mostly prefer the substance during exam time because it gives them the ability to memorise. The mood is also affected in that a feeling of happiness or sadness is experienced, while some become paranoid, sleepy and hungry (Sharmanesh, 2005).

Among the negative effects associated with marijuana use are physical health damage such as respiratory problems and cancer. Withdrawal comes with negative experiences, therefore, long term use with more deleterious effects is practised (Cunningham, Bondy, & Walsh, 2000; Lane, Chereck, Pietras & Tcheremissine, 2004; Kaye, 2004; Ramaekers, Berghaus, & Drummer, 2004).

Brook, Balka and Whiteman (1999) emphasize that the use of marijuana in the early ages of adolescents may lead to later delinquency, having multiple sexual partners, and the use of other drugs. Other associated behaviours of marijuana use are criminal behaviour, notably attempted homicide, drug trafficking, and delinquency in adolescents and young adults (Fergusson &

Horwood, 1997; Friedman, Glassman, & Terras, 2001). According to the Public Health Agency of Canada (2004), most adolescents addicted to marijuana were likely to engage in sexual risk-taking which may serve as a predictor for HIV risk. Adolescents who use drugs are associated with a greater risk of a number of physical problems including attention deficit disorder, anxiety disorder, phobias, and depression (McDowell & Futris, 2003).

The substance use may not only result in risky behaviours but may cause impairment on an individual's performance, psychomotor functioning and decision-making (Ramaekers, Robbe, & O'Hanlon, 2000). Behaviours related to risk-taking behaviours such as aggression, impulsivity, and complex decision-making becomes affected as a result of this substance (McDonald, Schleifer, Richards, & deWit, 2003). Marijuana is said to have a pharmacological effect on risky behaviours. According to Bechara, Damasio, Damasio, and Lee (1999); Breiter, Aharon, Kahneman, Dale, and Shizgal (2001); Rogers, Tunbridge, Bhagwagar, Drevets, Sahakian, and Carter (2003), acute marijuana affects the mesolimbic pre-frontal cortex (PFC) activity and sensitivity, which are involved in risk taking decision-making. A widespread use of cannabis use is on the increase among young male youths in South Africa. In trauma units it was shown that a high proportion of patients test for cannabis and most arrested individuals also test for cannabis in all sections of South African society (Bham, Parry, Myers, Pluddemann, Mrojele, & Flisher, 2002).

3.4.5. Other drug use

A substance associated with the use of marijuana is cocaine, which is preferred by most adolescents. Cocaine is preferred because it produces reinforcement by activating a brain reward system (Gardner & Steinberg, 2005). The substance is potentially known to lead to pathological thinking, seizures, cerebrovascular abnormalities, and compulsive drug seeking (American Psychiatric Association, 2000).

3.4.6. Sexual behaviour

There are some socio-economic factors that a child has no control over that influence the delay of initiation of sexual activities. These are having a two-parent family and high socio-economic status, residing in a rural area, performing better in school, feeling greater religiosity, not having suicidal thoughts, and believing parents care and hold high expectations for their children (Dillard, 2002). The exposure of adolescents to smoking at early school grades leads to initiation of sexual activity especially when they come from socio-economic environments opposite to the above-mentioned (Robinson, Telljohann, & Price, 1999). This is then followed by an increase in the number of sexual partners and the increase of violent activities and abuse of other substances especially marijuana and alcohol (Valois, Oeltmann, Waller, & Hussey, 1999).

Sexual risk taking contributes directly to high rates of sexually transmitted diseases and the continued spread of HIV infection (Janssen & Bancroft, 1996). The influence of marijuana and alcohol leads to adolescents' increased involvement in high-risk sexual activities (Kingree, Braithwaite, & Woodring, 2000), such as sexual activity with multiple sexual partners, sexual activity without protection and contraceptives, which may lead to teenage pregnancy and sexual transmitted infection (Flisher & Chalton, 2001). Chandra, Krishna, Benegal, and Ramakrishna (2003) observe that as a need for sensation, adolescents who abuse alcohol get involved in high-risk sexual activities. Thus high-risk sexual activity usually happens in the context of other high-risk activities.

Sexual molestation, both in males and females, at a young age was seen to correlate with early age initiation of sexual activity, early and unwanted pregnancies and multiple partners (Raj, Silverman, & Amaro, 2000). Low levels of sexual activities among adolescents and teenagers are found among those with high religious and spiritual beliefs and associating themselves with friends that share their religious beliefs. The same group of people was also found to use condoms in their sexual encounters (Zaleski & Schiaffino, 2000). An adolescent male usually encounters first sexual

activity due to peer pressure, whilst female adolescents would encounter first sexual activity due to pressure from her partner (Bearman & Brückner, 1999).

In South Africa now HIV/AIDS infection among young adults and adolescents is seen to be reaching an alarming stage. A study done in a black township (SA) showed that 68% men and 56% women reported HIV related high-risk sexual behaviour (Simbayi, Kalichman, Jooste, Cherry, Mfecane, & Cain, 2005). However, knowledge about HIV was high. For men HIV was associated with misconception about AIDS, transmission, fewer years in school, low levels of HIV/AIDS knowledge, condom attitude, and dagga use (Simbayi et al., 2005).

According to Goldman, Lakdawalla and Sood (2004), HIV in the developed countries has been transformed from a death sentence into chronic and manageable disease. A study conducted showed that treatment not only improves the health of HIV positive individuals, but rather to a certain extent, allows them to engage in more sexual risk-taking behaviours and drug abuse (Goldman et al., 2004). In this regard some HIV infected individuals will continue to engage in risky sexual behaviour such as having unprotected sex.

3.5. Other risk taking behaviours

Llewellyn (2003) explains that most adolescents engage in dangerous activities simply because they are confident that they can manage the risks involved, and have friends that also choose to take potentially fatal risks. Such high-risk activities are rock climbing, bungee jumping, car racing, motorcycle riding, white water rafting, mountain climbing, and parachuting (Swanberg, Passno, & Larimore, 2005). She further mentions that adolescents attribute a threatening environment to be rather challenging without thinking about the consequences and that gives them a feeling of satisfaction once they realise they are able to control those risky situations.

The concept risk does not necessarily make adolescents perform high risk activities and behaviours. The ability to be in control of those activities is rather more appealing to them. Sporting risk takers are more likely to be male, and may be high in emotional stability (low

neuroticism), suggesting that they may be strong when dealing with more challenging stimuli and low anxiety that may partially explain their self-confidence (Llewellyn, 2003).

3.5.1. Bullying

The most common forms of bullying are teasing, excluding, or spreading lies about the victim (Corben, 2001). This particular behaviour is found to be common amongst individuals who take substances. Research studies showed that adolescents who bully others or are victimized by others are more likely to be at the risk of long-term difficulties and that may affect their healthy way of living (Corben, 2001). Boys were significantly more reported to be bullied and victimized than were girls and it was found that boys are more likely to engage in physical victimization compared to girls (Corben, 2001).

3.5.2. Suicidality

Suicide is one of the most leading causes of death in both men and women from adolescence to middle age (Langlois & Morrison, 2002). Previous research has shown that men are four times more likely to commit suicide than women, whereas women become hospitalised as a result of attempted suicide at 1,5 times more than men (Langlois & Morrison, 2002). Suicidal behaviour is, therefore, correlated with mental illness and it is usually seen as an expression of hopelessness, helplessness, and despair. According to the American Psychiatric Association (2000), individuals display symptoms such as loss of interest in usual activities, loss of interest in friends, expressing negative comments about self, and loss of appetite. Suicide as a result of hopelessness and depressive states adolescents find themselves in, tends to resort to risk taking behaviours (Leenaars, 1998).

Suicide poses a serious health risk by the violent methods used and by the completion of the act itself (Dixon, Howie, & Starling, 2004). Langlois and Morrison (2002) state that both men and women display suicidal behaviour in different ways in that men would resort to fatal acts such as using fire arms (26%) or hanging (40%), whereas women would resort to less lethal acts such as

overdosing. This suggests that men who attempt suicide are more likely to complete suicide compared to females.

Suicidality is observed in adolescents that have experienced stressful life events, poor family environment, parental psychotic history, and low parental monitoring (Langlois & Morrison, 2002). It is associated with other risk taking behaviours such as running away, assault behaviour, weapon carrying, and predominantly tobacco use (King et al., 2001). A study conducted by Frank, Lester, and Wexler (1991), on compulsive gamblers showed that gamblers who are preoccupied with suicidality, began the activity at an early stage and have stolen as a result to support their gambling. The mental status of adolescents is predominantly depressed and anxious with frequent substance abuse and both these have led to attempt and completion of suicide in adolescents (Gould, King, Greenwald, Fisher, Schwab-Stone, Kramer, et al., 1998). All these factors not only predispose adolescents but also put them in vulnerable positions, which may result to risk-taking behaviour. Adolescence, because of their impulsiveness and their lack of experience in dealing with stressful issues, therefore, contribute to the high risk of suicide (Langlois & Morrison, 2002).

Jick, Kaye and Jick (2004) in their study indicated that suicide in most individuals was not the result of depression as an underlying factor, but the use of medication rather had an impact on suicidal tendencies. The use of medication has become a controversial issue. Some researchers strongly argue that suicidal behaviour is still prevalent in the first month after starting antidepressants especially during the first 1 – 9 days of treatment (Jick et al., 2004). In this regard taking antidepressants does not necessarily reduce the risk of suicidal behaviour or the risk of self-harm.

3.5.3. Violence

A variety of health compromising behaviours becomes prevalent during adolescence (Bachman, Johnston, O'Malley, & Sculenberg., 1996; Rodgers, 1996) and as a result they become more vulnerable to risk taking behaviour and more likely to demonstrate maladaptive coping

(Donenberg, Emerson, Bryant, Wilson, & Weber-Shifrin, 2001). Violent exposure can be seen as a factor that influences an adolescent's involvement in risk taking behaviour such as aggression, substance use and sexual behaviour (Donenberg et al., 2001).

According to Singer, Anglin, Song, and Lunghofer (1995), adolescents may witness specific acts of violence either in their homes, community, and/ or school and to some might have been a victim of that specific act. Research work showed that victimization by and the witnessing of violence could be associated with the likelihood of adolescence alcohol, cigarette and marijuana use (Albus, Weist, & Perez-Smith, 2004; Berenson, Wiemann, & McCombs, 2001).

Violence exposure on the other hand is said to be related to sexual risk-taking during adolescence, including early age at first intercourse, having more than one sexual partner, decreased condom use, contracting sexually transmitted infections, and early pregnancy (Berenson et al., 2001; Silverman, Raj, Mucci, & Hathaway, 2001). They further showed that females who were directly victimised by violence as compared to non exposed peers, reported early initiation of intercourse with strangers, multiple partners, and having STI. This means that exposure of adolescence to such environment may predispose them to having antisocial behaviour and having compromised lifestyle (Berenson et al., 2001).

The lack of mental health care and therapy for these victimized adolescents may put them at risk of developing poor effective coping strategies and leaving them vulnerable. This is supported by the fact that adolescents experiencing multiple types of violence tend to engage in the highest level of risk taking (Berenson et al., 2001) and their way of coping with stress will be through escape. In this regard adolescents will always find a way to assert themselves and resist pressure by behaving in risky ways (i.e. using substances or engage in risky sexual acts), which may also cause damage to their health (Carr-Gregg, Enderby, & Grver, 2003). Unger, Sussman, and Dent (2003) further explained that adolescents, as they continue to have poor coping strategies, develop sensation seeking as a way out of their problem behaviour and hence engage in the use of

substances and sexual risk behaviour (Donohew, Zimmerman, Cupp, Novak, Colon, & Abell, 2000; Wagner, 2001).

3.5.4. Body modification

Body modification in the form of tattooing and body piercing is becoming increasingly common and well accepted in western society (Carroll, Riffenburgh, Roberts, & Myhre., 2002). About 10% to 13% of adolescents' aged 12 to 18 have tattoos (Anderson, 1992; Stuppy, Armstrong, & Casals-Ariet, 1998). Armstrong and McConnell (1994) state that 57% of tattooed adolescents labelled themselves as "risk takers", and of these 28% used alcohol, drugs or both before the tattooing. These adolescents were said to be under the influence of hard drugs before they make spontaneous decisions to obtain tattoos (Carroll et al., 2002). The use of substance in this regard can be seen as a factor that leads most adolescents to outrageous behaviours.

According to Dhossche, Snell, and Larder (2000), the use of hard drug abuse is associated with a number of increased body piercing. Research studies so far have shown a possible relationship between tattooing and violence (Carroll et al., 2002). A study done on adolescents with tattooing and body piecing at an early ages, showed that they had a greater risk of involvement in areas of drug abuse, sexual activity, disordered eating behaviours, and suicide compared to their peers without tattooing and body piercing (Carroll et al., 2002).

More findings continue to show that males with tattoos and females with body piercing are more likely to participate in physical fights, would receive medical care as a result of the fights, carry weapons and carry guns compared to their peers without tattoos and body piercing (Carroll et al., 2002). A variety of pathological behaviours are seen to be prevalent among these adolescents hence findings indicated that females with tattoos were generally found to be at high risk for suicide thoughts (behaviours and attempts), while males with tattoos were found to be associated with violence (Carroll et al., 2002). Females with body piercing were also found to be associated with violence (Carroll et al., 2002).

Farrow, Schwartz, and Vanderleeuw (1991) found tattooing in most adolescents to be associated with low self-esteem, delinquency, drug abuse, and participation in satanic rituals. This could explain that body modification in adolescents can be seen as a gateway or as a warning to various risk taking behaviours.

According to a study conducted on college men and women with tattoos, it was found that college men were involved in more cigarette smoking and having multiple sexual partners, while college women reported using drugs other than alcohol and shoplifting (Drews, Allison, & Probst, 2000). This means that cigarette smokers are more likely to have tattoos on their bodies than non-smokers (Rooks, Roberts, & Scheltema, 2000).

Carroll and colleagues (2002) emphasize that amateur markings suggest greater involvement with hard drugs. They further explain that those with amateur tattoos had them while in lower grade levels, then had more of such tattoos and obtained lower academic grades. Other findings showed that adolescents who obtained tattoos from professionals are less likely to experiment with hard drugs compared to those with homemade tattoos. Adolescents with professional tattoos were again reported to be less violent than those who did not know the status of their tattoo artist. This means adolescents who knew the professional status of their tattoo artist were found to have clear decision making prior to having a tattoo and have high self confidence (Carroll et al., 2002). This, according to Armstrong and McConnell (1994), may serve as a protective factor against the types of violence displayed by these individuals.

A gang-affiliated tattoo is also another form of behaviour among adolescents and is associated with using hard drugs (Carroll et al., 2002). This may show that adolescents because of their developmental phase do not have independent decision-making skills unlike mature adults.

3.6. Factors implicated in risk taking behaviours

3.6.1. Peer pressure and adolescent risk behaviours

According to Wild and colleagues (2004a), different risk behaviours are more strongly related to certain domains (family, school, peers, and self) of self-esteem than others. Low self esteem with effect from family and school domains combined with high self esteem with respect to peers were observed to correspond with increased risk-taking behaviours such as suicidality, alcohol use, risky sexual behaviours, and cigarette smoking in boys (Wild et al., 2004b). Most adolescents engage in more risky behaviours than adults because they are more vulnerable to the influence of their similarly risk-prone peers (Gardner & Steinberg, 2005). Most of them are more likely to be young people and extraverted, which means that they may be sociable optimists, like parties, take chances, and have many friends (Llewellyn, 2003).

According to Corben (2001), pleasure seeking, the desire to impress one's friends and the search for new experiences are all motivating forces that drive many teenagers to act without concern for consequences or without even being able to fully evaluate the potential risks they involve themselves in. On the other hand, adolescents find themselves caught up in the crises of being rejected or being referred to as not being "cool"; hence they engage in risky behaviour for the sake of acceptance and to fit in. It seems then that peer relationships increasingly replace family relationship in adolescents (Wild et al., 2004b).

A study showed that alcohol use among youths from grade 8 – 11, was accounted for by peer domain, tobacco by school domain and marijuana by peer and community (Morojele et al., 2002).

3.6.2. Demographics and risk taking behaviours

Age, race and gender are important predisposing factors towards risk-taking behaviour. Absenteeism and length of stay in the city were correlated with the increased use of tobacco and alcohol in adolescents of all demographics, whereas repeating a grade was correlated with alcohol

use among black males and substance abuse among coloureds and whites (Flisher, Parry, Evans, Muller, & Lombard, 2003).

3.7. Summary

Involvement in criminal activity and school dropouts all frequently occur due to the influence of substance abuse. It is clear then that substance abuse as an individual risk-taking behaviour can be implicated in other different risk-taking behaviours as described above. An adolescent growing up under such a critical time in their lives learns to depend heavily on the use of substances. It is important as well to reckon with the impact that social environment plays in the development of an adolescent. Put together, a poor environmental background and the rapid developmental changes can lead to a downward spiral of self-destructive behaviours called risk-taking behaviours. However, on their own behaviours such as risky sexual activities, suicide, recklessness, and dropping out of school without an influence of substances, can negatively impact on an adolescent's well-being. Finally, family lifestyles as seen above largely influence most of these problems.

RELATIONSHIP BETWEEN ADHD AND RISK TAKING-BEHAVIOURS

4.1. Introduction

ADHD is a progressive disorder and it can be masked by other problems as children enter their teenage years. ADHD in adolescents can be associated with a number of risk-taking behaviours and adolescents as they experiment with new rules may become vulnerable to pressures that can stimulate risk-taking behaviour (Tercyak, Goldman, Smith, & Audrain, 2002). A variety of behaviours are involved: recklessness, accident proneness, alcohol use, cigarette smoking, other drug use, and having many casual sexual relationships. The same behaviours were found to be linked to some of the ADHD symptomatology (Johnston & Mash, 2001). In Chapter two, all characteristic markers of ADHD have been clearly outlined. Impulsiveness has thus far been seen as a key characteristic of ADHD. Impulsiveness may be characterised as a failure of response suppression or a failure in executive functioning (Barkley, Edwards, Laneri, Fletcher, & Metevia, 2001; Willcutt et al., 2005). In a nutshell, impulsiveness and inattention were noted as the key symptomatology, which were linked to high risk-taking behaviours.

