The Prevalence of Traumatic Brain Injury (TBI) and an Investigation of Behavioural and Executive Functioning Outcomes (among those who have sustained TBIs) in a Sample of Male Young Offenders.

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COMPULSORY DECLARATION: This work has not been previously submitted in whole or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, cited, and referenced.

Signature: Date:

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Abstract

Adolescents are at risk for antisocial behaviour as well as for sustaining traumatic brain injuries (TBI; Moffitt, 1993; Williams, Cordan, Mewse, Tonks & Burgess, 2010). International literature has long made known the explicit link that exists between TBI and delinquent behavior (Eslinger, Flaherty-Craig, & Benton, 2004; S. Anderson, Bechara, Damasio, Tranel, & Damasio, 1999). The onset of antisocial behaviour post-TBI may not be surprising given the vulnerability of the frontal lobes in sustaining such an injury. Considering the strong overlap between the behaviour of offenders and the behavioural outcomes of sustaining TBIs, the high prevalence rates of TBI in offending populations is not surprising (Perron & Howard, 2008; Slaughter, Fann, & Ehde, 2003; Turkstra, Jones, & Toler, 2003; Williams et al., 2010). In this study, I investigate the prevalence of TBI in an offending population and the overlap between offending behaviour and outcomes of sustaining TBIs.

This research employs a cross-sectional quantitative design and has two parts. In Part 1, I aim to determine the prevalence of TBI in a sample of male young offenders in the Western Cape. Due to the dearth of research on TBI prevalence in South Africa, I used a matched control group of non-offenders in order to establish whether the incidence of TBI in the young offender sample is not simply a function of the general population. In Part 2, I investigated the behavioural outcomes and executive functioning profiles of young offenders who reported sustaining TBIs compared to young offenders who did not report sustaining such an injury. Part 2 was conducted by making use of standardized neuropsychological test batteries and behavioural measures.

The sample included 106 male, English- and Afrikaans-speaking, young offenders from an institution in the Western Cape, and 27 matched non-offenders from a high school

situated in the same area as the young offender institution. All participants were from low socioeconomic status backgrounds in the Western Cape.

The results for Part 1 of the study show that there is a higher prevalence rate of TBI in the young offender sample compared to the group of non-offenders. The results for Part 2 show that young offenders with TBI are more aggressive and show more delinquent behaviour such as defiant and rule breaking behaviour, involvement in criminal activities and substance use, compared to young offenders who did not report TBIs. Young offenders with TBI also had higher levels of anxiety.

In summary, although the data do not particularly show a difference in cognitive function between young offenders report sustaining TBI and those who do not, the data do show that young offenders with TBI have more adverse behavioural outcomes. This study, therefore, emphasizes the importance of knowing and understanding the behavioural and cognitive sequelae of sustaining TBIs as this may aid the process of behavioural management and re-integration of young offenders back into their communities.

Keywords: traumatic brain injury, young offenders, adolescents, antisocial behaviour, delinquency, executive functioning

Introduction

Aggression, behavioural and cognitive impulsivity, low intelligence quotient (IQ) and lack of emotional control are characteristics often found in young people who exhibit antisocial behaviour (Koolhof, Loeber, Wei, Pardini, & D'Escury, 2007). Researchers studying antisocial behaviour in adolescence have suggested that delinquent behaviour tends to peak during that time and decreases in early adulthood (Blumstein & Cohen, 1987; Moffitt, 1993). The behavioural characteristics observed in young offenders appear similar to those seen in individuals who have sustained TBIs. Moreover, the prevalence of TBI amongst young offender populations are reportedly high worldwide. Thus, there is strong evidence in international research for a behavioural overlap between young people who have sustained TBIs and those who exhibit antisocial behaviour such as young offenders (Barnfield & Leathem, 1998; Hux, Bond, Skinner, Belau, & Sanger, 1998; Moffitt, 1993; Perron & Howard, 2008; Slaughter et al., 2003). In the current study I examine the prevalence of TBI in a young offender sample and I investigate this aforementioned behavioural overlap as well as the executive functioning of young offenders who have reported sustaining TBIs.

Review of the Literature

In the literature review that follows, I will first focus on discussing TBI in terms of its definition, levels of severity, epidemiology and pathophysiology. Second, I move on to discussing the cognitive and behavioural outcomes of TBI. Third, I discuss the development of antisocial behaviour, looking particularly at adolescents and delinquency. Lastly, I discuss young offenders in the South African context.

Definition of TBI

Traumatic brain injury (TBI) is defined as an injury to the head, caused by a blunt or penetrating object that may lead to a loss of consciousness (LOC), and consequently results

in an alteration in brain function. The resultant brain injury can be open or closed, focal or diffuse (Bruns & Hauser, 2003; Von Holst & Cassidy, 2004; Xiang, Sinclair, Yu, Smith, & Kelleher, 2007). An open TBI refers to an impact to the head with a sharp object that penetrates the skull, whereas a closed TBI denotes an alteration of brain function due to a blunt force to the head.

A distinction must be made between a *head injury (HI)* and a *traumatic brain injury (TBI)*. Although these terms are sometimes used interchangeably, for example, in previous literature, in this thesis I focus on TBI as opposed to HI. There may however be times where I draw on literature that makes reference to both terms (Hyder, Wunderlich, Puvanachandra, Gururaj, & Kobusingye, 2007).

A 'head injury' may refer to skull fractures and facial abrasions without LOC and without any change in brain function. A 'traumatic brain injury' refers to brain damage that was caused by impact to the head, and involves an alteration in brain function with behavioural and neuropsychological sequelae (Bruns & Hauser, 2003). The extent of altered brain function in a TBI is mainly dependent on the severity of the injury.

Severity of Injury

The severity of a TBI can be measured in different ways. One common way to do so is to examine the patient's state of consciousness. The most widely used clinical measure is the patient's score out of 15 on the Glasgow-Coma Scale (GCS). This score is determined by the patient's response to visual, verbal, and motor stimuli. A score equal to or more than 13 denotes a mild injury, a score of 9 – 12 denotes a moderate injury, and a score below 9 denotes a severe injury (Bruns & Hauser, 2003; Von Holst & Cassidy, 2004; Teasdale & Jennett, 1974). Other ways of determining injury severity include the length of time that consciousness is lost and the length of time of post-traumatic amnesia (PTA). An individual with PTA usually cannot recall events before and after the injury, and experiences

disorientation and confusion for a limited period of time (Russel, 1935; Van Zomeren & Van Den Burg, 1985). Researchers studying TBI make use of one, or of a combination of these methods when determining the incidence and severity of TBI (Annegers, Hauser, Coan, & Rocca, 1998; Bruns & Hauser, 2003; Williams et al., 2010).

Epidemiology of TBI

TBI has become an important public health problem that is claiming the lives of many worldwide (see Abelson-Mitchell, 2008; Bruns & Hauser, 2003; Hyder et al., 2007 for a review). It has become known as a silent epidemic that often goes unreported and unnoticed (Bruns & Hauser, 2003; Schrieff, Thomas, Dollman, Rohlwink, & Figaji, 2013; Semple, Bass, & Peter, 1998). There are a few reasons for this global underrepresentation of TBI. First, the definition of TBI is inconsistent. This changing definition makes it difficult to identify TBIs, especially mild TBIs. Second, TBI statistics are underestimated as the neurocognitive, behavioural, and emotional effects that often persist post-TBI may not always be as apparent as the physical injury. Thus, the physical injury may heal but the outcomes may go unseen. Third, many low-and-middle income countries (LAMICs) do not make use of well-established health reporting systems, thus TBI is often unreported there (Hyder et al., 2007; Langlois, Rutland-Brown, & Wald, 2006). For these reasons, studies regarding the epidemiology of TBI are challenging to undertake. Perhaps then the dearth of research concerning the incidence of TBI, particularly in South Africa as a LAMIC, is not surprising. The well documented and widely cited epidemiological study carried out by Nell and Brown (1991) on South Africans living in Johannesburg, was conducted over two decades ago. Furthermore, data on the prevalence of TBI amongst South African children is also scarce (Levin, 2004), even though children are particularly at risk in South Africa for two main reasons. First, as a LAMIC, South Africa has one of the highest crime rates in the world (Africa Check, 2013). Second, South Africa has one of the highest motor vehicle

accident (MVA) rates in the world (Levin, 2004). Previous studies on severe pediatric TBI (pTBI) in Cape Town show that more than half of their participants were injured in MVAs or as pedestrians in MVAs (see Semple et al., 1998 and Schrieff et al., 2013).