There seems to be an association between ADHD and risk-taking behaviours among adolescents. Studies have recently identified a link between ADHD and the abuse of alcohol and drugs as well as criminal activity (Schmitz, Cadore, Paczko, Kipper, Chaves, & Rohde, 2002). About 40% of adolescents living with ADHD have been arrested by their eighteenth birthday as a result of risky behaviours (Swanberg et al., 2005). An attempt on the relationship between ADHD and risk taking behaviours outlined in the study will be examined.

Research has established that the patterns of problems suffered by persons with ADHD are related to response suppression (Kooijmans, Scheres, & Oosterlaan., 2000; Scheres, Oosterlaan, & Sergeantl., 2001), and inability to wait for delayed reinforcement (Johansen et al., 2002),

preference for small, immediate rewards rather than later larger ones, and difficulty in timing (Rubia, Oosteraan, Sergeant, Brandeis, & Leeuwen, 1999). Various theories have tried to explain factors underlying the role of impulsiveness in risk-taking behaviours. They looked at factors such as brain dysfunction (Barkley, 1997a; Brown, Bullock, & Grossberg, 1999), and the role of other metabolic chemicals in the body (Johansen et al., 2002; Sagvolden et al, 2005b).

4.2. Biopsychosocial model of impulsiveness

Research work done is of the opinion that behaviours displayed by adolescents with impulsiveness are as a result of response inhibition (Moeller et al., 2001). A research study has found that individuals who are likely to become aggressive have larger evoked potential amplitudes and a higher Cerebral Spinal Fluid serotonin metabolite level than non-aggressive individuals (Moeller et al., 2001). Barratt, Stanford, Kent and Felthous (1997), state that individuals tend to act differently when given anticonvulsant treatment compared to their counterparts with planned aggression. According to Vitacco and Rogers (2001), impulsiveness is the best predictor of externalized behaviours and conduct problems.

Psychologically, impulsiveness is regarded as the determination of a response that is punished (Moeller et al., 2001). Adolescents are in most cases seen as being impatient and instead would prefer immediate responses to a larger delayed reward. On the other hand, because of their impulsive behaviour adolescents tend to make premature responses or are not able to withhold a response (Barkley, 1997c).

From the social approach, the model sees impulsiveness as a learned behaviour, coming from a family background in which adolescents learn to react immediately to obtain what is desired for satisfaction (Moeller et al., 2001). Adolescents in most cases have trouble in waiting for a change to happen, either for themselves or for others. The disorder does not necessarily cause harm to themselves alone, but also to others as well (Moeller et al., 2001).

4.3 Structural abnormalities in the brain

Research studies point to various anatomical abnormalities in the central nervous system of children and adolescents with ADHD (Castellanos et al., 2002). Studies using either computerized tomography (CT) or magnetic resonance imaging (MRI) have shed light on the developing brain of adolescents and have found some evidence of structural brain volume abnormalities among ADHD adolescents (Castellanos et al., 2002). The most common findings identified smaller volumes in regions of the corpus callosum, smaller hypoactivation of prefrontal brain, basal ganglia, and cerebellum.

The subcortical structures implicated by imaging studies (caudate, putamen, and globus pallidus) are part of the neural circuitry underlying motor control, executive functions (EF), inhibition of behaviour, and the modulation of reward pathways. However, other studies still argue that specific abnormalities relating to the disorder have not yet been convincingly demonstrated (Baumeister & Hawkins, 2001). It was assumed that adolescents with ADHD, when exposed to stimulants such as drugs would, have smaller brain regional volumes especially in caudate nucleus, cerebellum and frontal lobe similar to those unmedicated adolescents with ADHD.

Thus structural deficiency with decreased activity of parts of the brain responsible for normal functioning have been shown to be related to ADHD leading to predicted behaviours as seen with ADHD patients.

The brain undergoes two major developmental spurts i.e. in the womb, during childhood and through teen years. Wallis and Dell (2004) indicate that the prefrontal cortex as the area responsible for executive functions (planning, setting priorities, organising thoughts, suppressing impulses, and weighing the consequences of one's actions becomes) the last part of the brain to be pruned and shaped. On other part of the brain, which is less developed, is the amygdala, which explains why adolescents react impulsively. This part of the brain is hypothesised to be capable of decision making yet develops at the final stage (Wallis & Dell, 2004).

4.4. Executive function theory and ADHD

Executive functions (EF) are not fully formed in early childhood; they develop gradually as the brain continuously grows. The most important changes in the executive function abilities occur as a child develops into adolescence (Barkley, 1999). Luria (1980) suggests that certain areas of prefrontal cortex in man begin to mature at about the ages 4 to 7. According to Grodzinsky and Diamond (1992), full growth of the frontal cortex functions may not be complete until ages 12 to 15 or beyond. These developmental parts of the executive function need to be considered in the assessment of executive function damages of ADHD (Barkley, 1999).

Willcutt and colleagues (2005) explain that ADHD is associated with a major weakness in several key EF domains. Sonuga-Barke (2002) and Sonuga-Barke (2003) describe that adolescents suffer extreme deficiency in areas of executive functioning and motivational delay aversions pathways of ADHD, while others point out that ADHD adolescents experience cognitive deficiency in processing these dual pathways hence were seen as having a difficulty in displaying a preference for immediate rewards to delayed rewards. Sonuga-Barke (2003) mentions that the executive pathway had to do with a non regulation of thought and action that is primarily a core deficit in inhibitory control, whereas the motivational pathways mediate a link between behavioural symptoms, task engagement, and alteration in reward mechanisms. Research work has proved that impairment in processing of the two dual pathways will give rise to a manifestation of ADHD symptoms and more engagement in risky activities than their normal peers (Barkley, 2006; Toplak, Jain, & Tannock, 2005).

The dual pathways are seen to have independent contributions in the manifestation of ADHD symptoms at a neuropsychological level (Crone, Jennings, & van der Molen, 2003). On the other hand, multiple distribution in the brain circuits was hypothesized (Sonuga-Barke, 2003). It was observed that the executive pathways receive inputs from the dorsolateral prefrontal cortex to the dorsal portion of the neostriatum, as well as reciprocal connections from subcortical areas

that include the dorso-medial section of the thalamus (Toplak et al., 2005). The motivational dual pathway on the other hand, receive inputs from the ventral striatum, specifically the nucleus accumbens, with connections from frontal regions, including the anterior cingulate and orbitofrontal cortex, and the amygdala (Castellanos & Tannock, 2002; Toplak et al., 2005). Willcutt and colleagues (2005) further indicate that injuries in the prefrontal might sometimes produce behavioural hyperactivity, distractibility, or impulsiveness. The two theoretical aspects points that account for ADHD and risk-taking behaviour have thus been suggested.

4.4.1. Barkley's model of executive functions and ADHD

Barkley (1997c), suggests that a deficit in behavioural inhibition is the main cause of ADHD, and in turn, creates disturbances in five neuropsychological functions: working memory; internalisation of speech; self-regulation of affect; behaviour analysis and synthesis; and motor control. However, deficit in response inhibition may also be observed in externalising disorders such as Opposition Defiant Disorder and Conduct Disorder (Farrington, 1993; Milich, Hartung, Martin, & Haigler, 1994; Newman, Wallace, Strauman, Skolaski, Orelan, Mattek, et al., 1993).

Working memory: It is the provisional or working memory because it represents remembering to do. ADHD children were found to be less well controlled by internally represented information than normal children; they are more controlled by external stimuli and have difficulties with nonverbal working memory, planning and a sense of time (Barkley, 2001).

Verbal memory: Involves the retention and oral repetition of digit spans (i.e. a form of memory that provides for the recall of the past and their manipulation to construct a hypothetical future) (Barkley, 2001).

Internalisation of speech: Internalisation of speech is the process of turning speech on the self in a form of dialogic conversation with oneself that becomes increasingly more private, covert and internalised. This is a main contributor to the development of self-control (Barkley, 1997c).

Self-regulation of affect/motivation/arousal: There are three basic functions provided by the prefrontal lobes, which create self-regulation. Firstly, there must be a system that provides for the inhibition of more automatic and dominant responses that have as their function the maximisation of immediate consequences. Secondly, the inhibitory system provides for the power to interrupt ongoing behavioural patterns should information from immediately past behaviours in the sequence are indicating errors or ineffectiveness of the going pattern. Thirdly, this inhibitory system functions to control potential sources of interferences that could disrupt or destroy the activities taking place within the working memory (Barkley, 2001).

Behaviour Analysis and Synthesis: This is the ability of humans to generate novel, complex, hierarchically organised, and goal-directed behaviour. Goal-directed behavioural flexibility and creativity are believed to reflect the executive function of reconstitution, and might be measured by tasks such as the Wisconsin Card Sorting Test (Barkley, 2001; Meyer & Sagvolden, 2006).

Motor Control: According to Lezak and others (2004) and Barkley (1997a), ADHD children were found to be less coordinated in the testing of fine motor coordination. It might be measured by the Maze Coordination and Grooved Pegboard tasks (Meyer & Sagvolden, 2006).

4.4.2. Brown's model of executive functions and ADHD

Brown and colleagues (1999) developed a model of ADHD, which, like Barkley's model, sees ADHD as involving developmental impairment of executive functions. In his model, he included all three subtypes of ADHD in the DSM-IV (American Psychiatric Association, 1994). Brown's model derived from listening to a large number of adolescents and adults diagnosed with Attention Deficit Disorder (ADD) as they described the broad nature of their chronic impairment. What emerged from his listening was a list of impairments that include a wide range of cognitive impairments, which extend beyond the existing DSM-IV criteria. The wide range of impairments reported by these persons diagnosed with ADDs includes impairments in using of *working memory*, *regulation of affect*, *regulation of motivation and arousal*, and *inability to sustain appropriate behaviour to complete a*

task goal. All these are duties of the executive functions and can improve with the use of medication (Barkley et al., 2005).

Several executive functions were significantly related to many risk taking behaviours among adolescents (Barkley et al., 2002). Because of their lack of investment in time, adolescents become prone to immediate needs, hence the processing of working memory becomes distracted and a response is made prematurely (impulsively). Although the impairments in this list are experienced from time to time by virtually everyone, with persons suffering from ADD there were greater intensity and frequency of these difficulties than reported by others of the same age (Brown et al., 1999).

4.5. Dopamine dysfunction

The role of dopamine in modulating behaviour has been discussed in Chapter two. The dynamic developmental model of ADHD suggests that altered dopamine branches give rise to the different ADHD symptomatology, that is, a hypofunctioning mesolimbic dopamine branches give rise to delay aversion, a hypofunctioning mesocortical dopamine branch gives risk to poor executive functions, and a hypofunctioning nigrostriatal dopamine branch as a result gives rise to problems with motor functioning (Johansen et al., 2002; Sagvolden et al., 2005; Toplak et al., 2005). Damage to any of the systems may have a negative effect on behaviour. Behaviours such as deficient sustained attention, hyperactivity, increased behavioural variability, impulsiveness, poor motor control, clumsiness, longer reaction time, lack of planning and organization are observed as a result of dopamine dysfunction (Aase et al., 2006; Johansen et al., 2002a; Meyer & Sagvolden, 2006; Sagvolden et al., 2005).

Imaging studies explained that alteration in the prefrontal cortex (PFC) and its connections to striatum and cerebellum might result in ADHD (Arnsten, 2006). The PFC is known for its role in sustaining attention over delay, regulation of behaviour, and inhibiting destruction. PFC normally receives energy from its own neurochemicals, norepinephrine and dopamine, for proper

functioning in controlling behaviour and attention. Damage to the PFC will simply lead to forgetfulness, impulsiveness, poor planning, and locomotor hyperactivity. All these may pose risky behavioural tendencies in adolescents.

Dopamine is made from the amino acid tyrosine and first changed to L-dihydroxyphenylalanine (L-DOPA) and later to dopamine by the enzyme DOPA decarboxylase which functions in the brain as a result of pre-synaptic syntheses release (Forssberg, Fernell, Waters, Waters, & Tedroff, 2006). The frontal cortex and the basal ganglia are innervated by dopamine neurons and are involved in the control of the executive functions (working memory, response inhibition and motor timing) (Barkley, 1997a). There is increasing evidence into the relationship between dopamine in the basal ganglia and frontal lobe with ADHD (Li, Sham, Owen, & He, 2006). Studies by Forssberg and colleagues (2006), using a radio labelled chemical identical to L-DOPA named L-[¹¹C]DOPA, revealed that in male adolescents with ADHD the rate of dopamine synthesis was lower, particularly in the sub-cortical regions such as the nucleus accumbens, putamen and midbrain, which, indicates a regional difference and that ADHD specific changes due to dopamine synthesis are region specific (Forssberg et al., 2006).

This deficiency causes behavioural symptoms of ADHD, mostly attention processes, whereas serotonin alters impulse control (Robbins, Connors, Sheehan, & Vaughan, 2005). Forssberg and colleagues (2006) suggested then that hyperactivity and impulsiveness could be due to overactivity of dopamine in the basal ganglia while a lack of attention could be due to underactivity of dopamine in the cortical areas. The relationship between ADHD and the types of risk taking behaviours discussed in this study will be examined.

4.6. The link between risk taking behaviours and ADHD

4.6.1. Safety

Reckless driving was seen in ADHD adolescents and young adults due to inattention and more frequently associated with Conduct Disorder and Oppositional Defiant Disorder (Nada-Raja,

Langley, McGee, Williams, Begg, & Reeder, 1997). Having ADHD may have a huge impact in causing secondary impairments in EF, causing sufferers to act without hindsight and to be less able to anticipate future events (Nigg, Blaskey, Huang-Pollock, & Rappley, 2002). Adolescents tend to make risky decisions about vehicle approach times because they are unable to accurately appreciate the interrelations among event duration velocity and distance (Clancy, Rucklidge, & Owen, 2006). Adolescents with ADHD are always at the risk of accidental injuries because of their neuropsychological deficit.

The most leading cause of trauma related hospital admission among ADHD adolescents is pedestrian injuries. The ability to cross the road safely is a complex cognitive task, which involves a collaboration of well-developed knowledge and skills, including a specific attentional control process to assess complex traffic situations and to choose and execute the appropriate response (Clancy et al., 2006). It then becomes important that adolescents have a good perceptual motor skill and good coordination between the perception of time to arrival of approaching and the individual's own walking ability. Adolescents with ADHD display poor decision-taking, including inattention and impulsiveness; hence they have difficulty in applying safe road crossing when they are supposed to cross the road.

Research study showed that ADHD was related to fractured injuries as well as greater driving risk (Maughan, Rowe, Messer, Goodman, & Meltzer., 2004). Most traffic accidents among adolescents with ADHD are as a result of their behaviour, which is more likely to be hyperactive, impulsive, or inattention as well as impairment in self-regulation and working memory (Clancy et al., 2006). Brook and Boaz (2006), explained that adolescent's proneness to accidents as having difficulty in intellectual processing and their being less attentive. As a result ADHD sufferers have more traffic fines for speeding and vehicle crashes than others. Moreover, their impaired judgment skill will, therefore, cause problems and end in accidents (Woodward, Fergusson, & Horwood,

2000). Nada-Raja and colleagues (1997) explain that proneness to auto accidents among adolescents with ADHD is due to their aggressive driving.

According to Barkley (2005), ADHD may have a huge impact on industries. It will therefore be necessary that employees be screened for ADHD before they can be employed as drivers in order to improve safety and to reduce costs. ADHD adolescents and young adults are likely to be involved in traffic accidents with great damage to their vehicles and this risk is increased in male adolescents associated with other ADHD risk behaviours as well as substance abuse and excessive risk-taking behaviours (Barkley et al., 2005).

4.6.2. Substance use

The most researched adolescent psychiatric condition associated with substance use is ADHD (Ernst et al., 2006). ADHD is an important factor in the development of alcoholism, which together with substance use disorder tends to appear at an earlier age for adults with ADHD compared to those without ADHD (Abrantes, Strong, Ramsey, Lewinsohn, & Brown, 2005). Moreover, ADHD is considered to accelerate the transition from substance abuse to dependence and up to 40% of ADHD adolescents were reported to exhibit alcohol or substance use disorder (Kim et al., 2006). Studies have shown that externalizing of behaviours such as aggression, hyperactivity, conduct problems, and impulsiveness are associated with greater risk for substance initiation (Ernst, Luckenbaugh, Moolchan, Leff, Allen, Eshel et al., 2006).

Among the three commonly used substances among adolescents alcohol (46%) is the most frequently used substance followed by tobacco (35%), and marijuana (28%). Of these, alcohol users showed more impulsiveness compared to non-alcohol users (Ernst et al., 2006). There seems to be a biological factor underlying the association of impulsiveness with alcohol in adolescents. Studies have reflected that an alteration in serotonergic function may result in impulsiveness and aggression in alcohol users (de Boer & Koolhaas, 2005; Nelson & Chiavegatto, 2001). Serotonin is well known for its function in modulating impulse control (Robbins et al., 2005). De Boer and

Koolhaas (2005), stated that both aggression and impulsiveness differ in terms of affective processes i.e. aggression is expressed in association with strong emotions whereas impulsiveness is externally driven particularly in the context of ADHD (de Boer & Koolhaas, 2005). Both aggression and impulsiveness share the same genetic factors.

According to Faraone, Doyle, Mick, and Biederman (2001), heredity is a pivotal in the mechanism of ADHD and alcohol dependency and the two may share an overlapping source of genetic components (Johann, Bobbe, Putzhammer, & Wodarz, 2003). The candidate (potential) gene associated with alcohol use has been identified. These genes include the dopamine type 2 receptor genes (DRD2), aldehyde dehydrogenase type 2 gene (ALDH2), serotonin transporter gene (5-HTT), serotonin 1B receptor gene, and catechol-O-methyltransferase gene (COMT). All these genes are also the candidate (potential) genes associated with ADHD (Bobb, Castellanos, Addington, & Rapoport, 2005).

ADHD is associated with substance disorder and cigarette smoking among adolescents (Abrantes et al., 2005). Most adolescents experiment first with smoking along with their peers as early as 15 years and that can be regarded as a gateway to other advanced forms of drug use (Tercyak et al., 2002a). Externalizing behaviours such as fighting, destroying objects, and arguing are signs of aggression, which plays a major role in tobacco and marijuana use initiation (Ernst et al., 2006). Symptoms such as hyperactivity and inattentiveness have been shown independently to contribute to daily smoking in females while hyperactivity alone contributed to increased smoking in boys (Galera et al., 2005).

Research on the possible relationship between ADHD and nicotine dependence so far has shown that ADHD is linked with an early onset of regular smoking and a higher risk for cigarette smoking (Tercyak et al., 2002b). In a study conducted on tobacco use among ADHD adolescents, it was reported that by age 17 close to 46% researched participants with ADHD, reported daily

cigarette smoking compared to their counterparts at 24%. Having ADHD in this regard will precipitate and predispose adolescents to engage in risky behaviours such as cigarette smoking.

The issue around why ADHD is strongly related to cigarette smoking has become controversial. Potter and Newhouse (2004) mention that nicotine has an effect on improving attention, learning, memory, and behavioural inhibition in adolescence with ADHD. Scientists have tried to come up with the possible explanation that the effect of nicotine remediates ADHD symptoms (Tercyak et al., 2002b). Nicotine is a known central nervous system stimulant and activates the release of the chemical dopamine (Tercyak et al., 2002b). The substance is widely used by adolescents because it creates a sense of “feel good” and improves sustained attention (Mirza & Stolerman, 1998).

In Chapter 2 it is documented that altered dopamine synthesis gives rise to impaired behaviour, hence the use of nicotine will activate the release of dopamine to substantiate and regulate symptoms of ADHD, such as attentional impairments (Ernst et al., 2001). This shows that adolescent smokers with ADHD symptoms will continue to increase smoking and become lifetime smokers.

4.6.3. Risky sexual behaviour

There are childhood conduct problems (ODD and CD) that contribute to risky sexual behaviour in individuals with ADHD (Molina & Pelham, Jr., 2003). ADHD, on the other hand, can independently contribute to risky sexual behaviours. This is increased by factors such as peer relations, which are common among adolescents with ADHD (Flory, Molina, Pelham, Gnagy, & Smith, 2006). A study conducted on psychosocial intervention on ADHD/C vs. ADHD/I adolescents reported that adolescents with ADHD/C engage in high sexual drive and early dating experiences compared to the other group (Canu & Carlson, 2003).

Family factors such as low parental monitoring and trust, as well as poor quality parental communication regarding safe sex, may contribute to a higher rate of risky sexual behaviour among

adolescents with ADHD (Barkley, 2006). In some studies, ADHD is mostly associated with males with socially deviant sexual arousal such as paraphilias (PAs) (Vaih-Koch & Bosinski, 1999). According to DSM IV-TR (American Psychiatric Association, 2000) Paraphilias are sexual disorders characterised by repetitive, social deviant expressions of intensified sexual arousal and associated behaviours. The use of cocaine among paraphilic males is prevalent and most of reported a history of childhood physical/sexual abuse, lower educational achievements, behavioural problems, more extensive involvement with the criminal justice system and a history of psychiatric hospitalization (Kafka & Hennen, 2002).

4.7. Other risk taking behaviour

Swanberg and colleagues (2005) stress that the usual characteristics of adolescents with ADHD are a desire for high-risk activities, whereas as children they can be prone to accidents. DiScala, Nescohier, Barthel, and Li (1998) confirm that even as adolescents, they still show proneness to accidents, which may lead to severe injuries and long term hospitalization. ADHD sufferers can show other talents such as creativity, thinking and leadership skills (Swanberg et al., 2005). Adolescents have such an intense desire for high risk activities such as bungee jumping, car racing, motorcycle riding, white-water rafting, and gambling, to mention a few. Among adolescents gambling has become an increasingly risk-taking behaviour.

Research work has strongly indicated that pathological gamblers display what is known as impulse control disorder rather than pathological gambling (Specker, Carlson, Christenson, & Marcotte., 1995). In a conducted study of 35% of pathological gamblers, it was observed that only 20% of those had ADHD (Specker et al., 1995). Other risky behaviours observed among adolescent gamblers were compulsive buying and compulsive sexual behaviour. Delfabbro (2004) indicate in his report that among adolescents who gambled regularly, 23% engaged in cigarette smoking, 32% drank alcohol, 28% smoked marijuana, while 13% used hard drugs. He further mentions that adolescents who gamble intensively are likely to go on and become problem

gamblers. This is the reason why gamblers have difficulty in controlling their habit even though they want to quit. According to Swanberg and colleagues (2005), ADHD does not go away at the end of childhood or adolescence yet the symptoms lessen with neurological social maturing and, therefore, with instruction, skills, and mentoring.

4.8. Summary

Understanding risk-taking behaviours in adolescents can be very challenging, especially when trying to highlight the fact that most of these behaviours are as a result of an underlying disorder from childhood (Chang & Chuang, 2000). Another difficulty arises because certain risk taking behaviours typical of ADHD, CD, and ODD cannot be clearly isolated as being either one or the other (Sondeijker, Ferdinand, Oldehinkel, Veenstra, Winter, Ormel, et al., 2005).

As the key symptom of ADHD, impulsiveness seems to play a pivotal role in influencing most risk-taking behaviours, especially smoking. This shows that most behaviours manifested by this age group are a result of impulsiveness as a symptom of ADHD. Adolescence is a time of experimenting and at this age adolescents would experiment with different substances and situations for various reasons such as curiosity, experimentation and fun, peer pressure, and dependency (Kaye, 2004; Rey, Sayer, & Prior, 2005). However, the earlier they start, the higher the risk of developing a disorder.

PROBLEM STATEMENT AND HYPOTHESES

5.1 Introduction

Attention Deficit Hyperactivity Disorders (ADHD) is a common neurodevelopmental behavioural disorder among school-age children, which in most cases continues in adolescence and adulthood, and is mainly characterised by symptoms of impulsiveness, hyperactivity and/or inattention (Biederman et al., 2000b). ADHD poses a complex problem to parents, caregivers, teachers, and people close to the sufferers. It can be seen as a psychiatric disorder with a great impact on behaviour (Barkley, 1997a), which is found to be more prevalent in boys than in girls (American Academy of Pediatrics, 2000; Biederman, 2005; Swanson et al., 1998).

Adolescence is a stage in which a person undergoes a period of exploring and behavioural change (Corben, 2001). This is a time during which adolescents will display behaviours and attitudes that are not socially acceptable. Serious offences are usually committed against the law, while teachers and parents find it difficult to cope with certain disciplinary behaviours of adolescence. It is usually the case that parents and teachers are unaware of the basic and fundamental root cause of these behaviours and as a result, are not capable of addressing the problem in a proper manner. Most children are not diagnosed as suffering from ADHD until they have reached adulthood. It is important that the basic defining symptoms of this neuropaediatric disorder be understood in every stage of childhood development. That is, ADHD symptoms typical to adolescence have to be well-understood (Corben, 2001).

The present study will focus mainly on risk-taking behaviours, which may be due to impulsiveness and inattention. In adolescence this will typically be alcohol use, cigarette smoking, drug use, traffic violation and sexual risk-taking behaviour. The hope is that risky behaviours by adolescence point to the relationship with ADHD symptoms. Researchers have

agreed that behaviour changes and risk taking in adolescence is a normal developmental phase. It is, therefore, important to describe and differentiate between normal and expected behavioural changes in adolescents with varying changes of ADHD symptoms.

5.2. Problem statement

There are various kinds of behaviours manifested in most adolescents and many of them are associated with impulsiveness, which is a key symptom of Attention Deficit Hyperactivity Disorder (ADHD). These include traffic violation, sexual activity, and the use of various substances. Such behaviours are observed as risk-taking and, therefore, linked with ADHD as the underlying factor. Research work has shown that typical characteristics of adolescents with ADHD are a desire for high-risk activities and that there is a relationship between ADHD and risk taking behaviour (Swanberg et al., 2005).

Research work has linked inattention to risk-taking behaviours (August, Winters, Realmuto, Fahnhorst, Botzet, & Lee, 2006; Nada-Raja et al., 1997) but there is less information available on impulsiveness and high risky behaviours. Barkley and Brown's model of the executive functioning (EF) indicates that a deficit in behavioural inhibition is the major cause of ADHD, and in turn, creates disturbances in five neuropsychological functions and cognitive impairments (Barkley, 1997a; Brown, 2000). In this study an attempt is made to establish whether there is a relationship between risk-taking behaviour and the most common symptoms of ADHD (inattention, hyperactivity/impulsiveness).

5.3. Aim of the study

The main goal of this research project is to explore the relationship between ADHD symptoms in adolescents and risk-taking behaviours such as a higher incidence of tobacco use, substance abuse, traffic violations, and sexual promiscuity. The study will furthermore investigate if there is a relationship between a specific ADHD symptom and specific risk-taking behaviours.

Dinn, Ayciegi, and Harris (2004) found that inattentiveness was significantly related to smoking initiation. This will then help to target and address key symptoms of ADHD that lead to adolescents' misbehaviour. The aim of the study will also be to investigate the performance of adolescents with ADHD on two psychometric tests, which measure impulsiveness as a function of Executive Functions deficiency (poor response inhibition). A study conducted by Barkley and colleagues (2002a) and Dougherty, Bjork, Harper, Marsh, Moeller, Mathias, and others (2003a), showed that adolescents with impulsive behavioural syndromes will produce lower inhibited response rates compared to healthy adolescents.

5.4. Research Hypothesis

5.4.1 Research hypothesis 1

There is a relationship between the symptoms of ADHD (Inattention and Hyperactivity/Impulsiveness) and risk taking behaviours, namely: safety transgressions, tobacco use, alcohol use, cannabis use, other drug use and sexual behaviour

Specific null hypotheses derived from research hypotheses 1:

- 1.1. There is no relationship between safety and Inattention.
- 1.2. There no relationship between safety and Hyperactivity/Impulsiveness (H/I)
- 1.3. There is no relationship between tobacco use and Inattention.
- 1.4. There is no relationship between tobacco use and Hyperactivity/Impulsiveness.
- 1.5. There is no relationship between alcohol use and Inattention.
- 1.6. There is no relationship between alcohol use and Hyperactivity/Impulsiveness.
- 1.7. There is no relationship between cannabis use and Inattention.
- 1.8. There is no relationship between cannabis use and Hyperactivity/Impulsiveness.
- 1.9. There is no relationship between other drug use and Inattention.
- 1.10. There is no relationship between other drug use and Hyperactivity/Impulsiveness

1.11. There is no relationship between risky sexual behaviour and Inattention.

1.12. There is no relationship between risky sexual behaviour and Hyperactivity/Impulsiveness

5.4. 2 Research hypotheses 2:

There is a relationship between performance on neuropsychological tests sensitive to the symptoms of ADHD (WCST and GoStop paradigm task) and risk-taking behaviours, namely: tobacco use, alcohol use, dagga use, other drug use, sexual behaviour, and safety.

Specific null hypotheses derived from research hypotheses 2

2.1. There is no relationship between perserverative errors on the WCST and tobacco use.

2.2 There is no relationship between non-perserverative errors on the WCST and tobacco use

2.3. There is no relationship between category shift on the WCST and tobacco use.

2.4. There is no relationship between the GoStop paradigm task and tobacco use

2.5. There is no relationship between perserverative errors on the WCST and alcohol use.

2.6. There is no relationship between non-perserverative errors on the WCST and alcohol use.

2.7. There is no relationship between category shift on the WCST and alcohol use.

2.8. There is no relationship between the GoStop paradigm task and alcohol use.

2.9. There is no relationship between perserverative errors on the WCST and dagga use.

2.10. There is no relationship between non-perserverative errors on the WCST and dagga use.

2.11. There is no relationship between category shift on the WCST and dagga use.

2.12. There is no relationship between the GoStop paradigm task and dagga use.

2.13. There is no relationship between perserverative errors on WCST and other drug use.

2.14. There is no relationship between non-perserverative errors on WCST and other drug use.

2.15. There is no relationship between category shift on the WCST and other drug use.

2.16. There is no relationship between the GoStop paradigm task and other drug use.

2.17. There is no relationship between perserverative errors on the WCST and risky sexual behaviour.

2.18. There is no relationship between non-perserverative errors on the WCST and risky sexual behaviour.

2.19. There is no relationship between category shifts on the WCST and risky sexual behaviour.

2.20. There is no relationship between the GoStop paradigm task and risky sexual behaviour.

2.21. There is no relationship between perserverative errors on the WCST and safety transgressions.

2.22. There is no relationship between non-perserverative errors on the WCST and safety.

2.23. There is no relationship between category shift on the WCST and safety transgressions.

2.24. There is no relationship between the GoStop paradigm task and safety.

A full description of the statistical test used to accept and reject the hypotheses formulated here will be outlined in the next chapter.

RESEARCH METHODOLOGY

6.1. Introduction

The purpose of this study was to establish the association between ADHD symptoms (inattention, hyperactivity/impulsivity) and risk taking behaviours such as tobacco use, alcohol use, dagga use, other drug use, sexual behaviour, and traffic violation among adolescents. The study also focused on investigating the role of neuropsychological testing in predicting certain risk taking behaviours. The reason for targeting this area and population was that the type of crimes and maladaptive behaviour reflected by this age group are mostly common to behaviours manifested in adolescents with impulsive behaviours. Behaviours such as accident proneness, unsafe sexual activity, recklessness, and substance abuse are the key symptoms of behaviour common in young adults. Studies have earlier shown that certain symptoms of ADHD such as inattention have a role in initiating risk behaviours such as smoking and substance use (August et al., 2006).

Neuropsychological assessment tests are basically used to confirm the findings conducted by the clinician with guidance from the DSM-IV-TR (American Psychiatric Association, 2000) in diagnosing the disorder. Two methods were used to investigate the symptoms associated with ADHD (inattention, hyperactivity and impulsiveness) and risk-taking behaviour among adolescents. Barkley and Brown's model of ADHD suggests that deficiency in the executive functioning may result in impulsive behaviour (Barkley, 1997a; Brown, 2000). The Barkley's Symptom Scale for Adolescents (Barkley & Murphy, 2006) and Youth Risk Behaviour Scale (Centres for Disease Control and Prevention, 1990) were also used to measure ADHD symptoms and tendencies for risk-taking behaviours among adolescents. This can be used to predict the relationship between ADHD symptoms and poor performance as measured by these neuropsychological tests.

The neuropsychological tests such as the GoStop paradigm (Dougherty et al., 2003b) were used to measure impulsivity while the Wisconsin Card Sorting Test (Grant & Berg, 1948) was used to measure domains of the executive functioning (EF) (unhold poor response inhibition, which underlies impulsive behaviour).

6.2. Research Design

This is a correlation study and the participants were chosen irrespective of an ADHD diagnosis. The symptoms of ADHD as measured by the Barkley's Symptoms Scale for Adolescents (BSSA) were correlated with responses from the Youth Risk Behaviour Scale (YRB) as well as responses from the two neuropsychological tests i.e. WCST and GoStop paradigm task.

6.3. Sample

The sample consisted of adolescent boys who were not screened for ADHD, aged 16-20 years, who were randomly selected. A mean of 100 (n=100) participants was drawn from the Mankweng and Polokwane populations (Pax High School and University of Limpopo).

The Barkley's Symptom Scale for Adolescents developed by Barkley and Murphy (2006) and the Youth Risk Behaviour Scale (Centres for Disease Control and Prevention, 1990) were handed out to the participants and the researcher was available during the completion of the questionnaires to assist the participants in case they experienced any difficulties. After the completion of the questionnaires the participants were administered with two computerised neuropsychological tests before they could leave the room.

The participation was voluntary and informed consent was obtained from the school principal and parents or guardians for adolescents doing <7, grades 8 to 12. Participants from the university gave their own consent because most of them were above the age of eighteen. The purpose of the study was also clearly outlined to them.

Adolescents with a medical history of neurological problems (e.g. epilepsy, head injuries, cerebral palsy, or cerebral malaria) were excluded from the research project. None of the participants used psychostimulant medication at the time of testing.

Table 6.1 shows the mean age, as well as the scores for Inattention and Hyperactivity/Impulsiveness for the sample.