The incidence rate for TBI in LAMICs is generally reported to be higher than that of high-income countries (HIC), with rates in Africa suggested to be the highest (Abelson-Mitchell, 2008; Hyder et al., 2007). For example, the rate of TBI in the city of Johannesburg, South Africa, was previously reported to be 360 per 100 000 for the 15-to-24 year age group (Nell & Brown, 1991). The overall incidence rate of TBI in Johannesburg South Africa was estimated to be 316 per 100 000 in 1991; whereas in a HIC like Switzerland, the overall prevalence of TBI was reported to be 20 per 100 000 (Abelson-Mitchell, 2008). The incidence of TBI for the 25-to-44 year old age group (409 per 100 000; Nell & Brown, 1991) in South Africa, was the highest amongst other studies with comparable age incidence rates (Bruns & Hauser, 2003).

In their review of the incidence of TBI, Bruns and Hauser (2003) report that the general rate of TBI in HICs is reported to be 200 per 100 000. They caution that this estimate excludes undisclosed TBIs and patients who were not admitted to hospital for treatment. LAMICs, generally, are reported to have higher prevalence rates of TBI than HIC due to increased risk factors for sustaining this kind of injury, such as restricted access to health care, increased violence due to uncontrolled crime, or political conflict, and high rates of MVAs (Bruns & Hauser, 2003; Hyder et al., 2007).

Studies have shown that males are at higher risk for TBI than females (Abelson-Mitchell, 2008; Bruns & Hauser, 2003; Schrieff et al., 2013; Semple et al., 1998) and that children, young adults and the elderly are particularly vulnerable to sustaining TBIs (Abelson-Mitchell, 2008; Bruns & Hauser, 2003; Hux et al., 1998; Williams et al., 2010).

Not only has TBI become a public health concern because of its increasing prevalence worldwide, its increasing trend in children, young adults and the elderly; but also because of the unseen behavioural and cognitive effects that often occur given the pathophysiology of TBIs.

Pathophysiology of TBI

The frontal lobes are particularly vulnerable in the case of a TBI. These frontal structures are at risk for two main reasons. First, this vulnerability is due to the position of the frontal lobes inside the skull, making it a likely target on the point of impact. Second, the acceleration-deceleration action that often occurs upon impact when sustaining a closed TBI may cause the neurons in the frontal lobes, as well as other brain areas such as the temporal lobes, to tear and shear causing diffuse axonal injury (DAI; Meythaler, Peduzzi, Eleftheriou, & Novack, 2001; Rabinowitz & Levin, 2014). The cranial cavity has bony projections, such as the sphenoidal ridges, that hold the brain in position. However, these protrusions place the soft brain tissue at risk for damage in the case of impact, as is commonly seen with TBI (see Levin & Kraus, 1994).

Damage to the frontal lobes and the pre-frontal cortex (PFC), in particular, has been associated with neuropsychological impairment, specifically executive dysfunction. The PFC is known for the regulation of cognition as well as for the regulation of socio-emotional and behavioural responses (Beer, John, Scabini, & Knight, 2006; Eslinger, Biddle, Pennington, & Page, 1999; Eslinger et al., 2004; Fuster, 2002; P. Anderson, 2002; Rabinowitz & Levin, 2014; S. Anderson et al., 1999). The maturation of the PFC has been determined as an important link in the establishment of executive functions, as well as the attainment of socially appropriate behavior from childhood through to adulthood (Eslinger et al., 1999; Eslinger et al., 2004).

Executive Functions

The term *executive functions* commonly refer to a range of higher order cognitive abilities such as attentional control, problem-solving and goal-directed behaviour (Catroppa & Anderson, 2006; P. Anderson, 2002, Rabinowitz & Levin, 2014). The developmental trajectory of these higher order functions is still fairly undetermined. It is known, however, that considerable brain development is necessary before these higher order functional skills emerge, as they are dependent on the integrity of the frontal lobes and connected neural structures. The development of executive functions occurs throughout infancy and middle childhood in growth spurts as opposed to a linear pattern of progressive growth. These functions emerge from infancy and develop rapidly throughout life, with information processing, cognitive flexibility and goal-setting largely mature by the age of 12 (P. Anderson, 2002; V. Anderson, P. Anderson, Northam, Jacobs, & Catroppa, 2001; V. Anderson, 2002). P. Anderson (2002) proposes a model of these higher order functions for children.

Model of executive functioning. P. Anderson's (2002) model of executive functioning has four main domains: attentional control, cognitive flexibility, goal setting and information processing. These domains and the relevant subdomains are presented in Figure 1. According to this model the attentional control domain acts as a gateway and exercises great influence over the other executive domains, whereas the other three domains are interrelated and inter-dependent (see Figure 1 below).

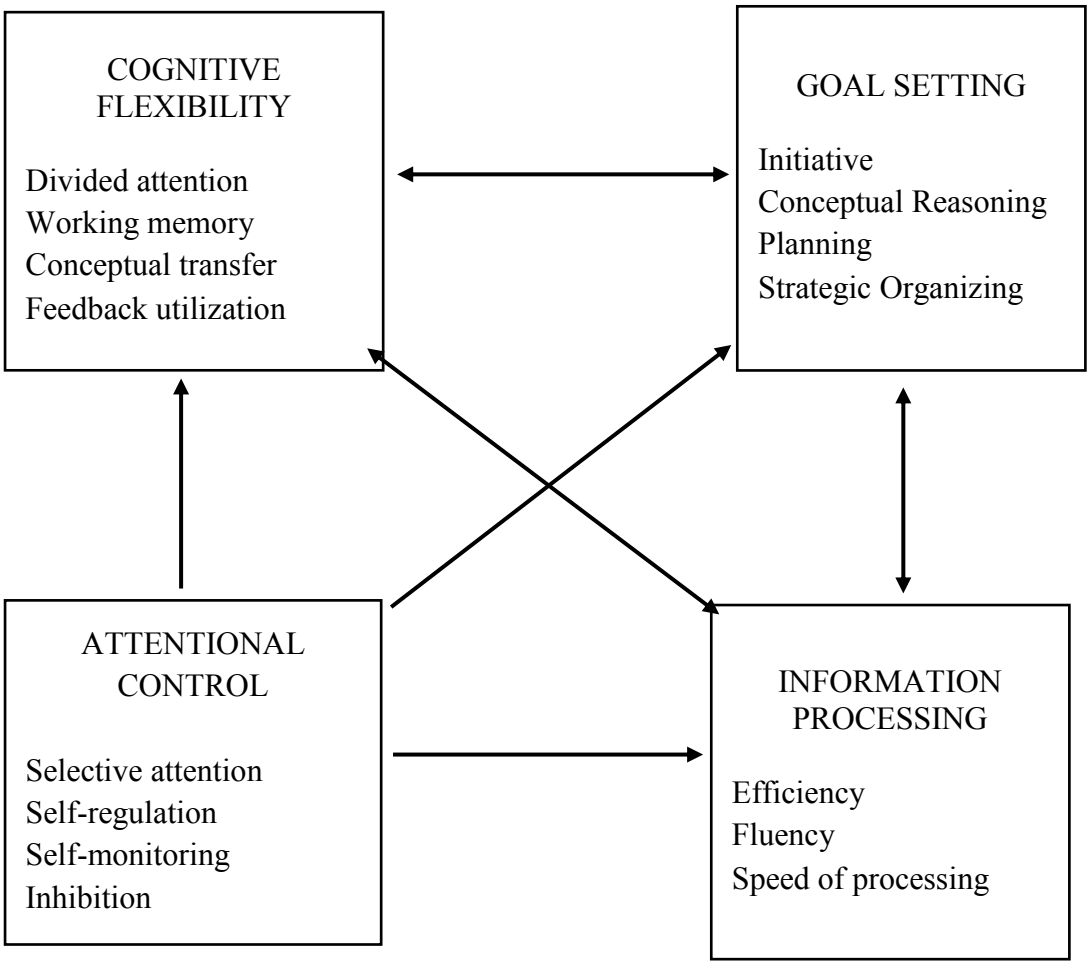

Figure 1: P. Anderson's (2002) model of executive function.