Table 6.1 Mean scores for age and ADHD symptoms for the sample

	N	Mean
Age	100	17.07 ± 1.52
Inattention score	100	7.14 ± 4.12
Hyp/Imp score	100	7.98 ± 4.47

Figure 6.1 shows the age distribution of the sample

Figure 6.1 Age distribution of the sample (n= 100)

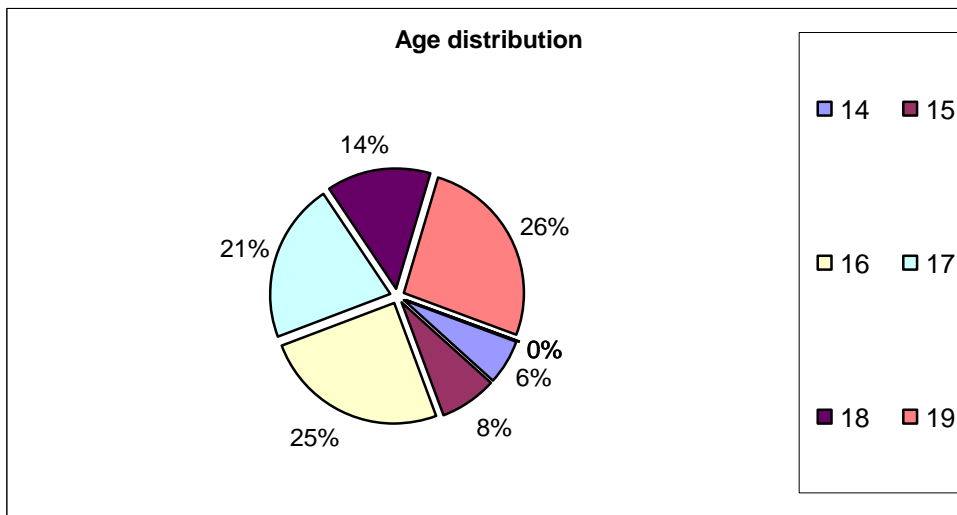


Figure 6.2 illustrates the distribution of the level of education of the sample

Figure 6.2 Education level distribution (n= 100)

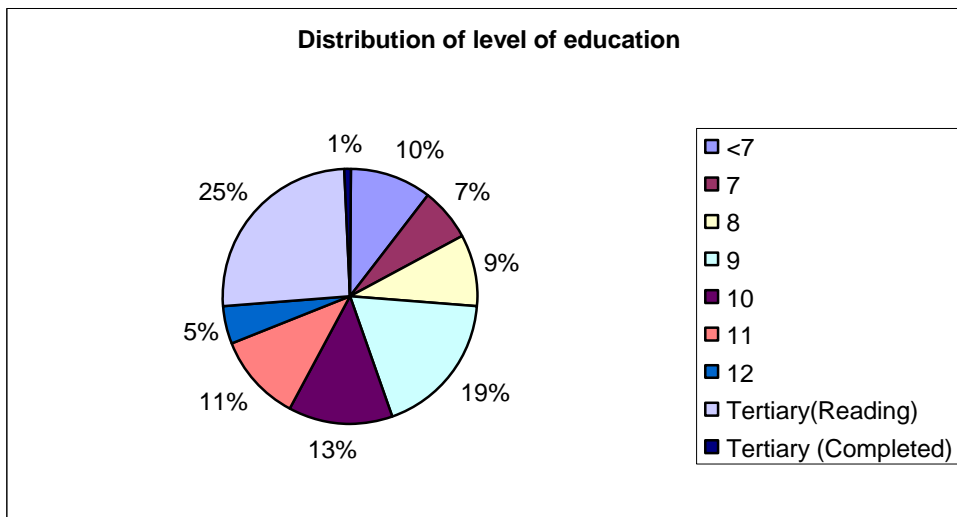
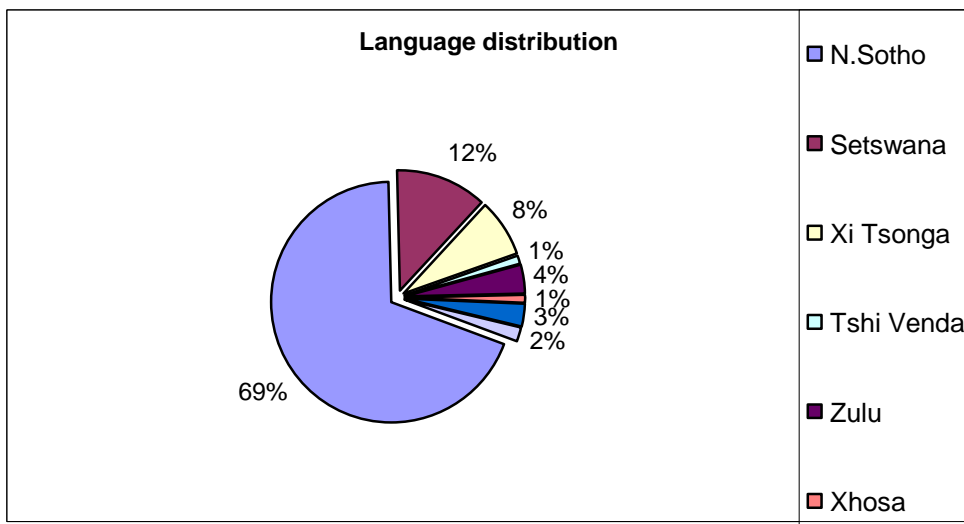


Figure 6.3 illustrates the distribution of the language groups of the sample

Figure 6.3 Language distribution of the sample (n = 100)



6.4. Measurement Instruments

The following methods were used in the study: Barkley's ADHD Symptom Scale for Adolescents, Youth Risk Behaviour Scale (YRBS), the Wisconsin Card Sorting Test, and the GoStop Impulsivity Paradigm.

6.4.1. Barkley's Symptom Scale for Adolescents

Barkley's Symptoms Scale for Adolescents (Barkley & Murphy, 2006) was used to assess the presence and degree of ADHD symptoms of the participants. It contains the symptoms for ADHD as they appear in DSM-IV (American Psychiatric Association, 1994). The scale was translated and back translated into Northern Sotho for those participants who were not fluent in English. The scale consisted of 18 items that measured ADHD-related symptoms. The respondents were asked to rate their behaviour on a four point scale comprising of the following options: *never or rarely* (0) *sometimes* (1) *often* (2) and *very often* (3). See appendix

6.4.2. Youth Risk Behaviour Scale (YRBS)

The Youth Risk Behaviour Scale – YRBS (Centres for Disease Control and Prevention, 1990) is a questionnaire used to assess and monitor health risk behaviours associated to social problems among youth and adults. The scale was developed in 1990 with the idea to measure the prevalence of health risk behaviours, whether health risk behaviours increase, decrease or stay the same over time, to measure the co-occurrence of health risk behaviours, and to provide comparable data among subpopulations of youths. The questions were in the form of multiple-choice, where the respondent was to circle the most relevant response. See appendix.

6.4.3. Wisconsin Card Sorting Test

This is a computerized test, used to test frontal lobe functions (Lezak et al., 2004), in which the individual is asked to place 128 different cards under four stimulus cards, according to a principle that the child must deduce from the computer feedback given to the individual's placement of the cards (Heaton & Pendleton, 1981). The test has proved to be useful to neuropsychologists since it has a high sensitivity to frontal lobe dysfunction. The purpose of the test is to assess the ability to form abstract concepts, to shift and maintain set, and utilize feedback. The test is considered a measure of executive functioning in that it requires strategic planning,

organized searching, the ability to use environmental feedback to shift cognitive sets, goal oriented behaviour, and the ability to modulate impulsive responding (Strauss, Spreen, & Hunter, 2000).

This WCST test (Strauss et al., 2000) measures the subject's ability to shift categories of cards according to the set rule, number of preservatives and a number of non-preservative errors. See appendix B.

Category shifted:

The sorting rule shifts after every 10 consecutive responses. The rule cycles through colour, form, and then number. The number of changes is denoted as categories achieved and most healthy subjects should achieve at least 4 shifts of the sorting rule.

Perserverative response:

A perserverative response is defined as one that matches the perseverated into principles, i.e. a response that would have been correct in the previous stage, e.g. sorting a correct set to colour when the current rule is form.

Perserverative Errors:

A preservative error is an incorrect preservative response. A score above 13 are predictive of brain damage and above 16 of frontal lobe involvement.

Non-Perserverative errors:

A non-preservative error is one that is incorrect but not preservative.

The instructions for the Wisconsin Card Sorting test were as follows and were given in the subject's own languages and in English:

When the test starts, you will see the screen as shown below. Please sort out the deck of cards, using the mouse, by moving each card to the placeholder below the key card you think it matches, once you have moved a card, you cannot move again. After each sort move, you will receive a feedback, informing you if the sort was correct or not. Please try to sort the cards correctly. Good Luck.

6.4.4. GoStop Paradigm Task

This is a computerized test, developed by Dougherty and colleagues (2003b). The test was developed specifically to measure response inhibition as well as inhibited response and impulsivity

or motor activity in the participants. The test consists of a series of visual stimuli (i.e. numbers), which appears in a black and a red colour. Participants are requested to attend to a series of visual stimuli and respond when a target “go” signal appears, and withhold responding when a “stop” signal or non-target stimuli appears. The “go” signal is a matching number that changes to black, while the “stop” signal represents a matching number changing from black to red. During test taking the participants are supposed to click on the matching number appearing only in the colour black while still appearing on the screen and withhold once a different number or similar number appears in red

The appearance of stimulus in the task differs in time, i.e. stimulus occurring in an interval of 50, 150, 250 and 350 milliseconds following the go stimulus onset. The Go Stop task is also designed to regulate expression versus inhibition of motor behaviour and stimulus modality (visual). The test lasts for 11.5 minutes and there will be a break in between and then continue with the test (Dougherty et al., 2003b).

The instructions for the Gostop impulsivity test were as follows:

When the test starts, you will see a series of stimuli flashing in a red colour and a black colour. Every time the matching number flashes in a black colour you should click the left button of the mouse while the numbers are still visible on the screen. Once the matching number flashes in a red colour, you must withhold the mouse i.e. you don't click the mouse. Remember to click the mouse while the number is still visible on the screen in order to collect points. The test lasts for 11.5 minutes and there will be a ten second break in between, and then you will continue with the test. Good luck.

6.5. Procedure

A letter to the school principal to obtain consent to conduct this study was sent out. A letter obtained from the Ethics Committee of the University of Limpopo stating the purpose of the study was presented to the respective school principals who in turn presented the research project to the teachers. After having obtained the necessary permission, the participants were given a questionnaire stating their biographical information, Barkley's ADHD Symptoms Scale and the

Youth Risk Behaviour Scale to complete. After completion, each participant had to play two computerised neuropsychological tests. Adolescents with a history of neurological trauma (e.g. epilepsy, head injuries, cerebral palsy, or cerebral malaria), psychosis, or other severe psychiatric disorders were not included in this study.

The participants, particularly from tertiary institutes, were tested in their leisure time and at school they were tested on a weekend as arranged with the school principal and teachers. The researcher herself administered the test for a period of three weeks. Participants, who had difficulties in using the mouse, particularly with the Wisconsin card sorting test, were asked to point out where they wanted the card to be placed while the researcher placed the cards for them. The tests were administered in the following order: (1) Questionnaire (consisting of Parts A, illustrating biographical information of the adolescents; B, illustrate Barkley's ADHD symptoms scale and C, illustrate Youth Risk Behaviour Scale), (2) WCST (3) GoStop paradigm task. The procedure lasted about 45 minutes per participant.

6.6. Data Analysis

The ADHD scores on Barkley's Symptoms Scale for Adolescents - BSSA (Part B of the questionnaire) were correlated with scores on the Youth Risk Behaviour Scale – YRBS (Part C of the questionnaire) as well as with the scores obtained on the Wisconsin Card Sorting Test–WCST and the Go-Stop Task, both tests for response inhibition (impulse control).

The computer programme STATISTICA 6.1 (StatSoft, 2003) was employed. Descriptive statistics were used to describe the responses on the BSSA and the YRBS and the scores on the WCST and GoStop Impulsivity Paradigm. Pearson's product-moment correlations were computed to investigate the relationship between ADHD symptoms on the BSSA and the responses on the YRBS and the scores on the WCST and GoStop Impulsivity Paradigm.

RESULTS

7.1. Introduction

The aim of the study was:

1. to establish a relationship between the symptoms of ADHD (Inattention and Hyperactivity/Impulsiveness) and common risk taking behaviours of adolescence, namely violation of safety rules, tobacco use, alcohol use, cannabis use, use of other drugs, and risky sexual behaviour.
2. to establish a relationship between the performance of two psychometric tests, which are sensitive to ADHD symptomatology (especially impulsiveness) and common risk-taking behaviours of adolescence, namely violation of safety rules, tobacco use, alcohol use, cannabis use, use of other drugs, and risky sexual behaviour.

This chapter will report on the results obtained when the collected data were analysed for testing the postulated hypotheses.

7.2 Results of the study

The results are presented in the following format:

- Descriptive statistics in table form.
- Results of the correlations to establish a relationship between the symptoms of ADHD (Inattention and Hyperactivity/Impulsiveness) and performance on psychometric tests which are sensitive to impulsive behaviour, and the risk taking behaviours, violation of safety rules, tobacco use, alcohol use, cannabis use, use of other drugs, and risky sexual behaviour.

- Scatter plots to illustrate the significant relationships between ADHD symptoms and test performance and risk taking behaviour.

7.2.1 Descriptive statistics

Table 7.1 represents the results obtained on the various scales of the YRBS for the sample.

Table 7.1. Scores on the risk taking behaviour scales of the YRBS (N = 100)

Measurement scale	Mean
Safety risks	6.48 ± 4.05
Tobacco use	7.38 ± 8.32
Alcohol use	7.71 ± 6.28
Dagga use	2.97 ± 4.55
Other drugs	2.03 ± 4.58
Sexual behaviour	11.19 ± 5.42

Table 7.2 depicts the results obtained on the Inattention and Hyperactivity/Impulsiveness subscales of Barkley's Symptom Scale for Adolescents.

Table 7.2. Results on Barkley's Symptom Scale for adolescents

ADHD symptoms	N	Mean
Inattention	100	7.1400 ± 4.12
Hyperactivity/ Impulsiveness	100	7.9800 ± 4.46

Table 7.3 displays the results obtained on the psychometric measures (WCST and GoStop Task).

Table 7.3 Results of the Psychometric measures (WCST and GoStop Task)

Psychometric measure	N	Mean
WCST	100	
<i>Perseverative errors</i>		13.460 ± 11.1
<i>Non- Perseverative</i>		58.290 ± 24.8
<i>Categories Shift</i>		2.110 ± 2.29
Go Stop	100	496.250 ± 45.9

7.2.2 Correlation results

In order to investigate whether the symptoms of ADHD, Inattention and Hyperactivity/Impulsiveness, and the performance on tests sensitive to impulsive behaviour are related to risk-taking behaviours, the scores obtained were correlated with each other, using Pearson's Product-Moment. Tables 7.4 and 7.5 show the correlations obtained.

Table 7.4. Correlations between ADHD symptoms and risk scores

	Inattention	Hyperactivity/ Impulsiveness
Safety	0.04	0.03
Tobacco use	0.10	0.02
Alcohol use	0.27*	0.30*
Dagga use	0.32*	0.29*
Drug use	0.27*	0.24*
Sexual behaviour	-0.02	0.03

*p < 0.05

There were statistically significant correlations between inattention and alcohol use, dagga use, and drug use ($p < 0.05$). However, the correlations were weak. There were also statistically

significant correlations between alcohol use, dagga use, and drug use ($p < 0.05$). The correlations were also weak.

Table 7.5 gives the results of the correlations between the results obtained on the psychometric tests (WCST and GoStop) and risk taking behaviours.

Table 7.5 Correlations between risk-taking behaviours and test results

	WCST			Go-Stop
	Pers. Errors	Non-pers. errors	Categories	
Safety	0.03	-0.06	0.02	-0.05
Tobacco use	-0.02	0.00	0.03	0.08
Alcohol use	0.11	-0.16	0.12	-0.02
Dagga use	-0.01	-0.05	0.02	-0.14
Drug use	0.04	0.15	-0.16	-0.23*
Sexual behaviour	0.12	-0.24*	0.24*	-0.07

* $p < 0.05$

There was a statistically significant negative correlation between the number of non-perservative errors on the WCST and risky sexual behaviour ($p < 0.05$) and a statistically positive correlation between categories completed on the WCST and risky sexual behaviour ($p < 0.05$). The correlations were however, weak.

There was a statistically significant negative correlation between drug use and scores on the GoStop task. The correlation was, nevertheless, weak.

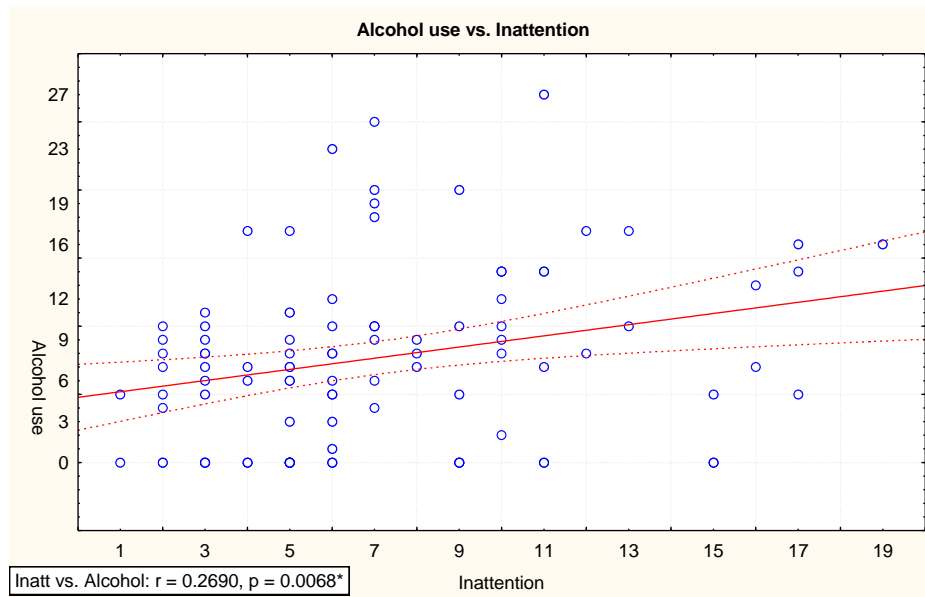
7.2 3 Scatter plots

The scatter plots to illustrate the obtained statistically significant correlations will be depicted in this section.

7.2.3.1 Inattention

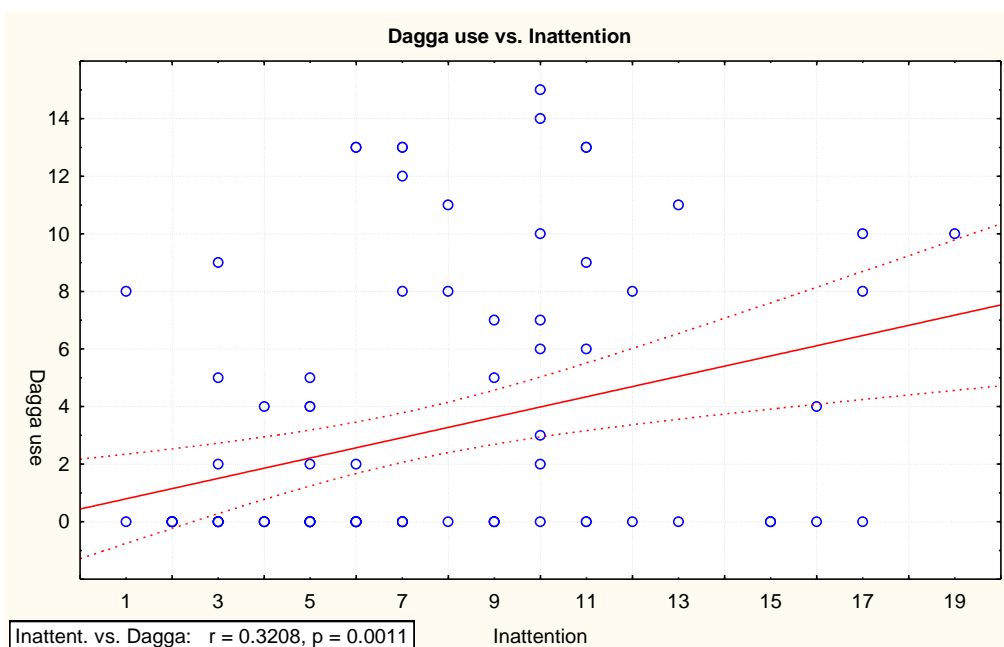
Figure 7.1 illustrates the correlation between Inattention and alcohol use.

Figure 7.1 Graphic representation of the result of Alcohol use and Inattention



The relationship between inattention and alcohol use shows a steady increase in slope which shows a weak significant positive correlation ($r = 0,27$; $p = 0,007$).

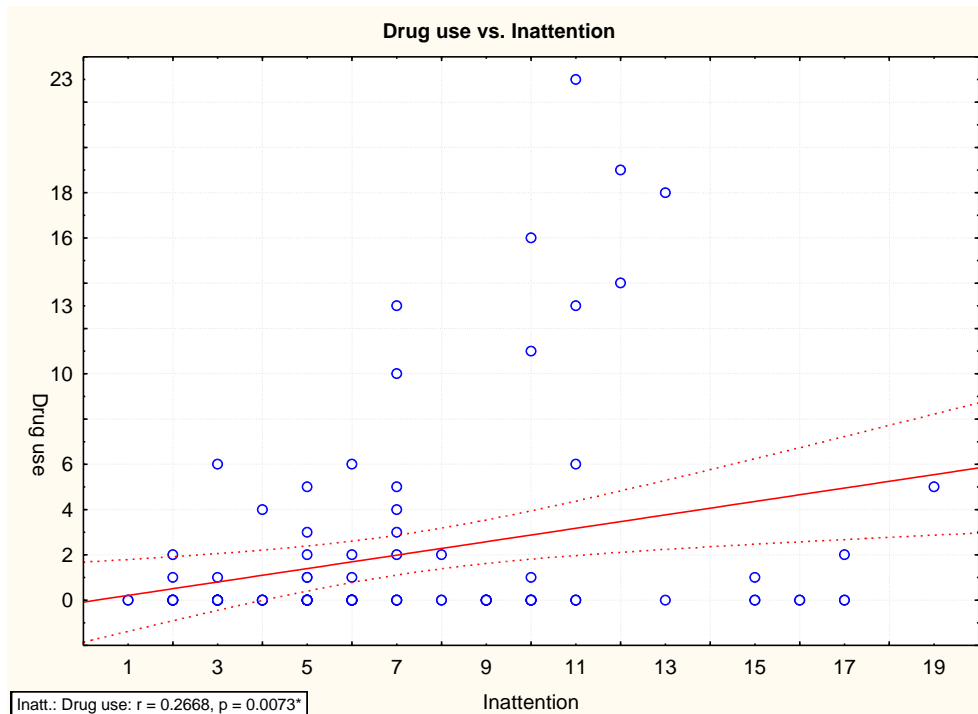
Figure 7.2 shows the scatter plot of the relationship between Inattention and cannabis (dagga) use. Figure 7.2 Graphic representation of the results of Dagga use and Inattention



The slope of the graph shows a significant positive correlation coefficient, however weak ($r = 0.32$; $p = 0.001$).

Figure 7.3 shows the scatter plot of the relationship between Inattention and drug use.

Figure 7.3 Graphic representation of the results of Drug use and Inattention



The slope of the graph shows a statistically significant, but weak, relationship between Inattention and drug taking ($r = 0.27$; $p = 0.007$).

7.2.3.2 Hyperactivity/Impulsiveness

The significant relationships between Hyperactivity/Impulsiveness and risk taking behaviours are illustrated below.

Figure 7.4 shows the scatter plot of the relationship between Hyperactivity/Impulsiveness and alcohol use.

Figure 7.4 Graphic representation of the results of Alcohol use and Impulsiveness



Figure 7.4 The slope of the graph indicates a positive but weak correlation coefficient.

Figure 7.5 shows the scatter plot of the relationship between dagga use and Impulsiveness.

Figure 7.5 Graphic representation of the result of Dagga use and Impulsiveness

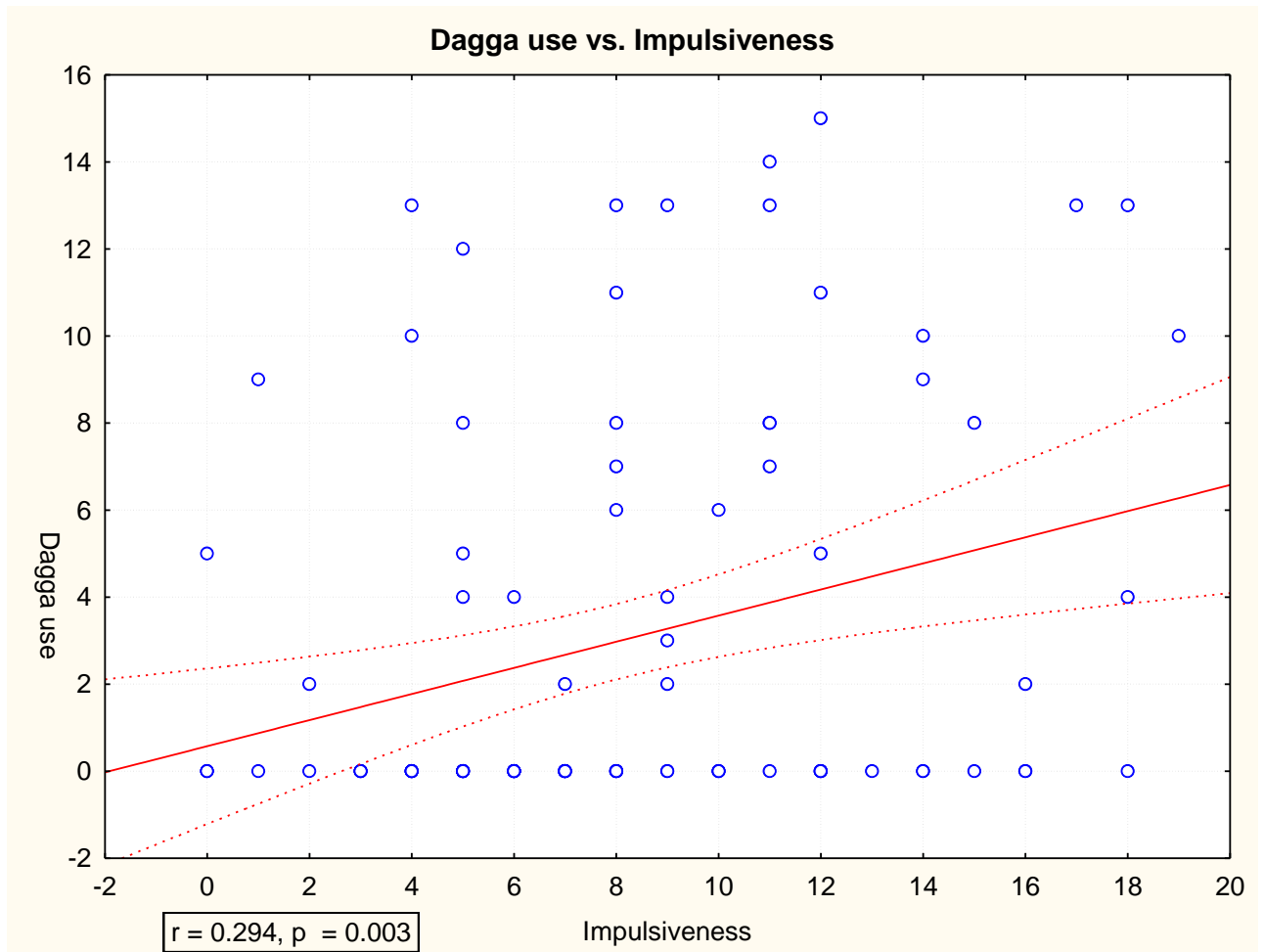


Figure 7.5. The slope of the graph shows a significant positive correlation coefficient, however weak.

Figure 7.6. Shows the scatter plots of the relationship between drug use and impulsiveness.

Figure 7.6 Graphic representation of the results of Drug use and Impulsiveness

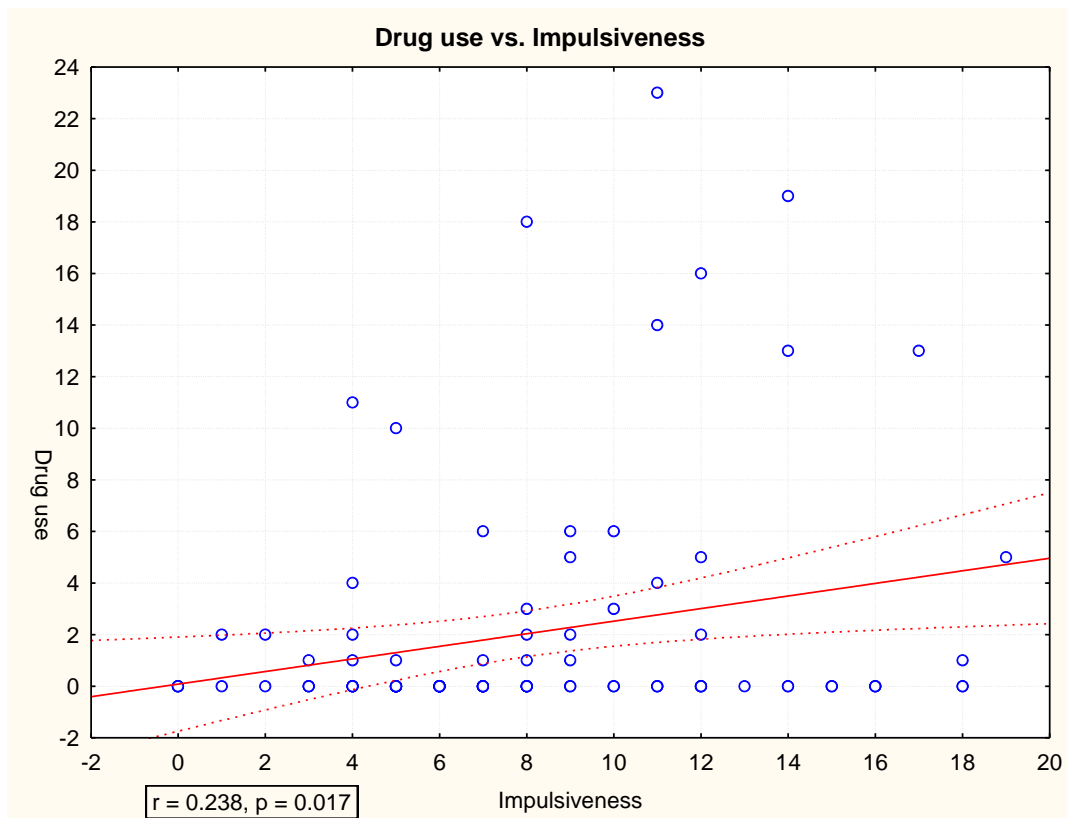


Figure 7.6. The slope of the graph shows a significant positive correlation coefficient, although weak.

7.2.3.3 Test results

7.2.3.3.1 WCST

Figure 7.7. The scatter plots show the relationship between drug use and performance on the WCST.

Figure 7.7 Graphic representation of the results of Drug use and Non-perserverative errors.

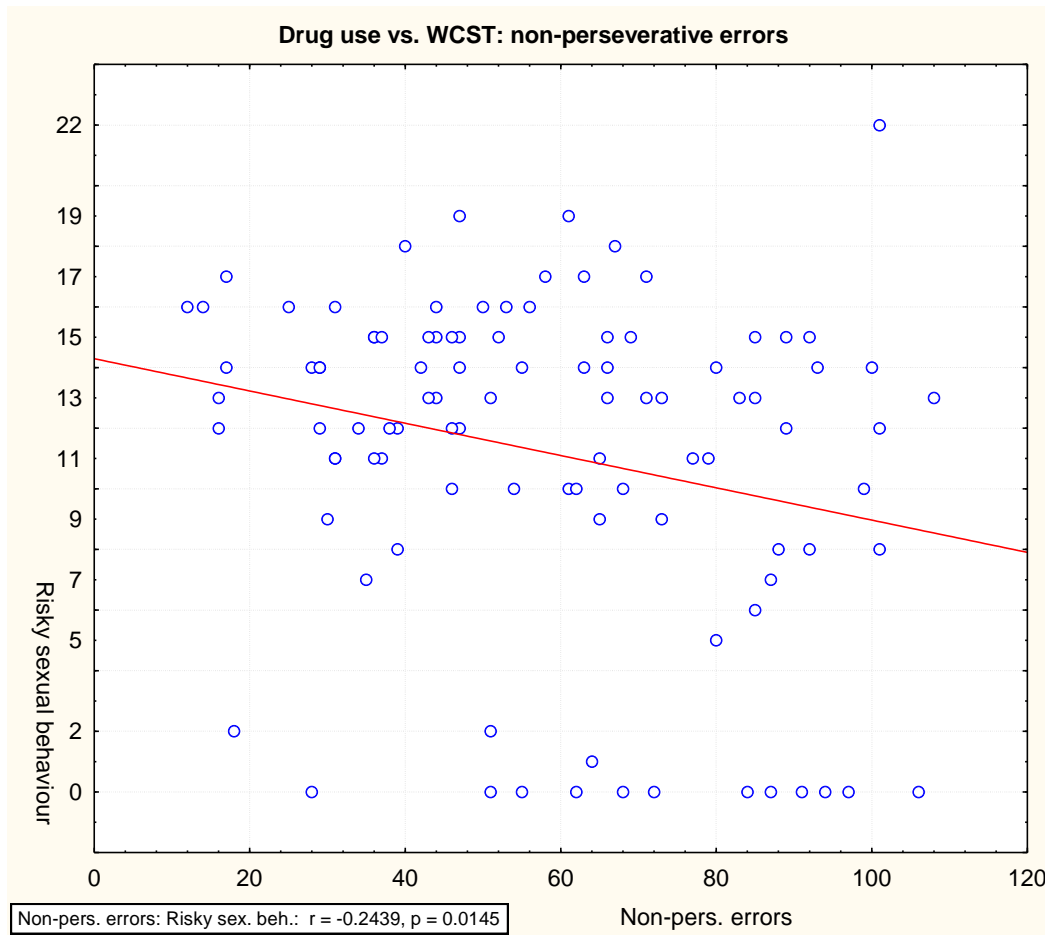


Figure 7.7. The slope of the graph shows no significant correlation coefficient.

Figure 7.8. The scatter plots show the relationship between sexual behaviour and performance on the WCST.

Figure 7.8 Graphic representation of the results of risky sexual behaviour and categories shifted

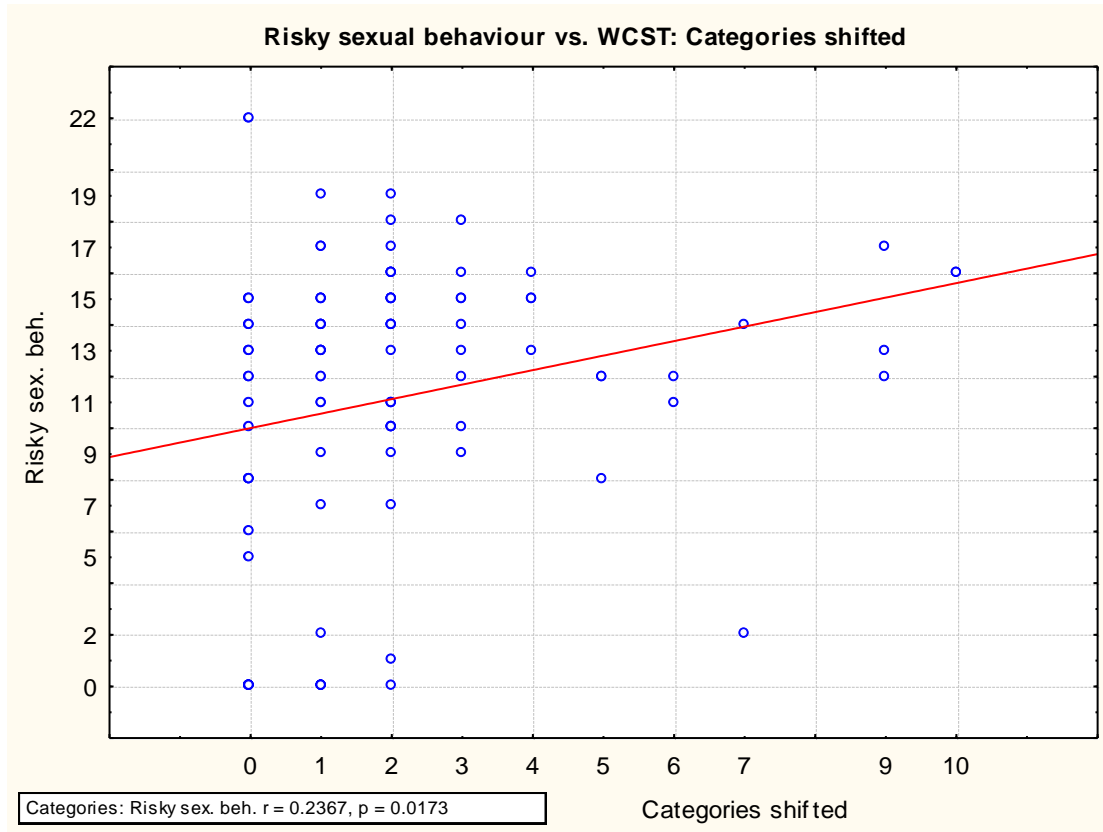


Figure 7.8. The slope of the graph shows a weak significant correlation coefficient

Figure 7.9. The scatter plots show the relationship between drug use and GoStop.