Besides regulating higher order cognitive functions, the frontal lobes are also considered the neural substrates that sub-serve social behaviour (Eslinger, Grattan, & Geder, 1995). Intact executive functioning, therefore, contributes to the moral and social behavioural functioning of an individual. Hence, executive dysfunction, as a result of injury, can lead to multiple externalizing socially maladaptive behaviours and poor psychosocial functioning (P. Anderson, 2002; Wood & Rutterford, 2004). Therefore, affective changes post-injury such as mood swings, aggression, disinhibition, change in energy levels, and change in initiative may also be seen (Eslinger et al., 2004; Jacobs & Anderson, 2002; S. Anderson et al., 1999).

Brain damage during childhood has often been linked to persistent antisocial behaviour later in life (Eslinger et al., 2004; Moffitt, 1993; S. Anderson et al., 1999; Yeates et al., 2004). Children with frontal lobe impairment early in their lives show social maladaptive behaviours more than children with brain lesions in areas other than the frontal lobes, children with generalized pathology, and children without brain lesions (Jacobs & Anderson, 2002). In their review of neuroimaging studies, Brower and Price (2001) state that violent and aggressive behaviour is associated with reduced size and activity of the PFC. The well documented case of JP, a patient who had congenital bilateral damage to the PFC, illustrates how impairment to, and reduced activity of, the PFC, may lead to antisocial behaviour. He was socially maladaptive, with behaviours such as boastfulness, bossiness and compulsive stealing, planning deficits and lack of impulse control, an inability to sustain friendships, an inability to learn from previous experiences, an inability to submit to rules or punishment, and a lack of social self-regulation (Ackerley & Benton, 1948 as cited in Eslinger et al., 2004).

S. Anderson and colleagues (1999) assert that early damage to the polar and ventromedial PFC bilaterally, and unilateral damage to the dorsal and medial polar regions in the right hemisphere have resulted in inadequate socio-emotional responses and poor regulation of sensitive social and moral situations. Of note, patients in these studies sustained TBIs as young children and their immediate recovery was reported as normal. Their disruptive and antisocial behaviour started in their later childhood years into adolescence. These patients were incarcerated multiple times (Eslinger et al., 2004; S. Anderson et al., 1999).

Childhood TBI and Development

Injury in the child brain occurs within the context of ongoing functional development. Therefore, functional deficits seen shortly post-injury may not persist into adulthood.

However, some ongoing deficits may only appear as the child reaches various developmental milestones; a process known as growing into the deficit. Behavioural and cognitive maladaptation resulting from childhood TBI often go unseen at the time of injury but may emerge later in life (Dennis & Levin, 2004; Eslinger et al., 2004; Hornemann & Emanuelson, 2009; Hux et al., 1998; Nadebaum, Anderson, & Catroppa, 2007; S. Anderson et al., 1999; V. Anderson et al., 2011). Therefore, typical developmental patterns may be disturbed due to the ripple effects that can be caused by impairment in brain function (Dennis & Levin, 2004; Horneman & Emanuelson, 2009; Jacobs & Anderson, 2002; V. Anderson, 1999; V. Anderson et al., 2002; V. Anderson et al., 2011). For instance, a child who sustains an injury in the cognitive domain of language may also become impaired in the developing area of social competence. This child with language impairment may not be able to communicate effectively and therefore may start to develop feelings of isolation amongst his or her peers. This may lead to further social maladaptation on a larger scale.

Whether children who have sustained TBIs manage to recover and adapt to their societies, especially in the face of these possible cognitive, social, and behavioural outcomes, is important for their continued development into adolescence and adulthood.

The outcomes of a TBI depend on various factors such as the localization of the injury, severity of the injury, age at the time of injury, and access to rehabilitative interventions post-injury (Dennis & Levin, 2004). Depending on these factors, both long-term behavioural and cognitive outcomes may result from sustaining a brain injury.

Outcomes of TBI

Cognitive outcomes. There are two processes simultaneously occurring in the brain post-injury, that affect cognitive outcomes: recovery and development. These two processes coexist in the injured brain to bring about complex cognitive functioning. This means that while new cognitive functions emerge, others are being reorganized (Dennis & Levin, 2004).

Therefore, the emergence of cognitive functions may be influenced in the long-term by these processes of development and reorganization.

Research on the cognitive outcomes of children who have sustained TBIs has shown that deficits in functions, such as attention and working memory, speed of information processing, as well as deficits in social and behavioural functioning, are evident post-injury (Catroppa & Anderson, 2006; Ganesalingam et al., 2011; Horneman & Emanuelson, 2009; Jacobs & Anderson, 2002; Mateer & Williams, 1991; P. Anderson, 2002; V. Anderson, 1999).

Nadebaum and colleagues (2007) have shown that greater severity of TBI in children younger than 7 years of age has long-term effects for their executive functioning. After a 5-year follow-up, these children with more severe TBI showed less cognitive flexibility and had more impaired goal setting; defined as impaired organizing and reasoning abilities. These children also had slower processing speed than their mildly and moderately injured peers. Their greater severity of injury led to a short attention span, lack of initiative and difficulty adapting to new situations. Thus, executive dysfunction causes an inability to learn and difficulty acquiring new skills. Children with executive dysfunction may, therefore, find it difficult to meet the demands of their environment and social contexts (Mateer & Williams, 1991; P. Anderson, 2002; V. Anderson, 1999).

Behavioural outcomes. Children, adolescents and adults alike, who have sustained TBIs frequently display increased levels of aggression, impulsivity, and poor social outcomes (Brower & Price, 2001; Cole et al., 2008; Dooley, Anderson, Hemphill, & Ohan, 2008; Rochat et al., 2010; Slaughter et al., 2003; Yeates et al., 2004). Such behavioural changes post-TBI is in accordance with literature on executive dysfunction which often leads to poor impulse control and poor mood regulation, and thus social incompetence (Brower & Price, 2001; Cole et al., 2008; Eslinger et al., 2004; P. Anderson, 2002; Rochat et al., 2010; S.

Anderson et al., 1999). Aggression has long been established in the literature as one of the most prominent behavioural sequelae resulting from a TBI.

Aggression. An increase in one's level of aggression is specifically associated with damage to the PFC (Brower & Price, 2001). Increased aggression can occur as a direct effect of damage to the relevant neuroanatomical pathway. The neuroanatomical structures that regulate aggression in the brain include the PFC, specifically the orbitofrontal cortex, the amygdala and other limbic system regions. Damage to the orbitofrontal region, as well as other limbic structures and the amygdala, has been implicated in the inhibition of one's ability to regulate emotions. Impairment to these areas may also cause an increase in disinhibited aggression. Patients with damage in these areas usually experience self-regulatory problems such as difficulty managing their feelings of frustration and increased aggression (Dyer, Bell, McCann, & Rauch, 2006; Greve et al., 2001; New et al., 2004; Siegel, Bhatt, Bhatt, & Zalcman, 2007; Siegel, Schubert, & Shaikh, 1995).

Further, an increase in aggression may result indirectly from sustaining a TBI. Sustaining a TBI may exacerbate premorbid personality traits such as existing levels of impulsive aggression and irritability (Greve et al., 2001). Social issues such as unemployment as a result of TBI, cognitive impairments such as language difficulties, or difficulty with emotional regulation post-injury may also aggravate feelings of frustration (Dyer et al., 2006; Macmillan, Hart, Martelli, & Zasler, 2002; V. Anderson et al., 2011; Yeates et al., 2004).