Figure 7.9 Graphic representation of the results of Drug use and GoStop

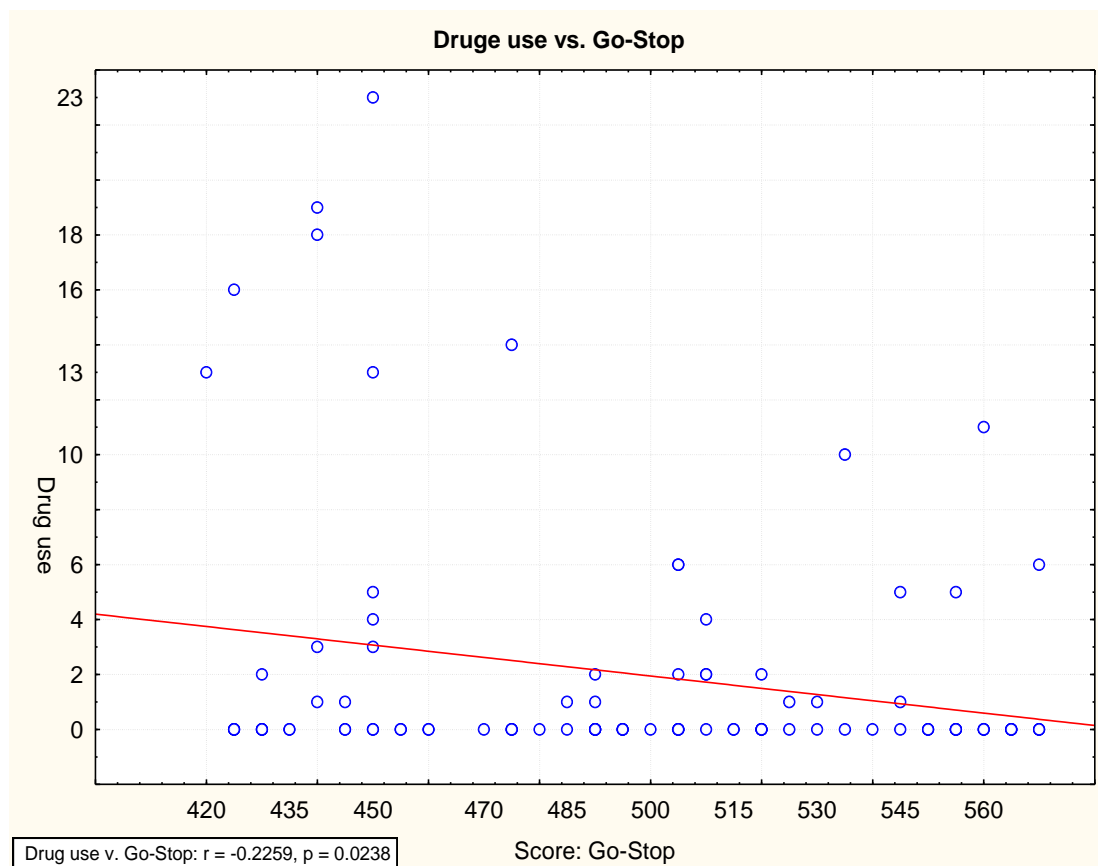


Figure 7.9. The slope of the graph shows a negative correlation coefficient, however weak.

7.3 Hypotheses Testing

7.3.1 Research hypotheses 1

Research Hypothesis 1 must be partially accepted as there were statistically significant correlation between symptoms of ADHD (hyperactivity/impulsiveness and inattention) and some of the risk taking behaviours.

Null hypothesis 1.1 must be accepted as there was no statistically significant correlation between transgression of safety rules and symptoms of ADHD (inattention and hyperactivity/impulsiveness).

Null hypothesis 1.2 must be accepted as there was no statistically significant correlation between tobacco use and symptoms of ADHD (inattention and hyperactivity/impulsiveness).

Null hypothesis 1.3 must be rejected as there was a statistically significant correlation between alcohol use and symptoms of ADHD (inattention and hyperactivity/ Impulsiveness).

Null hypothesis 1.4 must be rejected as there was a statistically significant correlation between cannabis use and symptoms of ADHD (inattention and hyperactivity/ impulsiveness).

Null hypothesis 1.5 must be rejected as there was a statistically significant correlation between drug use and symptoms of ADHD (inattention and hyperactivity/ impulsiveness).

Null hypothesis 1.6 must be accepted as there was no statistically significant correlation between risky sexual behaviour and symptoms of ADHD (inattention and hyperactivity/ impulsiveness).

7.3.2 Research hypotheses 2

Research Hypothesis 2 must be partially accepted as there were statistically significant correlations between symptoms of ADHD (hyperactivity/impulsiveness and inattention) and results on some of the psychometric tests sensitive to the symptoms of ADHD.

Null hypothesis 2.1 must be accepted as there was no statistically significant correlation between transgression of safety rules and performance on the perseverative errors subtest of the WCST.

Null hypothesis 2.2 must be accepted as there was no statistically significant correlation between transgression of safety rules and performance on the non-perseverative errors subtest of the WCST.

Null hypothesis 2.3 must be accepted as there were no statistically significant correlations between transgression of safety rules and performance on the categories-shifted subtest of the WCST.

Null hypothesis 2.4 must be accepted as there were no statistically significant correlations between transgression of safety rules and performance on the GoStop Task.

Null hypothesis 2.5 must be accepted as there were no significant correlation between tobacco use and performance on the perserverative errors subtest of the WCST.

Null hypothesis 2.6 must be accepted as there were no significant correlation between tobacco use and performance on the non-perserverative errors subtest of the WCST.

Null hypothesis 2.7 must be accepted as there were no significant correlation between tobacco use and performance on the categories shifted subtest of the WCST.

Null hypothesis 2.8 must be accepted as there were no significant correlation between tobacco use and performance on the GoStop Task.

Null hypothesis 2.9 must be accepted as there were no significant correlation between alcohol use and performance on the perserverative errors subtest of the WCST.

Null hypothesis 2.10 must be accepted as there were no significant correlation between alcohol use and performance on the non-perserverative errors subtest of the WCST.

Null hypothesis 2.11 must be accepted as there were no significant correlation between alcohol use and performance on the categories shifted subtest of the WCST.

Null hypothesis 2.12 must be accepted as there were no significant correlation between alcohol use and performance on the GoStop Task.

Null hypothesis 2.13 must be accepted as there were no significant correlation between cannabis use and performance on the perserverative errors subtest of the WCST.

Null hypothesis 2.14 must be accepted as there were no significant correlation between cannabis use and performance on the non-perserverative errors subtest of the WCST.

Null hypothesis 2.14 must be accepted as there were no significant correlation between cannabis use and performance on the categories shifted subtest of the WCST.

Null hypothesis 2.15 must be accepted as there were no significant correlation between cannabis use and performance on the GoStop Task.

Null hypothesis 2.16 must be accepted as there were no significant correlation between drug use and performance on the perserverative errors subtest of the WCST.

Null hypothesis 2.17 must be accepted as there were no significant correlation between drug use and performance on the non-perserverative errors subtest of the WCST.

Null hypothesis 2.18 must be accepted as there were no significant correlation between drug use and performance on the categories shifted subtest of the WCST.

Null hypothesis 2.19 must be rejected as there was a significant correlation between drug use and performance on the GoStop Task.

Null hypothesis 2.20 must be accepted as there were no significant correlation between sexual behaviour and performance on the perserverative errors subtest of the WCST.

Null hypothesis 2.21 must be rejected as there was a significant correlation between sexual behaviour and performance on the non-perserverative errors subtest of the WCST.

Null hypothesis 2.22 must be rejected as there was a significant correlation between sexual behaviour and performance on the categories shifted subtest of the WCST.

Null hypothesis 2.23 must be accepted as there were no significant correlation between sexual behaviour and performance on the GoStop Task.

The discussion of the results will follow in the next chapter.

DISCUSSION OF RESULTS

8.1. Introduction

The aim of this study was twofold:

1. To explore the relationship between ADHD symptoms and risk-taking behaviours such as higher incidence of tobacco use, alcohol use, dagga use, other drug use, traffic violations, and sexual promiscuity in adolescents.
2. To investigate the performance of adolescents on two psychometric tests, which measure the symptoms of ADHD (Impulsiveness and Inattention) in relation to risk taking behaviours.

The results of the test scores i.e. the ADHD scores on Barkley’s Symptoms Scale for Adolescents (BSSA) were correlated with scores on the Youth Risk Behaviours Scale (YRBS) as well as with the scores obtained on the Wisconsin Card Sorting Test (WCST) and the GoStop paradigm task.

8.2. Summary of results

Tables 8.1 and 8.2 illustrate the summary of all significant results for all the tests administered in the current study.

Table 8.1. The relationship between risk taking behaviours and ADHD symptoms

ADHD symptoms	Safety	Tobacco use	Alcohol use	Cannabis use	Other drugs	Sexual behaviour
Inattention	no	no	weak	weak	weak	no
Impulsiveness	no	no	weak	weak	weak	no

Table 8.2. The relationship between risk taking behaviours and test results

Test	Safety	Tobacco use	Alcohol use	Cannabis use	Other drugs	Sexual behaviour
WCST						
<i>Persev. errors</i>	no	no	no	no	no	no
<i>Non-persev errors</i>	no	no	no	no	no	weak
<i>Categories shifted</i>	no	no	no	no	no	weak
GoStop	no	no	no	no	weak	no

Some of the rating scales and tests used showed a statistical significant positive relationship between ADHD symptoms and risk-taking behaviours, although the relationships were weak.

The data results can be summarized as follows:

No significant relationship was found between the risk taking behaviours such as safety, tobacco use, and sexual behaviour and the measures of ADHD symptoms (impulsiveness and inattention), which contradicts most other studies (Dougherty et al., 2002; Justus, Finn, & Steinmetz., 2001; Moeller et al., 2001), while a significant but weak, relationship, was found between alcohol use, cannabis use, other drug use, and sexual behaviour, which is in line with most other studies in the field (Lejuez, Bornoalova, Daughters, & Curtin., 2005).

These findings may be ascribed to the fact that the participants did not have a diagnosis of ADHD, but were selected randomly and their symptoms of ADHD (Inattention and Hyperactivity/Impulsiveness) were assessed, later.

8.2.1. Relationship between ADHD symptoms and risk taking behaviours

8.2.1.1. Safety

The findings show no significant correlation on the measurement of safety and ADHD symptoms.

Research studies have shown that adolescents with ADHD are at a high risk for accidental injury in traffic environments (Clancy et al., 2006). This was observed as a result of impairments in areas associated with ADHD, including attention, time perception, and behavioural inhibition deficit as well as impairments in the executive domains (Nigg et al., 2002). Adolescents with ADHD had an increased risk of road crossing collisions because they walked slower, underrated the gap between incoming traffic and had lower margins of safety (Clancy et al., 2006).

In the present study most participants obtained a zero score because the majority of the adolescents assessed did not have driver's licenses, and had never driven a car, bicycle, or motorcycle before. ADHD adolescents have poor impulse control, mainly characterized by decreased attention span, absence of responsibility, and behavioural disturbances (Brook & Boaz, 2006).

It seems as if there are certain characteristics of a driver that influence the speed at which they drive such as gender and age. Evans (2004), showed that men aged between 16-22 had higher rates of traffic violations. Caution needs to be taken in interpreting such findings because different factors influence the behaviour and the rate at which individuals are involved in traffic violations. For example, race and socio-economic factors are such that Africans with a low socio-economic status would have less access to a vehicle than more affluent whites.

Results obtained from the questionnaire need careful interpretation, as the respondents tend not to report truthful behaviours when asked about a characteristic they deem as undesirable (Evans, 2004). However, in his study it was shown that more males were stopped by the police due to speeding than females.

8.2.1.2. Tobacco use

The study revealed no significant correlation between the use of tobacco and ADHD symptoms (inattention and impulsiveness).

In their study Flisher et al., (2003) found that tobacco and alcohol use were prevalent among the students assessed and that their usage was significantly associated with poor psychosocial behaviours among which were absenteeism and poor performance in school resulting in repetition of a grade. Smoking was also linked significantly to peer smoking and ADHD (inattention) (Tercyak et al., 2002b). Nicotine stimulates nicotinic receptors in the reticular formation and limbic system, which are the pleasure centres in the brain, which reduce and compensate ADHD symptoms including a low level of attention, arousal, and concentration (Ernst et al., 2001; Levin, Conners, Silva, Canu, & March, 2001).

In the present study the participants did not meet the DSM-IV criteria for ADHD diagnosis and the number of those who smoked was outnumbered by those participants who had never smoked. This may be the reason why a positive significant relationship was not obtained. As noted by Riggs, Mikulich, Whitmore, and Crowley (1999), having ADHD is associated with earlier and a high incidence of cigarette smoking but unlike the studies mentioned, no relationship between ADHD symptoms and cigarette smoking, were observed in this study. This strongly suggests that the clinical diagnosis of the disorder is important and that a clinical assessment should be made.

These findings of the present study also contradict the findings of Pomerleau and colleagues (2003). They found that adolescents with ADHD experiment with tobacco smoking at a younger age and smoked regularly at a younger age while consuming more cigarettes daily compared to their non-ADHD counterparts. They also found an increased dependence on nicotine among the same group. What was also interesting in their finding was that when cigarette smoking was stopped, these adolescents tended to report symptoms characteristics of ADHD as

classified in the DSM IV-TR (American Psychiatric Association, 2000). They suspected that in childhood, ADHD may have triggered tobacco use, and also that these individuals were dependent and continued to smoke through adolescence to adulthood with minimal trigger.

Conners and colleagues (1996) and Pomerleau and colleagues (2003) suggest that nicotine is able to improve performance and decrease distractibility in people who smoke, which acts as a form of medication for ADHD symptoms. Studies have shown that ADHD sufferers used tobacco to boost their cognitive functioning and enhance attentional function (Coger, Moe, & Serafetinides., 1996; Dinn et al., 2004). As no link was found between tobacco use and ADHD, smoking participants in the current study may be smoking due to peer pressure and/ or due to the pleasurable effect of nicotine such as relieving anxiety and depression that are usually common with cessation of smoking. The study did not investigate some of the individual reasons behind smoking in its subjects.

Research work has shown that tobacco use simply demonstrates the difficulty to use reward and punishment cues to guide behaviour (Dinn et al., 2004). Failure in regulating behaviour would reflect dysfunctioning of the mesocortical dopamine pathways. The dopamine pathways dysfunction predicts symptoms associated with ADHD, behaviour inhibition, sustained attention, and response inhibition (Carlson, Lehey, & Frick, 1994; Castellanos, 1997; Johansen et al., 2002; Sagvolden et al., 2005).

Smoking behaviour may reflect a diminished ability to anticipate long-range negative consequences. This may suggest that the decision to smoke may be linked to these impairments in the meso-cortical branches of the dopamine pathways. This was evident by others who found that rapid changes in dopamine-rich areas of the brain could be seen as a factor in making adolescents vulnerable to stimulation, such as tobacco (Giedd et al., 2004).

Even though tobacco is easily accessible in the community assessed, many of the participants in the present study did not use tobacco at all.

8.2.1.3. *Alcohol use*

The study revealed a weak, but statistically significant, correlation ($r = 0.27$) between the use of alcohol and ADHD symptoms (inattention and impulsiveness). This finding is consistent with what other researchers have found, that namely alcohol is associated with impulsiveness (Ernst et al., 2006).

Alcohol is an easily accessible substance in the community, hence the majority of the participants did use it. Alcohol use disorder (AUD) occurs in 5% of adolescents and co-exists with other behavioural disorders (Moss & Lynch, 2001). It is important to learn that having ADHD may lead to the development of AUD in adolescents. Impulsiveness is one of the main characteristics present in adolescents with an early development of AUD (Soloff, Lynch, & Moss, 2000). ADHD precedes alcohol use and is followed later by inappropriate levels of alcohol abuse (Smith, Molina, & Pelham, 2002). Early onset of alcohol use may be an important predictor of ADHD (Barkley et al., 1990a). Most studies have reported a weak correlation between ADHD and alcohol use due to mixed results among which age difference was a major factor (Barkley, 2006).

In young adults (25 years) there was no difference in alcohol use between the ADHD and non-ADHD groups (Weiss & Hechtman, 1993), whereas a study on alcohol using adolescents showed that a diagnosis of ADHD predicted increased alcohol use (Smith et al., 2002). Therefore, the results of the present study are consistent with most other studies (Smith et al., 2002) in that alcohol use is related with both ADHD symptoms (Hyperactivity/Impulsiveness and Inattention). In young adolescents there would be a relationship between ADHD and alcohol use whereas with older adolescents no such relationship was found. Inattention in adolescents may lead to alcohol related problems (Molina & Pelham, Jr., 2003).

Studies such as those done by Luria (1980), demonstrate the importance of the frontal lobe in behavioural inhibition, regulation of emotional impulses, planned behaviour, destructibility, and judgment. Normal execution of these functions is dependent on normal function of the pre-frontal

region and the reticular activity system (RAS). These areas, as well as the frontal lobes, are cortical areas targeted for their most rapid development during adolescence (Luria, 1980). This is the time when adolescents also initiate into alcohol and drug use.

The present study only looked at behavioural outputs of ADHD symptoms and for these psychometric measurement tools (WCST and Gostop) were utilized, and as a result direct cognitive dysfunctions were extrapolated and not proven. The frontal lobe dysfunctions can be better studied using brain scans (MRI) in order to link alcohol use to defects in those areas of the brain. Moreover, it was suggested that various biological factors do contribute to these risky behaviours (Soloff et al., 2000). They found that serotonergic dysfunction plays a major role in mediating the risk of alcohol abuse, which results into increased impulsiveness and chronic exposure to alcohol. The present study, therefore, looked at impulsiveness and inattention as the key symptoms of ADHD and how they are associated with risk taking behaviours, and has found similar results as in most research studies.

8.2.1.4. Cannabis use

The study showed that the use of substances such as cannabis can be associated with some behaviours typical of ADHD symptoms i.e. inattention and impulsiveness (Barkley et al., 1990a). The obtained positive correlation was statistically significant, but weak ($r = 0.32$). The results of this study showed that the use of dagga is related to the key symptoms of ADHD (inattention and impulsiveness).

ADHD symptoms at an early age predict high levels of cannabis use (Molina & Pelham, Jr., 2003). ADHD and externalized comorbid disorders (ODD and CD) are associated with an elevated risk of marijuana and tobacco use; (Barkley et al., 1990a; Biederman, Faraone, Millberger, Curtis, Chan, Mars, et al., 1996). Adolescents using dagga were observed to be very reckless in behaviour as well as being inattentive (Barkley et al., 1990a). A variety of self-management deficits and impairments in functions such as in cognitive function, social, school activities and substance

use are associated with ADHD and cannabis use (Barkley, 2006; Barkley et al., 1990a). It is also important to consider that adolescence is a stage of experimentation (Kaye, 2004) in which initiation into alcohol and dagga is predominant.

8.2.1.5. Drug use

The results of the study showed a weak but statistically significant correlation ($r= 0.27$) between drug use and both ADHD symptoms, inattention and hyperactivity/impulsiveness.

Barkley and colleagues (2004) showed that when externalizing problems were controlled, there was no association between ADHD and drug use. On the other hand, however, others showed that ADHD in childhood without Oppositional Defiant Disorder/Conduct Disorder was associated with an increased risk of elevated use and abuse of drugs (Biederman, Wilens, Mick, Faraone, & Spencer, 1998; Molina & Pelham, Jr., 2003). Studies in the USA have revealed that a large majority of high school learners consume alcohol while daily smoking has been consistently high and associated with drug and alcohol use (Kaye, 2004). Drug use is still on the increase in those parts of the world. Substance use has been implicated in serious medical conditions and negative health outcomes, including teenage pregnancy, HIV and STI contracted during unprotected sex from individuals using drugs. There is also an increase in criminal activities, school dropout, and failures under the influence of these substances (Kaye, 2004).

The results of the present study show a weak association between both core symptoms of ADHD and drug use, probably because the sample was representative of a normal population of youths and not of those clinically diagnosed with ADHD. ADHD symptoms predict high levels of substance use when peer influence is allowed to play a role in sensitizing adolescents to this risk behaviour (August et al., 2006).

In the community under investigation it was clear that drugs were not easily accessible to these adolescents. Therefore, the results may have been more significant if they had easy access to drugs.

8.2.1.6. Sexual behaviour

The study found no significant relationship between risky sexual behaviour and ADHD symptoms (inattention and impulsiveness).

Certain risky sexual behaviours (non contraceptive use) should not be attributed to ADHD symptoms only as they have different psychosocial foundations and can be managed by proper education and guidance (Flisher & Chalton, 2001).

However, the study failed to show the correlation between risky sexual behaviour and ADHD symptoms of inattention in contrast to what other studies have found (Bradley & Golden, 2001). It has further been indicated that impulsiveness in adolescents can be associated with all sexual risk behaviours such as non-use of contraception at last intercourse, having more than one partner, and having sexual intercourse at an early age (Kahn et al., 2002). Therefore, adolescents with ADHD may be at risk of HIV/AIDS and other sexually transmitted diseases.

Studies have shown that individuals with childhood ADHD are likely to engage in risky sexual behaviour as young adults (Flory et al., 2006). In this regard adolescents, who engage in risky sexual behaviour, displayed ADHD symptoms during childhood. In the present study, the ADHD status of the adolescents was not determined, only the extent of the symptoms (inattention and impulsiveness). Therefore, an ADHD diagnosis cannot be made and other factors leading to their sexual activities other than ADHD may be implicated.

8.2.1.7. Theoretical consideration

ADHD is a neurodevelopmental disorder and a number of theories have pointed to various facts in the development of this disorder. The current study supports the notion that dopamine dysfunction plays an important role in manifesting behaviours associated with ADHD. What happens is that several changes in dopamine-rich areas of the brain which, as a result, make adolescents vulnerable to stimulating and addictive effects of drugs and alcohol, also regarded as risky behaviours (Giedd et al., 2004). Behaviours such as impulsiveness with a lack of planning,

organisation and acting without forethought, typical of ADHD symptoms, are due to delayed reinforcement resulting from dysfunctional meso-cortical and mesolimbic dopamine branches (Aase et al., 2006; Johansen et al., 2002; Sagvolden et al., 2005).

ADHD symptoms i.e. deficient sustained attention, overactivity, and impulsiveness, are viewed as a result of altered reinforcement mechanisms and a shorter delay of reinforcement gradient (Sagvolden et al., 2005; Sonuga-Barke, 2002). This explains why adolescents with ADHD need reinforcement in order to regulate their behaviour as often as possible. Behaviours such as smoking in adolescents can be seen as a way of self medicating which, on the other hand, remedies symptoms of ADHD, especially inattention. This is supported by research findings that adolescents with ADHD suffer diminished central nervous system arousal (Bradley & Golden, 2001), hence they become smokers to uplift their attention span and become elevated. This, according to Luria (1980), is as a result of impairment in the prefrontal region, the reticular activating system and their interconnective fibers.

Risk taking behaviours explained in the current study are observed as a result of impaired sustained attention and impulsiveness, hence adolescents with ADHD have the tendency to become reckless in activities that require safety considerations. (Nigg et al., 2002) explain these fundamentals as a failure to inhibit or delay behavioural responses, which as a result, cause secondary impairments in executive functioning (EF), such as acting without forethought, being unable to prepare for future events, and poor problem solving (Tannock, 1998), suggesting that these adolescents will encounter difficulties in executing tasks which require cognitive complexity.

8.2.2 Relationship between test performance and risk taking behaviours

8.2.2.1 Wisconsin Card Sorting Test

The Wisconsin Card Sorting Test has long been a measurement tool used for assessing deficits in the Executive Functions in adolescents with ADHD (Sergeant et al., 2002). The

Wisconsin Card Sorting Test (WCST) variables used in this study include categories obtained/achieved, perseverative errors, and non-perseverative errors.

8.2.2.2 Perseverative errors

No significant relationship in the number of errors and risk-taking behaviours in adolescents were observed. Adolescents with ADHD display poorer performance than normal adolescents on the Wisconsin Card Sorting Task as a result of failure to maintain set (Ernst et al., 2003). The WCST is used as a measure of cognitive impulsiveness such as the use of external cues to guide behaviour, self-monitoring, and the ability to shift response. Research studies showed that the WCST was positively used to assess impulsiveness in that most participants tend to display premature responses and preference for immediate rewards, which may be associated with risk-taking behaviour (Moeller et al., 2001). They, have problems to assess problem solving, planning and learning from ones mistakes, and cognitive flexibility (Lawrence, Houghton, Douglas, Durkin, Whiting, & Tannock, 2004).

In their study Romine, Lee, Wolf, Homack, George, and Riccio (2004), found that individuals with ADHD fairly consistently performed poorer on Perseverative Errors compared to individuals without a diagnosis of ADHD. Similar findings were not observed in the current study because the participants were not clinically assessed for ADHD diagnosis.

8.2.2.3 Non- Perseverative errors

The results of the current study showed that there was no significant relationship between most risk-taking behaviours and the number of non-perseverative errors made in the WCST. Again, this was probably due to the fact that the participants did not have a clinical diagnosis of ADHD. However, on measures of sexual behaviour and non-perseverative errors, a weak correlation was observed. This may be ascribed to the fact that the participants with risky sexual behaviour were not attending to the stimuli presented during the test.

Adolescents with ADHD fail to give close attention, have difficulty in sustaining attention in tasks, do not follow through on instructions, dislike or avoid tasks that require sustained mental effort, and are easily distracted (American Psychiatric Association, 2000). This could have been the cause of their poorer performance. Parents and teachers often complain that these youths do not seem to listen as well as they should for their age, cannot concentrate, are easily distracted, fail to finish assignments, are forgetful, and change activities more often than others (DuPaul, Power, Anastopoulos, & Reid, 1998). Research using objective measures confirms this and reports more “off-task” behaviour and less work productivity, showing less persistence at tedious tasks, being slower and less likely to return to an activity once interrupted, being less attentive to changes in the rules governing a task, and being less capable of shifting attention flexibly (Borger & van der Meer, 2000; Hoza, Pelham, Waschbusch, Kipp, & Owens, 2001; Newcorn, Halperin, Jensen, Abikoff, Arnold, Cantwell, et al., 2001). These characteristics may contribute to their casual attitude concerning sexual activity.

The participants with risky sexual behaviour may be also be impulsive as inattention and impulsiveness are strongly linked, being both dimensions of ADHD, and impulsiveness in adolescents can be associated with sexual risk behaviours such as non–use of contraception at last intercourse, having more than one partner, and having intercourse at an early age (Kahn et al., 2002). This finding, together with what other similar studies found, may conclude that adolescents tend to act before they think, do not learn from previous mistakes, and fail to plan ahead. This may be regarded as impulsive behaviour. This will also explain that adolescents with ADHD will initiate sexual intercourse first and think about the use of a condom later, which may put them at risk of HIV/AIDS and other sexually transmitted diseases (Waslick & Greenhill, 2004).

8.2.2.4 Categories achieved

The WCST subtest, categories completed, is often used to measure the rate of acquisition if the sorting rule, and reflecting the rate of learning from corrective feedback on each trial provided

by the examiner are provided (Sergeant et al., 2002). The results of the current study showed a weak relationship between risky sexual behaviour and fewer categories shifted. These findings are in line with other studies that found weakness in areas of the executive functioning such as response suppression (Kooijmans et al., 2000; Scheres et al., 2001) and an inability to wait for delayed reinforcement (Johansen et al., 2002; Sonuga-Barke, 2002) by persons with ADHD.

The relationship between risky sexual behaviours and fewer categories shifted indicates problems with understanding the nature of the categorization task (response shifting), which influences conceptual problem-solving, and not being able to benefit from feedback (Goldstein & Green, 1995; Tsuchiya, Oki, Yahara, & Fujieda., 2005; Ernst et al., 2003), which may indicate inflexibility of behaviour and an inability to learn from previous experiences.

8.2.2.6 Theoretical Considerations

A number of research documents showed that ADHD is associated with deficits on a variety of neuropsychological measures, which come from different psychological theories of ADHD (Sergeant, Geurts, Huijbregts, Scheres, & Oosterlaan, 2003). Adolescents with ADHD show impairment in areas of executive function (EF) domains (Tannock, 2002), such as complex cognitive processing that involves inhibition, set shifting, and working memory (Barkley, 1997c). Studies by Lawrence and colleagues (2004) indicated that detecting the extent of EF deficits on neuropsychological measures to predict real world activities could be challenging. This explains that the reliability of test procedures in predicting risk-taking behaviours in adolescents is not extensively researched.

However, adolescents with ADHD were observed to exhibit deficits in set shifting as assessed by WCST (perserverative errors and responses) (Lawrence et al., 2004). The WCST taps on areas supplied by the meso-cortical dopamine branch (cognitive impulsiveness, attention responses, and poor behavioural organisation) (Johansen et al., 2002; Sagvolden et al., 2005). Golden (1981) and Luria (1980) state outlined that the frontal and prefrontal lobes are cortical

areas that are expected to be fully developed during adolescents, therefore perseverative tendencies may be more manageable during this developmental phase. Having ADHD will then be a risk factor on poor performance on the WCST resulting in a number of perseverative errors.

The current study did not show similar results except on sexual behaviour, where a deficit in attention and set shifting was observed by the WCST (non-perseverative errors and categories shifted). ADHD sufferers usually demonstrate deficient performance on the number of perseverative errors and the total number of categories achieved (Bradley & Golden, 2001; Romine et al., 2004; Tripp et al., 2002), indicating difficulties in shifting a mental set. This explains that adolescents with ADHD have poor forethought (act without thinking), do not learn from previous mistakes, and may mostly be at risk for contracting HIV/AIDS, unplanned pregnancy, and other sexually transmitted diseases. Problems of inattention as discussed in the previous section, may contribute to these problems.

8.2.2.7. GoStop Task Paradigm

The GoStop paradigm is a measurement technique used to assess impulsiveness. The tasks also assess response disinhibition aspects of impulsiveness (Dougherty et al., 2003a). It requires participants to quickly respond to a target stimulus under conditions where a “go” signal is sometimes followed by a “stop” signal (target stimulus are digit numbers appearing in black or red). The task also measures the degree of impulsiveness in ADHD adolescents, which is also associated with risk-taking behaviours such as alcohol use (Dougherty et al., 2003a). ADHD sufferers are also prone to make rapid impulsive decisions, which also leads to maladaptive behaviours.

The results of the GoStop task did not show a significant correlation on measures of safety, tobacco use, alcohol use, cannabis use, and sexual behaviour and the test method used. Studies have shown that poor inhibitory control in a GoStop task is correlated with high self-

reported impulsiveness in non-ADHD adolescents (Kuhne, Schachar, & Tannock, 1997; Tannock, 2004).

The study found a weak, but statistically significant, correlation of (0.22) between drug use and poorer performance on the GoStop Task. Rubia and colleagues (1998) too found that ADHD adolescents were less efficient in inhibiting their response in GoStop tasks whether the stop signals were externally or internally related. ADHD is characterized by poor inhibitory control, which is the ability to withhold a planned response, to interrupt a response, to protect an ongoing activity, and to delay a response. The present study showed that impulsive responding was related to drug use.

8.2.2.8 Theoretical consideration

Numerous studies on neuroanatomical and neuropsychological aspects suggested that ADHD might be a frontal lobe disorder with impairments specifically in the prefrontal-lobe mediated self-regulation, and executive functions (Rubia et al., 1998). Self-regulation therefore refers to one's ability to withhold a planned response, to protect an ongoing activity from interfering activities, and to delay a response. All these components require attention and failure to sustain attention will be due to failure to inhibit distractibility and executing other tasks. This suggests that adolescents with ADHD face challenges in waiting for a chance to occur; withholding a goal directed behaviour and can be impatient. Taylor, Chadwick, Heptinstall, and Danckaerts (1996) indicate that responses inhibition and self-control play a pivotal role in social adaptation. Adolescents with ADHD can be impulsive and engage in risk taking behaviours without thinking of the results.

The present study's findings are consistent with other researchers' findings that impulsiveness is a risk factor manifesting in those maladaptive behaviours such as the use of drugs (Ross, Hommer, Breiger, Varley, & Radant, 1994). They mentioned that more symptoms of hyperactivity/impulsiveness are related to an impulsive response style and poor reflex-inhibition during test performance.

Although this test has been found to be objective and cost effective Dougherty and colleagues (2003a) state that the tasks used have not been validated, which as a result complicates data interpretation.

8.3. Integration of results and findings

The fact that no significant results were obtained on measures of tobacco use and safety, could be associated to most of the participants not owning methods of transport and were not using tobacco.

Even in a normal population, there is a significant, although weak, relationship between ADHD symptoms and risk-taking behaviours. This implies that adolescents with symptoms of ADHD, although not clinically impaired, can be at risk of engaging in risk-taking behaviours. A strong relationship can therefore, be expected in a clinically impaired population with diagnosed ADHD symptoms, which put them at a higher risk for these behaviours.

Alcohol consumption showed to be related to inattention and hyperactivity/impulsiveness, when it was correlated with the symptoms of ADHD, although both the psychometric tests sensitive to ADHD symptoms did not show a similar relationship.

The same results were observed for cannabis use, while for other drug use such as cocaine, heroine, and crack, not only a correlation was found with hyperactivity/impulsiveness and inattention, but also with a poorer score on the GoStop task. This is a clear indication that impulsive behaviour may be linked to increased drug use. Sexual behaviour did not show a relationship on measures of ADHD symptoms (inattention and hyperactivity/impulsiveness). However, on measures of non-perserverated errors and categories shifted which measure inattention and hyperactivity, a weak correlation was obtained.

Risky sexual behaviours did not show a relationship with hyperactivity/impulsiveness and inattention in the correlation study. However, the results of the WCST (non-perserverative errors

and categories shifted) indicated that both inattention and inflexible thinking and not learning from past mistakes were also related to risk taking sexual behaviour.

All these facts make it clear that ADHD symptoms, inattention and hyperactivity/impulsiveness, but especially the impulsiveness component of the latter, play a major role in developing risk-taking behaviours.

8.4. Limitations of the study

The first limitation of the study was that the sample consisted of only male participants, which is not representative of the population. As noted, the participants were not diagnosed for ADHD but only screened for ADHD symptoms. The participants were, therefore, not clinically impaired, but their risk-taking behaviour was correlated with the ADHD symptoms they displayed, which may explain the weak relationships.