Increased aggression is associated with more severe TBI in children. The dose-response relationship with regards to TBI severity and increased aggression is especially evident in children who have pre-injury aggression, anxiety and attention problems. Research has shown that inattention at pre-injury is significantly associated with the development of secondary reactive aggression (Cole et al., 2008). Aggression has become an important

concern particularly in children and adolescents, as it can become a gateway to social and occupational difficulties and criminal activity later in their lives (Dooley et al., 2008).

In their study of aggression in adolescent males with and without TBI, Dooley and colleagues (2008) found that participants with TBI reported more impulsive and uncontrolled aggression (reactive aggression) as opposed to pre-meditated and controlled aggression (proactive aggression). In addition to this, participants with TBI reported higher rates of reactive aggression compared to participants without TBI. Reactive aggression can be defined as, "emotional lability, increased levels of anger, feelings of emotional release, and an inability to tolerate frustration" (Dooley et al., 2008, p. 843). Thus, individuals who have sustained TBIs may battle with a range of emotional and behavioural changes post-injury, such as aggression. Often, behaviours associated with impulsivity are also evident.

Impulsivity. Impulsivity is another common externalizing behaviour that is often exacerbated when sustaining a TBI. Impulsivity is a multifaceted behaviour consisting of urgency, lack of premeditation, and a lack of perseverance (Rochat et al., 2010). Impulsivity is related to the inability to inhibit socially undesirable responses or the lack of carrying out goal-directed actions. In their study of impulsivity in 82 patients who had sustained moderate and severe TBIs, Rochat and colleagues (2010) found a significant increase in impulsivity from the level of pre-morbid functioning to the level of functioning post-TBI.

Impulsivity has also been noted as one of the main characteristics in early onset offending behaviour (Parker & Morton, 2009). Patients who have sustained TBIs often have trouble with social competencies, as might be the case from being uncontrollably aggressive or impulsive.

Social competence. Social outcomes of TBI are purported to be dependent on executive functioning, pragmatic language and social problem-solving abilities, independent of intellectual functioning (Yeates et al., 2004). Yeates and colleagues (2004) also assert that

long-term social outcomes of TBI are predetermined by a variety of neurocognitive skills, such as social information processing and social problem-solving, which are often hindered as a result of executive dysfunction. Barnfield and Leathem (1998) found that those who have sustained a TBI in their sample reported difficulties with socialization. Furthermore, researchers found that children who have sustained TBIs between the ages of 6 and 12 years are at a high risk for poor social competence (Yeates et al., 2004). In another study assessing the social competence of children who acquired a TBI at an age younger than 4, researchers found that 80% of these participants were at risk for social problems and 39% of these participants had moderate to severe social impairments approximately 4 years post-injury (Sonnenberg, Dupuis, & Rumney, 2010). The assessment of social competence by Yeates and colleagues (2004) suggested that many children who survived a mild TBI had higher social competence than their peers who sustained moderate to severe TBI. Research has shown that age at injury and severity of injury are major risk factors for social incompetence (McKinlay, Grace, Horwood, Fergusson, & MacFarlane, 2008; Sonnenberg et al., 2010; Yeates et al., 2004; Yeates, Taylor, Walz, Stancin, & Wade, 2010).

Moreover, with regards to social competence, social-problem solving skills are an important determinant for integration back into the community post-TBI. Demographic, social and higher-order cognitive abilities are additional predictors of success for social adaptation post-TBI (Muscara, Catroppa, Eren, & Anderson, 2009). Thus, individuals who have sustained brain injury early in their life, may become socially maladaptive and may show greater difficulty adhering to rules, having more trouble with self-regulation, and showing socially inappropriate behaviour, as they develop antisocial conduct.

Development of Antisocial Behaviour

Adolescents, even those who have not sustained a TBI, may often show antisocial behaviour such as little sensitivity to consequences of decisions, poor moral judgment and

hostility (Moffitt, 1993). There are few studies that have taken a longitudinal approach to investigating the development of antisocial behaviour in adolescents over time; most researchers have investigated criminal activity by teenagers cross-sectionally. However, Moffitt (1993) asserts that, if we are to better understand persistent antisocial behaviour and personality traits we need to identify and study these in people from childhood through adolescence into adulthood. She makes it very clear that although some aspects of behaviour are hereditary, like aggression for example, one's environment plays a key role in the manifestation of personality and behavioural traits. The expression of an individual's genes is partially dependent on that person's experiences in life, which contribute to their socialization (Pieri & Levitt, 2008; Rothbart & Posner, 2005). The way in which one's genetic make-up and one's life experiences interact influences one's ability to regulate thoughts and feelings (Rothbart & Posner, 2005). For instance, if a child is reared in a criminogenic environment, he or she is more likely to engage in criminal activity than his or her peers who were reared in a non-criminogenic environment. In her theory of the development of antisocial behaviour, Moffitt (1993) distinguishes between two hypothetical types of young offenders, namely the *adolescence-limited* offender and *life-course persistent* offender.

Adolescence-limited offenders. Young people who temporarily engage in criminal conduct are said to be *adolescence-limited* offenders. These antisocial tendencies are not stable across place and time; they arise only during the adolescent stage (at about age 13) and start to dissipate upon entry into adulthood (at about age 20). Of note, is that adolescence-limited offenders have no previous history of delinquent behaviour in their childhood and will most probably not act out antisocially in their future. The rise of this antisocial behaviour during the adolescent stage of life is most likely due to social theories such as *mimicry* and *reinforcement* in peer relations. Mimicry and reinforcement are social responses by young people. These social theories describe the behaviour of young people in their friendships with

peers who have become persistent offenders. As young people interact with peers who are persistent offenders, they may become adolescent-limited offenders. Mimicry is referred to as a social response to, and copying of, the antisocial behaviour that is observed in other young people who are offenders. This copying of socially unacceptable behaviours may be a desirable thing to do as it allows access to what is seen by adolescents as social status that comes with power and privilege. The concept of reinforcement here refers to the reinforcement of antisocial behaviour by "negative consequences" such as getting arrested and thus boosting the aforementioned social status (Moffitt, 1993).

Life-course persistent offenders. Young people who commit criminal offences consistently throughout their lives are referred to as *life-course-persistent* offenders. For these individuals, antisocial behaviour is stable across time and events. These individuals are usually socially unskilled and lack internal control (Patterson, Debaryshe, & Ramsey, 1990). In her discussion of this type of offender, Moffitt (1993) points to neuronal damage early in life, such as one might associate with a TBI for example, as one of the main causal factors, which distinguishes adolescence-limited offenders from life-course-persistent offenders.

TBI and Young Offenders

Considering the cognitive and behavioural sequelae of sustaining TBIs, one might be at greater risk for developing antisocial behaviour post-injury. Adolescents with TBI, specifically, may be more vulnerable to delinquency for two reasons. First, antisocial behaviour tends to peak during this stage of life (Moffitt, 1993). Second, the frontal lobes are often impaired when sustaining a TBI, given the neuroanatomical positioning thereof. As discussed above, damage to these structures may lead to a dysexecutive syndrome that may exacerbate antisocial conduct. (Beer et al., 2006; Dooley et al., 2008; Jacobs & Anderson, 2002; Moffitt, 1993; Rochat et al., 2010). A significant number of TBIs are often recorded in

offending populations (Perron & Howard, 2008; Slaughter et al., 2003; Turkstra et al., 2003; Williams et al., 2010).

Prevalence of TBI among young offenders. In their study of incarcerated males, Barnfield and Leathem (1998) reported that 86.4% of their sample had a history of TBI, of which 56.7% reported having sustained more than one injury. In a more recent study conducted in Missouri (USA), Perron and Howard (2008) found that one in every five young offenders reported a lifelong history of TBI. Similarly, multiple published neuropsychological research studies have found that many incarcerated adolescents have sustained one or more TBIs throughout their lifetime (Hux et al., 1998; Slaughter et al., 2003; Turkstra et al., 2003; Williams et al., 2010). The causal relationship between TBI and offending behaviour remains undeterminable. However, Sarapata, Herrmann, Johnson, and Aycock (1998) reported that 50% of their incarcerated participants reported a history of head injury with altered brain function; 83% of the sample reported having a brain injury before their first encounter with the law.

Hence, it is not surprising that TBI has been described as a "significant chronic health condition in adolescent male offenders" (Williams et al., 2010, p. 809). The published studies reviewed above suggest a strong relationship between sustaining one or more TBIs and antisocial behaviour, although the direction of causality cannot be determined. In other words, one cannot say with certainty that being an offender will result in sustaining a TBI or vice versa. Multiple researchers have suggested that adolescence is a risk period for both delinquent behaviour and TBI (Moffitt, 1993; Perron & Howard, 2008; Slaughter et al., 2003; Williams et al., 2010).

Neuropsychological profiles of young offenders. International literature regarding the executive functioning of young offenders has yielded mixed results. In a study by Moffitt and Henry (1989), they report that young offenders did not differ from other adolescents on

measures of executive functions, apart from a subgroup of young offenders who had Attention Deficit Disorder (ADD). These young offenders with ADD scored significantly higher on self-report measures of impulsivity, and differences were found with regards to executive functioning. Moreover, other researchers have reported that recidivistic young offenders differed from other offenders in terms of self-control, memory, and intelligence (Vermeiren, De Clippele, Schwab-Stone, Ruchkin, & Deboutte, 2002). Studies have also reported an association between delinquency and low verbal IQ (Parker & Morton, 2009; Vermeiren et al., 2002).

In studies on IQ and delinquent behaviour, male participants who showed high rates of antisocial behaviour had significantly lower IQ scores than those who were socially well adapted (Koolhof et al., 2007; White, Moffitt, & Silva, 1989). Lynam and Moffitt (1995) assert that IQ can be associated with delinquency. These researchers have also hypothesized that low IQ may be a contributing factor to delinquency, even though it might not be a leading cause. In their research, Koolhof and colleagues (2007) investigate impulsivity as the underlying deficit mediating this relationship between low IQ and delinquency. They conclude that impulsivity is one of the main characteristics of young antisocial boys with low IQ. Moreover, young males with low IQ's were found to be involved in more antisocial activities and had higher scores of both cognitive and behavioural impulsivity than young males with average and high IQ's. However, these researchers also note that boys who were classified as serious delinquents and had low IQ scores, were more likely to live in poor living conditions, being too old for their grade at school and to being depressed.

Although multiple studies have investigated the prevalence of TBI in young offender samples and executive functions of incarcerated teenagers, researchers have not yet, according to my knowledge, determined the neuropsychological profiles of young offenders

with TBI. Moreover, literature on the prevalence of TBI among, and the neuropsychological profiles of, South African young offenders has not yet been investigated.

Behavioural outcomes of young offenders who sustain TBIs. In a sample of 69 convicted inmates, Slaughter et al. (2003) found that 87% of this sample reported sustaining a TBI during their lifetime and 36.2% sustained a TBI in the previous year. Those who sustained a TBI in the year prior to their research had higher anger and aggression scores, much lower scores on cognitive tasks and higher prevalence rates for psychiatric disorders than other inmates who had not sustained TBIs. Furthermore, young offenders who had sustained a TBI showed electroencephalographic (EEG) abnormalities, which denote poor impulse control (Miura, Fujiki, Shibata, & Ishikawa, 2005). Within their population of inmates who had reported sustaining TBIs, Slaughter et al. (2003), found poor anger control, increased aggression, and impulsivity. Thus, offenders with executive dysfunction may have these kinds of neurogenic behavioural problems that may lead to delinquency, and therefore, may not be able to regulate or change their own behaviour to reduce reoffending (Williams et al., 2010). These findings are significant in the face of TBI and behavioural sequelae as they bear important implications for rehabilitation programs.

In light of previous literature it is clear that TBI is a pertinent risk factor for delinquent behaviour, especially amongst adolescents, who are particularly vulnerable to both TBIs and antisocial behaviour (Miura et al., 2005; Perron & Howard, 2008; Sarapata et al., 1998; Slaughter et al., 2003; Williams et al., 2010).

Young Offenders in South Africa

South Africa offers a unique context with regards to both sustaining TBIs and becoming an offender. South Africa has one of the highest crime rates in the world, with a total of 157 375 inmates, of which 786 are young offenders (below the age of 18; International Centre for Prison Studies, 2011). There have been approximately 2.1 million

serious crimes reported throughout the financial year of 2010/2011 (South African Police Service, 2010/2011).The latest report by the South African Police Service (SAPS) states that there has been an increase in the rate of interpersonal violence in the last financial year (South African Police Service, 2012/2013). South Africa's murder rate is approximately four and a half times higher than the global rate (Africa Check, 2012/2013). Furthermore, there are no current statistics available on the prevalence of TBI in South Africa, although it is a country with one of the highest motor vehicle accident (MVA) rates in the world; which is known to be a common mechanism of TBI (Bruns & Hauser, 2003; Hyder et al., 2007; Levin, 2004; Nell & Brown, 1991). According to recent statistics of the World Health Organization, MVAs cause the death of approximately 15 995 South Africans per year (WHO, 2011). Levin (2004) previously reported that MVAs are the most prominent cause of head injuries in South African children.

There is no research that has yet investigated the prevalence and neuropsychological profiles of South African young offenders with TBI, regardless of the fact that an increasing body of international literature demonstrates a strong association between offending behaviour and TBI. However, more research is required to determine the current existing relationship between these factors in South Africa. Therefore, in this study, I aimed to determine the prevalence of TBI in a sample of young offenders in the Western Cape and to investigate the executive functioning profiles of these individuals with regards to aggression and impulsivity.

Aims and Hypothesis

I investigated the prevalence of TBI and its association with executive functioning and behavioural outcomes in a sample of South African young offenders.

I report on two parts of my study in this thesis, each with different aims. The aim of Part 1 was to establish the prevalence rate of TBI in a sample of South African young offenders as compared to a sample of non-offenders. The aim of Part 2 of this research was to assess the behavioural outcomes and executive functioning of young offenders in relation to TBI, i.e. comparing the profiles of young offenders who have sustained a TBI to those who have not sustained a TBI, according to their self-reports.

For Part 1 (the prevalence of TBI among young offenders and non-offenders), I hypothesized that:

1.1) There is a higher prevalence of TBI in a sample of young offenders of mixed-race than in a sample of non-offenders of mixed-race.

For Part 2 (the behavioural outcomes and executive functioning profiles of young offenders with TBI compared to young offenders without TBI), I hypothesized that:

2.1) Young offenders who have sustained one or multiple self-reported TBIs will score more poorly on measures of antisocial behaviour, aggression, and internalizing and externalizing behaviours (as determined by questionnaires) than young offenders who have not sustained any TBIs.

2.1.1) Young offenders who report sustaining TBIs with LOC will score more poorly on measures of antisocial behaviour, aggression, and internalizing and externalizing behaviours (as determined by questionnaires) than young offenders who have not reported TBIs or TBIs with LOC.

2.2) Young offenders who have sustained one or multiple self-reported TBIs will perform more poorly on measures of executive function, in terms of generativity, attention, and inhibition (as determined by neuropsychological assessments) than young offenders who have not sustained any TBIs.

2.2.1) Young offenders who report sustaining TBIs with LOC will perform more poorly on measures of executive function, in terms of generativity, attention, and inhibition (as determined by neuropsychological assessments) than young offenders who have not reported TBIs or TBIs with LOC.

Methods

Design and Setting

Both Part 1 and 2 of this research were quantitative, cross sectional studies that adopted quasi-experimental between-subject designs (Field, 2009).

Part 1: Prevalence of TBI among young offenders and non-offenders. For Part 1, I determined the prevalence of TBI among young offenders by collecting data regarding the TBI status in a sample of young offenders and non-offenders through self-report. Together with co-researchers, we conducted all interviews at the institution of young offenders and at the high school where non-offenders were recruited.

Part 2: Behavioural outcomes and executive functioning profiles of young offenders with TBI compared to young offenders without TBI. For Part 2 of this research, I investigated behavioural outcomes and executive functioning between young offenders who were recruited for Part 1. I compared young offenders who reported sustaining TBIs to those who did not report such injuries. I assessed the behavioural outcomes and executive functioning profiles using interviews and neuropsychological tests. The co-researchers and I conducted all interviews, and I administered all neuropsychological assessments, at the young offender institution.