Other challenges experienced were that during the completion of the questionnaire participants might not have given a true reflection of their responses on the use of substances. Although some reported that adolescents provide reliable data regarding the use of substances (Flisher, Evans, Muller, & Lombard, 2004), it needs to be considered that various factors might affect reliability, such as language and cultural expression. The fact that a few of the participants were in possession of a driver's licence or owned bicycles or other means of transport also influenced the results of the safety part.

The tests used in the study need to be standardized for local populations. Therefore, cultural and tribal factors should be taken into consideration as they may influence performance on neuropsychological tests (Meyer, 2005; Meyer & Sagvolden, 2006a).

Other comorbid psychiatric conditions such as anxiety, depression, learning disorders, and pervasive developmental disorders that had not been formally diagnosed before testing, could affect the performance on the neuropsychological tests.

Moreover, making use of a larger sample can enhance the reliability of the results. The socioeconomic state of the regions where the study was conducted was largely poor. It could be for this reason that drugs (heroin and cocaine) have not yet found a responsive market, unlike in urban area such as Cape Town as described by Flisher and colleagues (2003).

It is also important to assess the presence of CD in these adolescents because on its own it can manifest behaviours that overlap with ADHD (Schubiner, Tzelepis, Millberger, Lockhart, Kruger, Kelley, et al., 2000).

8.5. Clinical Implications

The findings of the study suggest that screening for ADHD symptoms in childhood is advised, before risk-taking behaviours manifest themselves in adolescents. Intervention could therefore, start before the adolescents engage in these risk-taking behaviours.

More use should be made of assessment tools for assessing ADHD symptoms, especially tools that measure areas of inattention and hyperactivity-impulsiveness in order to predict risk-taking behaviours. This will be essential in assisting clinicians to link risk taking behaviour with specific ADHD key symptoms.

8.6 Suggestions for further research.

Future studies in this area will need to be focused on already ADHD diagnosed adolescents and compare them with non-ADHD individuals to ascertain the differences in risk-taking behaviours that exist between the two groups as a function of the disorder.

The sample will need to include female participants as well, in order to look at all risk-taking behaviours as a function of gender.

The socioeconomic status should be taken into account as the risk-taking behaviours may vary in different socio-economic settings.

It should be considered to look at the influence of one risk taking behaviour on subsequent risk behaviours, for example, the influence of smoking on dagga and drug use.

8.7. Conclusion

In conclusion, the results of the current study support the hypothesis that there is a relationship between ADHD symptoms (Inattention and Hyperactivity/Impulsiveness) and risk taking behaviours among adolescents. It is also important to understand that results obtained in this study were taken from a non-pathological population. This suggests that having ADHD symptoms and presenting with symptoms related to the disorder, put these individuals at risk for those behaviours. However, it is clear that even without a proper diagnosis, presentation of those ADHD symptoms and engagement in risky behaviours can still be observed. Studies so far have indicated that ADHD may be caused by fundamental neurobiological processes, dopamine dysfunction, and impairment in the EF domains (Johansen et al., 2002), which is expressed by cognitive impulsiveness, not learning from previous mistakes, and inattention.

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Appendix A: Letter to Pax College Principal



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University of Limpopo
School of Social Sciences
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The Principal

Dear Sir,

Research project: Attention-Deficit/Hyperactivity in the Limpopo Province

Attention-Deficit/Hyperactivity Disorder (ADHD) is a developmental disorder, which affects between 2% and 5% of primary school children and also persists into adolescence. It consists of problems with impulse control, attention span, and activity level. However, it is much more than a matter of being inattentive and overactive. The disorder is an obstacle to benefit from normal education methods and to form acceptable social relations. It is not a temporary state that will be outgrown, for most of the children will still be suffering from the disorder as adolescents and adults.

The child usually is disorganized, has problems with planning his/her activities and may be very forgetful. There are severe problems with sustained attention, especially in the classroom situation. The child has also problems with sitting still, is overactive and fidgety. Problems with gross and fine motor coordination are frequent.

The cause of ADHD is not known yet, but research suggests a genetic origin. Pollutants and poor nutrition may also play a role. It is not caused by failure to discipline or control the child. ADHD children not diagnosed and treated at an early age are at risk for future delinquent behaviour, psychiatric problems, and substance abuse. The financial cost for the society will be considerable. The families of these children experience undue stress and it has severe impact on academic activities at schools.

Diagnosis of ADHD has always caused a problem. Up to now, all instruments, which are used for the diagnosis of ADHD, are rating scales completed by teachers and/or parents and are usually culturally biased and have to be translated into all the official languages. These rating scales are mostly inaccurate because of the subjectivity of the rater. Especially in South Africa, with its many culture and language groups, the rating methods is often invalid.

The Department of Physiology, University of Oslo, Norway has therefore developed a culture-free, non-verbal test sensitive to impulsiveness, inattention and motor activity, the three major symptoms of ADHD. Together with tests for planning deficiencies and fine motor co-ordination, we are hoping to have been implicated to play a role in the disorder. This project is funded by the Norwegian Programme for Development related Research and Education (NUFU).

Postgraduate students from both the University of the Limpopo and University of Oslo also form part of the research team.

Method:

The research team will visit the participating school and participated in the study. The participants will be assessed on a battery consisting of the BSSA (Barkley’s Symptoms Scale for Adolescents) (Barkley & Murphy, 2006), YRBS (Youth Risk Behaviour Scale) (Centres for Disease Control and Prevention, 1990).

The participants will then undergo further testing which measure response inhibition (impulsivity) and executive functioning.

The following neuropsychological tests will be administered:

- Wisconsin Card Sorting Test (WCST) (Heaton & Pendleton, 1981)
- GoStop Paradigm (Dougherty et al, 2003)

The data will be used for statistical analysis only and in no circumstances will the identity of the adolescent and the school be revealed.

Your approval of this very important study will contribute to the establishment of a valid diagnostic method, which will enable professionals to identify adolescents with risk-taking behaviour.

Yours Sincerely

.....

Prof Anneke Meyer
Project Leader

Appendix B: Barkleys' Symptoms Scale for Adolescents and Youth Risk Behaviour Scale.

DOB _____

**IMPULSIVENESS IN ADOLESCENTS WITH ATTENTION DEFICIT
HYPERACTIVITY (ADHD)**

Do not write your name on this survey. The answers you give will be kept private. No one will know what you write. Answer the questions on what you really do. If you are not comfortable answering a question, just leave it blank. Make sure to read every question.

Thank you very much for your help!

Section A – Biographical Information

Age.....

Gender (circle) M F

Home language.....

1. Completed level of education (mark the appropriate space with X)

Less than grade 7	
Grade 7	
Grade 8	
Grade 9	
Grade 10	
Grade 11	
Grade 12	
1st year of University/college/technikon	
2nd year of University/college/technikon	
3rd year of University/college/technikon	

2. Occupation (mark the appropriate space with X)

Student at primary school	
Student at secondary school	
Student at tertiary institution	
Manual work / domestic help	
Office work	
Shop assistant	
Self employed	
Unemployed	
Other – specify:	

Health History:

3. Have you ever had the following?

Type of Problem	During Childhood	Currently
Allergies/ asthma		
Heart problems		
Epilepsy or seizures		
High blood pressure		
Serious head injury		
Injury resulting in loss of consciousness		
Lead poisoning		
Broken bones		
Surgery		
Migraine headaches		
Thyroid condition		
Problems with vision		
Problems with hearing		
Diabetes		
Any other serious medical problems (explain)		

4. Are you currently taking any medications? Yes No
 If yes, please give details:.....

5. Please describe any other health difficulties you have experienced now or in the past:

Social History:

6. How would you describe your mood most of the time? (Circle)

- A. Cheerful/ happy B. Sad/ depressed C. Changes all the time
 D. Anxious/ nervous E. Angry/ irritable F. Bland/ unfeeling

7. Do your moods changes very frequently, abruptly, and/ or unpredictably? YesNo

If yes, please give details:.....

8. Do you have trouble making friends? Yes No

9. Do you have trouble-keeping friends? Yes No

10. Do you have trouble in your relationships with others Yes No

If yes, give details:.....

11. Do you have problems with your temper? Yes No

f yes, give details:

12. Do you have driver's license? Yes No

13. Has your license ever been suspended? Yes No

If yes, give details.....

14 How many speed tickets have you ever gotten?.....

15. Have you ever been stopped for driving while intoxicated? Yes No
If so, how many times?..... were you arrested

16. How many car accidents, regardless of fault, have you ever been involved?
In?.....

17. How many times did your family move during your childhood and adolescent?
years?.....

18. How many times have you moved since leaving high school?.....

Section B: Barkley's Symptoms Scale for Adolescents

Current Symptoms scale

Instruction: Please circle the number next to each item that best describes your behavior during the past 6 months.

Items	Never or rarely	Sometimes	Often	Very often
1. Fail to give close attention to details or make careless mistakes in my work	0	1	2	3
2. Fidget with hands or feet or squirm in seat	0	1	2	3
3. Have difficulty sustaining my attention in tasks or fun activities	0	1	2	3
4. Leave my seat in situations in which seating is expected	0	1	2	3
5. Don't listen when spoken to directly	0	1	2	3
6. Feel restless	0	1	2	3
7. Don't follow through on instructions and fail to finish work	0	1	2	3
8. Have difficulty engaging in leisure activities or doing fun things quietly	0	1	2	3
9. Have difficulty organizing tasks and activities	0	1	2	3
10. Feel "on the go" or "drive by a motor"	0	1	2	3
11. Avoid, dislike, or am reluctant to engage in work that requires sustained mental effort	0	1	2	3
12. Talk excessively	0	1	2	3
13. Lose things necessary for tasks or activities	0	1	2	3
14. Blur out answers before questions have been completed	0	1	2	3
15. Am easily distracted	0	1	2	3
16. Have difficulty awaiting	0	1	2	3
17. Am forgetful in daily activities	0	1	2	3
18. Interrupt or intrude on others	0	1	2	3

How old were you when these problems with attention, impulsiveness, or hyperactivity first began

..... years old.

Section C: Youth Risk Behaviour Scale (YRBS)

Personal safety

1 When you rode a bicycle during the past 12 months, how often did you wear a helmet?

- A. I did not ride a bicycle during the past 12 months
- B. Never wore a helmet
- C. Rarely wore a helmet
- D. Sometimes wore a helmet
- E. Most of the time wore a helmet
- F. Always wore a helmet

2. How often do you wear a seat belt when riding in a car driven by someone else?

- A. Never
- B. Rarely
- C. Sometimes
- D. Most of the time
- E. Always

77. During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?

- A. 0 times
- B. 1 time
- C. 2 or 3 times
- D. 4 or 5 times
- E. 6 or more times

78. During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?

- A. 0 times
- B. 1 times
- C. 2 or 3 times
- D. 4 or 5 times
- E. 6 or more times

The next 11 questions ask about tobacco use:

79. Have you ever tried cigarette smoking, even one or two puffs?

- A. Yes
- B. No

80. How old were you when you smoked a whole cigarette for the first time?
- A. I have never smoked a whole cigarette
 - B. 8 years old or younger
 - C. 9 or 10 years old
 - D. 11 or 12 years old
 - E. 13 or 14 years old
 - F. 15 or 16 years old
 - G. 17 years old or older
81. During the past 30 days, on how many days did you smoke cigarettes?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 to 5 days
 - D. 6 to 9 days
 - E. 10 to 19 days
 - F. 20 to 29 days
 - G. All 30 days
82. During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?
- A. I did not smoke cigarettes during the past 30 days
 - B. Less than 1 cigarette per day
 - C. 1 cigarette per day
 - D. 2 to 5 cigarettes per day
 - E. 6 to 10 cigarettes per day
 - F. 11 to 20 cigarettes per day
 - G. More than 20 cigarettes per day
83. During the past 30 days, how did you usually get your own cigarettes? (Select only one response.)
- A. I did not smoke cigarettes during the past 30 days
 - B. I bought them in a store such as a convenience store, supermarket, discount store, or gas station
 - C. I bought them from a vending machine
 - D. I gave someone else money to buy them for me
 - E. I borrowed (or bummed) them from someone else
 - F. A person 18 years old or older gave them to me
 - G. I took them from a store or family member
 - H. I got them some other way
84. During the past 30 days, on how many days did you smoke cigarettes on school property?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 to 5 days
 - D. 6 to 9 days
 - E. 10 to 19 days
 - F. 20 to 29 days
 - G. ALL 30 DAYS
85. Have you ever smoked cigarettes daily, that is, at least one cigarette every day for 30 days?
- A. Yes
 - B. No

86. During the past 12 months, did you ever try to quit smoking cigarettes?
- A. I did not smoke during the past 12 months
 - B. Yes
 - C. No
87. During the past 30 days, on how many days did you use chewing tobacco, snuff, or dip, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandicts, or Copenhagen?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 to 5 days
 - D. 6 to 9 days
 - E. 10 to 19 days
 - F. 20 to 29 days
 - G. All 30 days
88. During the past 30 days, on how many days did you smoke cigars, cigarillos, or little cigars?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 or 5 days
 - D. 6 to 9 days
 - E. 10 to 19 days
 - F. 20 to 29 days
 - G. All 30 days

Drinking alcohol

89. During your life, on how many days have you had at least one drink of alcohol?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 to 9 days
 - D. 10 to 19 days
 - E. 20 to 39 days
 - D. 40 to 99 days
 - E. 100 or more days
90. How old were you when you had your first drink of alcohol other than a few sips
- A. I have never had a drink of alcohol other than a few sips
 - B. 8 years old or younger
 - C. 9 or 10 years old
 - D. 11 or 12 years old
 - E. 13 or 14 years old
 - F. 15 or 16 years old
 - G. 17 years older
91. During the past 30 days, on how many days did you have at least one drink of alcohol?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 to 5 days
 - D. 6 to 9 days
 - E. 10 to 19 days
 - F. 20 to 29 days
 - G. All 30 days

92. During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours?

- A. 0 days
- B. 1 day
- C. 2 days
- D. 3 to 5 days
- E. 6 to 9 days
- F. 10 to 19 days
- G. 20 or more days.

93. During the past 30 days how many times did you have at least one drink of alcohol on school property?

- A. 0 days
- B. 1 or 2 days
- C. 3 to 5 days
- C. 6 to 9 days
- D 10 to 19 days
- E. 20 to 29 days
- F. All 30 days

About Dagga use

94. During your life, how many times have you used Dagga?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 40 to 99 times
- G. 100 or more times

95. How old were you when you tried Dagga for the first time?

- A. I have never tried Dagga
- B. 8 years old or younger
- C. 9 or 10 years old
- D. 11 or 12 years old
- E. 13 or 14 years old
- F. 15 or 16 years old
- G. 17 years old or older

96. During the past 30 days, how many times did you use Dagga?

- A.0 times
- C. 1 or 2 times
- D. 3 or 9 times
- E. 10 to 19 times
- F. 20 to 39 times
- G. 40 or more times

97. During the past 30 days, how many times did you use Dagga on school property?
- A. 0 times
 - B. 1 or 2 times
 - C. 3 to 9 times
 - D. 10 to 19 times
 - E. 20 to 39 times
 - F. 40 or more times

About other drugs.

98. During your life, how many times have you used any form of cocaine, including powder, crack, or freebase?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 40 or more times

99. During the past 30 days, how many times did you use any form of cocaine, including powder, crack, or freebase?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 40 or more times

100. During your life, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 20 to 39 times
- G. 40 or more times

101. During the past 30 days, how many times have you sniffed glue, breathed the contents of aerosol spray cans, or inhaled any paints or sprays to get high?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 3 to 9 times
- E. 10 to 19 times
- F. 20 to 39 times
- G. 20 to 39 times
- H. 40 or more times

102. During your life, how many times have you used heroin (also called smack, junk, or China White)?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 40 or more times

103. During your life, how many times have you used methamphetamines (also called speed, crystal, crack, or ice)?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 40 or more times

104. During your life, how many times have you taken steroid pills or shots without a doctor's prescription?

- A. 0 times
- B. 1 or 2 times
- C. 3 to 9 times
- D. 10 to 19 times
- E. 20 to 39 times
- F. 40 or more times

105. During your life, how many times have you used a needle to inject any illegal drug into your body?

- A. 0 times
- B. 1 time
- C. 2 or more times

106. During the past 12 months, has anyone offered, sold, or given you an illegal drug on school property?

- A. Yes
- B. No

Sexual behavior.

107. How old were you when you had sexual intercourse for the first time?

- A. I have never had sexual intercourse
- B. 11 years old or younger
- C. 12 years old
- D. 13 years old
- E. 14 years old
- F. 15 years old
- G. 16 years old
- H. 17 years older

108. During your life, with how many people have you had sexual intercourse?
- A. I have never had sexual intercourse
 - B. 1 person
 - C. 2 people
 - D. 3 people
 - E. 4 people
 - F. 5 people
 - G. 6 or more people
109. Did you drink alcohol or use drugs before you had sexual intercourse the last time?
- A. I have never had sexual intercourse
 - B. Yes
 - C. No
110. The last time you had sexual intercourse; did you or your partner use a condom?
- A. I have never had sexual intercourse
 - B. Yes
 - C. No
111. The last time you had sexual intercourse, what one method did you or your partner use to prevent pregnancy? (Select only one response.)
- A. I have never had sexual intercourse
 - B. No method was used to prevent pregnancy
 - C. Birth control pills
 - D. Condoms
 - E. Depo – Provera (injectable birth control)
 - F. Withdrawal
 - G. Some other methods
 - H. Not sure
112. How many times have you been pregnant or gotten pregnant?
- A. 0 times
 - B. 1 time
 - C. 2 or more times
 - D. Not sure
113. Have you ever been taught about AIDS or HIV infection in school?
- A. Yes
 - B. No
 - C. Not sure

**This is the end of the survey.
Thank you for your participation.**

Appendix C: Wisconsin Card Sorting Test