Participants

All participants recruited for this study were mixed-race males from low socio-economic status backgrounds (SES). I used the general socioeconomic status of the suburb

where participants were situated as a proxy for participants' SES status. All participants recruited were 13 to 17 years of age at the time of this study, and were fluent in either English and / or Afrikaans.

Part 1: Prevalence of TBI among young offenders and non-offenders. Participants for Part 1 included both young offenders and non-offenders. Adolescents were considered young offenders if they had come into conflict with the law and were awaiting trial or if they had been convicted of criminal activity according to the South African justice system.

Adolescents in the non-offender group were those who were not incarcerated, were not awaiting trial, nor had been convicted of criminal activity at the time of the study.

The young offender sample was recruited by purposive sampling, as specific organizations and institutions in the Western Cape were contacted in order to gain access to young offenders. A co-researcher and I recruited matched controls in the non-offender group from a high school situated in the same area as the institution.

Together with a co-researcher, we matched the non-offender sample to the young offender sample on sex, age, language and SES background. I excluded potential participants, as far as possible, if they had severe intellectual disability, severe mental disorders, diagnosed Attention Deficit Hyperactivity Disorder (ADHD), and any medical health condition that may affect neuropsychological testing, such as stroke, epilepsy or diabetes (Williams et al., 2010). Furthermore, individuals who were not fluent in either English or Afrikaans were also excluded, as tests and interviews were only available and administered in either of these languages.

Part 2: Behavioural outcomes and executive functioning profiles of young offenders with TBI compared to young offenders without TBI. The sample for Part 2 consisted only of young offenders. I followed up on the young offender sample that had participated in Part 1. Therefore, the same exclusion criteria used for Part 1, applied to Part 2.

Both young offenders with TBI and those without TBI were identified and tested within this sample.

Measures

All measures were translated into Afrikaans and administered in either English or Afrikaans. These translations were conducted either internally at the University of Cape Town or by the Stellenbosch University Language Laboratory. These measures were translated for the purpose of this study and other studies of a similar nature. The measures used in this study were translated not only for the participants' convenience but also to ensure that all assessments and questionnaires were well understood and appropriately completed by the participant.

Demographic information. I used the Demographic Questionnaire and Asset Index to determine the demographic and SES information of participants. It is a 17-item questionnaire that measures SES by recording annual household income, material resources, and assets of parents / guardians. It also provides information concerning parental / guardian education and employment (Myer, Stein, Grimsrud, Seedat, & Williams, 2008; see Appendix A[1]). This questionnaire follows the asset index developed by Myer et al., (2008) and has a Cronbach's α of .92. The Demographic Questionnaire and Asset Index has successfully been used in the South African context to examine social determinants of mental health and psychological distress in previous studies (Myer, Ehrlich, & Susser, 2004; Myer et al., 2008).

Pediatric Neuropsychology Development Questionnaire (PNDQ). I used the PNDQ to obtain information about participants' developmental process. The PNDQ is a history taking sheet that is used at the Pediatric Neuropsychology Clinic at Red Cross War Memorial Children's Hospital in Cape Town, South Africa. The PNDQ covers a wide range of questions including prenatal development, developmental milestones, emotional

[1] Only English versions of all Appendices are provided

difficulties, schooling, family composition, and current medications used by the participant (see Appendix B).

Measure of general intellectual functioning.

Wechsler Abbreviated Scale of Intelligence – fourth version (WASI-IV). I used the WASI-IV to measure the general intellectual functioning of participants. The WASI-IV (Wechsler, 1999) is a well-accepted measure of general intelligence, designed for participants aged 6 to 89. Participants' Full Scale Intelligence Quotient (FSIQ) is determined by the summation of their Verbal Intelligence Quotient (VIQ) and Performance Intelligence Quotient (PIQ). For this study, all four subtests of this measure were administered: *Vocabulary* and *Similarities* subtests (make up the VIQ) and *Block Design* and *Matrix Reasoning* subtest scores (make up the PIQ).

Vocabulary. The Vocabulary subtest tests participants' knowledge of words. It consists of 42-items. Participants are asked to explain what is meant by different words. For instance, participants are asked to define the word 'bird'.

Similarities. The Similarities subtest tests participants' ability to think abstractly and their ability to categorize verbal concepts. They are asked to state the similarity between two objects or between pairs of words. It consists of 26 items.

Block design. The Block Design subtest is concerned with participants' spatial ability and visualization. They are provided with white and red coloured geometrical blocks and requested to form specific patterns either by copying constructions made by the examiner or by copying designs from a stimulus book. This is a timed task with 13 specified geometrical patterns.

Matrix reasoning. The Matrix Reasoning subtest tests participants' fluid reasoning. Participants are provided with incomplete geometrical patterns and are requested to select the

missing piece from five different geometrical possibilities. It consists of 35 geometric patterns.

The WASI-IV is a valid and reliable measure of general intellectual functioning with reliability coefficients that range from .92 to .95 (Wechsler, 1999). It has been normed amongst different clinical populations, such as individuals with learning disabilities and traumatic brain injury, and has been used successfully amongst various populations, including a sample of Arab school learners (Abu-Hilal, Al-Baili, Sartawi, Abdel-Fattah, & Al-Qaryouti, 2011). Moreover, this measure of general intellectual functioning was also validated across different ethnic groups across the United States of America (Wechsler, 1999). Ryan and colleagues (2005) have found that subtests of the WASI-IV are sensitive to brain dysfunction (including cases of TBI, stroke and dementia patients). The WASI has been previously used for assessing the IQ of young offenders (Hayes & O'Reilly, 2011). The WASI-IV has also previously been used in South African studies (Ferrett, Carey, Thomas, Tapert, & Fein, 2010; Hoare et al., 2012). The internal consistency and reliability of this measure, its sensitivity to TBI patients, as well as the fact that it is an abbreviated version and can thus be used as a quick screening measure, makes the WASI-IV an appropriate measure for use in the current study.

Screening measures.

Alcohol Use Disorders Identification Test (AUDIT). I used the AUDIT (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), to measure participants' alcohol consumption. The AUDIT is an instrument used to identify harmful drinking patterns in participants, which may lead to alcohol dependence (see Appendix C). It is a 10-item questionnaire that was developed for the World Health Organization (WHO) to help determine alcohol dependence in any given sample. This measure has strong internal consistency in identifying harmful / hazardous drinkers from non-harmful / non-hazardous drinkers. The internal reliability

coefficient for measuring alcohol dependence is r =.93 and for the adverse psychological reactions scale, the reliability coefficient is r = .81 (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). The internal consistency of the AUDIT has been assessed across six different nations and has been shown to be a valid and reliable measure cross-culturally (Hall et al., 1993; Saunders et al., 1993). This instrument has previously been used successfully in a South African sample, showing excellent sensitivity in this context (Myer et al., 2008).

Maudsley Addiction Profile (MAP). I used the MAP to measure various health and addictive behavioural tendencies in young offenders. The MAP is a brief questionnaire that assesses four main behavioural outcomes with regards to addiction: substance use, health risk behaviour, physical and psychological health, and personal / social functioning. It gives the researcher an indication of the participant's health status and frequency of drug and alcohol misuse. It is a measure designed particularly for use amongst individuals with drug and alcohol addiction, and can be administered in less than 15 minutes (Marsden et al., 1998; see Appendix D). The MAP was originally designed for use in England, but has been successfully used across different cultures in the European Union, namely Spain, Italy and Portugal (Marsden et al., 2000). Upon testing of the measure in field research, the developers found excellent reliability and validity, with test-retest reliability coefficients ranging from .81 to .94 (Marsden et al., 1998). Although the MAP has not yet been used in published South African studies, it has previously been used successfully in young offender samples (Greaves, Best, Day, & Foster, 2009; Williams et al., 2010).

Beck Depression Inventory (BDI-II). I used the BDI-II to assess depression in the sample of young offenders. The BDI-II (Beck, Steer, & Brown, 1996) is applicable for use with individuals from the age of 13 years to adulthood, and consists of 21 sets of statements. Participants are requested to select the statement that most accurately describes how they have been feeling over the last two weeks. In their psychometric evaluation of the BDI-II

compared to the BDI, Dozois, Dobson and Ahnberg (1998) found the BDI-II to be internally reliable and valid. According to their evaluation, the BDI-II has a Cronbach's α of .91, demonstrating excellent internal consistency (Dozois et al., 1998). These authors assert that the BDI-II is a stronger measure than the BDI. The BDI-II has been used successfully in research with various racial groups such as African Americans, Iranian college students, and in South African samples (Ghassemzadeh, Mojtabai, Karamghadiri, & Ebrahimkhani, 2005; Joe, Woolley, Brown, Ghahramanlou-Holloway, & Beck, 2008; Steele & Edwards, 2008). The BDI-II has successfully been used with young adult offenders in the United Kingdom (Palmer & Binks, 2008; Williams et al., 2010). Palmer and Binks (2008) assert that the BDI-II can reliably be used in research regarding young male offenders.

Measure for investigating the prevalence of TBI.

Comprehensive Health Assessment Tool (CHAT). I used the CHAT to identify participants who have sustained TBIs. The CHAT (Offender Health Research Network [OHRN], 2012) is a self-report measure that was developed particularly for use with young people in the correctional justice system in England. It has various chapters that can be used to screen for physical and mental health, substance misuse, and neurodisabilities. The manual does not specify an age range, but the CHAT has been used successfully with varying samples of young offenders in the Youth Justice System (YJS; Chitsabesan et al., 2014). The Neurodisability chapter was of particular interest for this research project and consists of four main health assessment sections: Traumatic Brain Injury, Learning Disability, Autism Spectrum Disorder, and Speech, Language and Communication Impairment. I used the Traumatic Brain Injury and Learning Disability sections in this study.

According to the CHAT, TBI is defined as "an injury to the head that has caused [the participant] to be knocked out and / or dazed and confused" (see Appendix E). The CHAT has been used successfully by Williams et al. (2010) as a valid and reliable measure for

recording self-reported TBI amongst young offenders. Although this measure has not yet been used in a South African sample, this current study was designed according to the research done by Williams and colleagues (2010).

Behavioural measures.

Maudsley Addiction Profile (MAP). In addition to using the MAP as a screening measure, as described above, I used the criminal activity component of this measure as part of the behavioural outcomes. Thus, I considered criminal activity as a behavioural outcome variable when assessing between group differences.

Inventory of Callous-Unemotional traits (ICU). I used the ICU to measure antisocial and aggressive behavioural traits in all participants of this research (Frick, 2004). It has been used successfully in a sample of German adolescents aged 13 – 18 years old (Essau, Sasagawa, & Frick, 2006). The ICU is a 24-item scale that covers three subscales: Callousness, Uncaring, and Unemotional. Participants are asked to rate their response on a 4-point scale: 0 (*Not at all true*), 1 (*Somewhat true*), 2 (*Very true*), 3 (*Definitely true*; see Appendix F). This scale has been determined as valid and reliable in a sample of violent adolescent offenders (Kimonis et al., 2008). The ICU showed good internal consistency across their samples ranging from .74 to .85. The alphas of the three scales: Callousness, Uncaring and Unemotional ranged from .45 to .88. The ICU showed high predictive validity and internal consistency (Cronbach's $\alpha = .77$) in a recent similar study of young offenders (Mooney, 2010). In another study, researchers used the ICU to screen for the antisocial behaviour across different groups of adolescents, including young offenders. They found it to be moderately satisfactory (Feilhauer, Cima, & Arntz, 2012). Although this measure has not yet been used in a published South African study, it has been successfully used amongst young offender populations (Kimonis et al., 2008).

Reactive-Proactive Aggression Questionnaire (RPQ). I used the RPQ (Raine et al., 2006) to measure aggression in young offenders. The RPQ is a 23-item scale designed to measure reactive and proactive aggression. This self-report measure of aggression is suitable for use in child and adolescent samples. The RPQ is easy to read and to complete with 12 items measuring proactive aggression and 11 items measuring reactive aggression. This questionnaire has fair reliability with item-total correlations of both proactive and reactive scales together ranging from .41 to .60. The proactive and reactive scales also have internal reliabilities of .83. Participants are asked to rate each item as 0 (*never*), 1 (*sometimes*) or 2 (*often*). Scores of each item are summed together to get an overall score of aggression (see Appendix G). This scale has shown adequate validity and reliability particularly with children and adolescent samples, and especially with the identification of delinquency, hostility and impulsivity in the adolescent sample (Raine et al., 2006). The RPQ has not yet been used in any published South African studies, but shows good cross-cultural validity as it has been used successfully to show meaningful differences in aggression in an East Asian population (Fung, Raine, & Gao, 2009).

Child Behaviour Checklist Youth Self-Report form (CBCL; YSR). I used the CBCL to assess various behavioural outcomes in young offenders. The CBCL is a 118-item clinical measure of behavioural problems, used with children aged of 11 to 18 years. It divides behaviour into two broad categories: internalizing and externalizing behaviour. Internalizing behaviours include the somatic complaints, anxiety / depression, and social withdrawal scales; whereas externalizing behaviours include delinquency and aggression scales (Achenbach, 1991). This measure shows excellent inter-rater reliability ranging from .93 to .96. In a study of Dutch and American children, the CBCL has shown excellent cross-cultural generalizability (De Groot, Koot, & Verhulst, 1994). The CBCL Youth Self-Report has also successfully been used in published South African research (Cluver, Gardner, & Operario,

2007). This measure has previously been used to detect antisocial behaviour and has been considered reliable and valid for this purpose (Le Corff & Toupin, 2010). Therefore, it was an appropriate measure of behaviour for this study

Measures of executive functioning.

Delis-Kaplan Executive Function System (D-KEFS). I used two subtests from this battery to assess inhibition as well as cognitive flexibility of participants. The D-KEFS consists of subtests that assess higher order executive functions in both children and adults from ages 8 to 89 (Delis, Kaplan, & Kramer, 2001). The D-KEFS has good internal consistency, test-retest reliability and validity (Delis et al., 2001). It consists of nine subtests that may be used independently.

*Color-word interference test***.** This subtest is designed to assess the inhibition of participants on an over-learned verbal response. On the first trial the participant is given a grid of colours (red, blue and green) and asked to name the colours. On the second trial the participant is given a grid of colour names (also red, blue and green) and asked to read these words. On the third trial the participant is given a grid of these colour names, which are printed in different colour inks (for example, the word 'red' is printed in the ink colour green). The participant is then asked to name the ink colour and not read the word. On the fourth trial the participant is given the same grid as in the third trial except some words are placed in text boxes on this grid. The participant now has to name the ink colour except when the word is in a text box, in which case the participant must read the word. The time per trial, as well as uncorrected and self-corrected errors are recorded. This test was successfully used in a study assessing executive functioning in Western and Eastern populations, showing good cross-cultural validity (Kelkar, Hough, & Fang, 2013). Although the D-KEFS color-word interference test has not yet been used in published South African research, it has been used

successfully in investigations of impulsivity in young offenders compared to non-offenders (Carroll et al., 2006).

Design-fluency test. This subtest consists of three trials and for each trial participants are given 60 seconds to complete the task. For the first trial, participants are provided with rows of boxes with filled dots in each box. They are instructed to connect as many dots as they can in 60 seconds, using four straight lines only. For the second trial, the grid of boxes contains five filled dots and five unfilled dots. Participants are asked to connect the unfilled dots only, thus to inhibit connecting the filled dots. For the third trial, participants are given the same grid as the second trial. The participant is asked to draw a design by alternating between filled and unfilled dots, testing their cognitive flexibility. Although this subtest has not yet been used in published research on South African populations, it has shown acceptable cross-cultural validity. It has been used successfully in studies with offenders, and autistic children in the United Kingdom. (Kleinhans, Akshoomoff, & Delis, 2005; Mullin & Simpson, 2007).

Color Trails Test (CTT). I used the Color Trails Test (D'Elia, Satz, Uchiyama, & White, 1997) to assess attention and switching. The CTT is a test of visual attention and executive processing such as cognitive switching (Dugbartey, Townes, & Mahurin, 2000). This test is relevant for use in this study particularly because it minimizes cultural bias by eliminating the use of letters and therefore minimizing the effect of language on participants' performance. It makes use of numbers and colours instead of letters. Participants complete a practice trial before each condition. Although colour-blindness was not formally assessed, it was hoped that the practice trial would provide an opportunity to identify this. In the first condition, participants are asked to connect coloured circles in the correct order, from 1 to 25. In the second condition, participants are asked to again connect the numbers in the correct order, but in this trial each number has two different coloured circles. Participants have to

alternate the colour of the circles from pink to yellow whilst connecting the numbers in order. Both conditions are timed. The number of colour errors, sequence errors, and near misses are recorded, as well as the number of times a participant had to be prompted in the right direction.

Due to the range of ages in this study, the Children's Color Trails Test (CCTT; ages 8 - 16) as well as the Color Trails Test (CTT; ages 18 - 89) were used. The CCTT (Llorente, Williams, Satz, & D'Elia, 2003) has the same conditions and rules as the CTT. The primary difference between the CCTT and the CTT is the number of circles that participants have to connect. As the CCTT is for a younger population, these participants connect circles numbered 1 to 15 in order, as opposed to 1 to 25. The manual states that the CTT is appropriate for use with adolescents who are 17 years old, although there are no norms and scaled scores for this age group. Both the CCTT and the CTT tests show high internal validity and reliability. Furthermore, the lack of language requirement to complete the CTT and CCTT, has increased its cultural validity. The CTT was successfully used in a study in China, looking at the executive functioning of various groups of Asian participants (Pau, Lee, & Chan, 2002). The CTT was also successfully used in a previous South African study (Joska et al., 2011). Further, the CTT was previously identified as a suitable test for assessing individuals who have sustained brain injuries (Hartman-Maeir, Erez, Ratzon, Mattatia, & Weiss, 2008). Considering this, and the decrease in cultural bias, this test was appropriate for use with participants from low SES backgrounds as in this study.

Neuropsychological assessment-second edition (NEPSY – II); Inhibition subtest. I used the NEPSY – II Inhibition subtest to assess inhibition in the young offender sample. The NEPSY-II Inhibition subtest is designed for use with children from the ages of 6-16 years (Korkman, Kirk, & Kemp, 2007). This subtest consists of two different conditions with three different components in each condition. The two conditions include shape and arrow stimuli,

and the three components are *Naming*, *Inhibition* and *Switching*. In the first condition, participants are given grids of black and white shapes. For the Naming component, participants are asked to name these shapes. For the Inhibition component, they are asked to inhibit a natural response, for example to say 'circle' when they see a 'square'. For the Switching component, participants are asked to switch between responses, for example, to say 'circle' when they see a black circle but 'square' when they see a white circle. Participants are required to follow the same procedure in the second condition of the test with black and white arrows.

This test has good construct and content validity ranging from .62 to .89. It has been used successfully in studies with different cultural groups and thus has shown good cross-cultural validity (Brooks, Sherman, & Iverson, 2010; Mulenga, Ahonen, & Aro, 2001). This subtest has also been used successfully in South African populations (Hoare et al., 2012). The NEPSY-II Inhibition subtest minimizes cultural bias by using shapes and symbols that are globally recognized as opposed to using language. It has been used successfully to determine inhibition in a sample of antisocial youth (Sinclair, Blencowe, McCaig, & Misch, 2013). It is, therefore, a suitable test for use in this study.

Procedure

Roles and Responsibilities. In order to increase the sample size, and therefore the generalizability of the results, there was a team of researchers who assisted in collecting the data. Three research assistants and a co-researcher helped me to conduct the interviews with both offenders and non-offenders. I administered all of the executive functioning assessments independently.

Recruitment. Together, the co-researcher and I used purposive and snowball sampling to recruit participants. In order to establish the prevalence of TBI among young offenders and non-offenders, we approached both young offenders and non-offenders in a

low socio-economic suburban area in the Western Cape. We approached male young offender rehabilitation homes and community centres in order to recruit participants for this study. All young offenders who participated were recruited from one privately owned institution in the Western Cape. This institution consented to the study after we explained the aims and rationale of this research. We approached young offenders in the order in which they appeared on the list of current residents at the institution, provided that they met the inclusion criteria for this study, in terms of their language, age, race, and also their willingness to participate.

Non-offender participants were then recruited from a high school in the same area as the young offender institution (see Appendix H for recruitment letter). The principal provided a co-researcher and I with class lists of names of individuals from grade 8 through to grade 11 (grade 12 learners were excluded due to the principals concern about interfering with the preparations for their final examinations). From these class lists, we compiled a list of all potential participants that matched our young offender sample. These names were numbered and an independent individual was asked to use a random number generator to select the required number of participants from each language and age group.

We assessed all of the young offenders and non-offenders on all of the behavioural measures. We then followed up on the young offenders, both those with and without reported TBIs, with executive functioning testing. Not all young offenders who participated in Part 1 were available for participation in Part 2. By the time Part 2 commenced, some young offenders had been released from the institution back into their communities or to rehabilitation centres, were sentenced to imprisonment, or did not consent to taking part in Part 2.

Because my thesis is divided into Part 1 (investigating the prevalence of TBI study between young offenders and non-offenders) and Part 2 (investigating behavioural and

executive function outcomes between young offenders with and without TBI), I used the data collected in the initial interviews using the behavioural measures in both parts of the study, i.e. for the prevalence part (using the CHAT) and the behavioural section of part 2 (using the AUDIT, MAP-adapted scales, BDI-II, ICU, RPQ and CBCL youth self-report . However, I only analyzed the behavioural data used in part two for those young offenders who also completed the executive function testing.

Part 1: Prevalence of TBI among young offenders and non-offenders. For Part 1 participants were asked for verbal and written assent at the beginning of the session (see Appendix I). Once the co-researcher and I obtained assent from potential participants, we administered the CHAT. An interview-style approach was adopted and this questionnaire was administered to one participant at a time at the institution or at the school. Administering this questionnaire in an interview style helped to ensure that participants understood the questions and responded appropriately. Participants in the young offender sample, who were willing to continue and who were still at the institution were recruited for Part 2 of the study.

Group assignment. Once all interviews were completed, and in preparation for part two of the study, young offenders were assigned to groups based on whether they had reported sustaining TBIs or not, as determined by the CHAT questionnaire. Young offenders who reported sustaining TBIs were placed in the TBI group and young offenders who did not report sustaining TBIs were placed in the No TBI group. I conducted the main analyses for Part 2 on these two groups. Furthermore, young offenders who reported having sustained TBIs were categorized into subgroups of those who reported loss of consciousness (TBI with LOC group) and those who had not reported any loss of consciousness (TBI No LOC group). I conducted sub-analyses on the TBI with LOC and TBI No LOC groups for all outcomes reported in this study (i.e. behavioural and executive functioning outcomes).

Part 2: Behavioural outcomes and executive functioning profiles of young offenders with TBI compared to young offenders without TBI. For Part 2 of this study, I used the behavioural data obtained from the, MAP (criminal activity only), ICU, RPQ and CBCL youth self-report. In addition, I collected data on executive functioning by administering the Neuropsychology test battery. At the beginning of each session for Part 2, the assent form was again given to and signed by the participant, so as to ensure ongoing voluntary participation. The WASI-IV was administered, as well as the D-KEFS Design Fluency, Color Trails Test, D-KEFS Color-Word Interference test, and the NEPSY-II Inhibition subtest. Upon administering the Color-Word Interference test, it was discovered that this test was inappropriate for this population due to its literacy demands. Therefore, the NEPSY-II Inhibition subtest was introduced. Although originally designed for a younger population, this subtest was an appropriate substitution to the D-KEFS Color Word Interference test, as it also tests inhibition but without literacy loading. I used raw scores to compute the composite for this measure, as scaled scores for 17 year olds are not available for this test. Part 2 took approximately 2 hours per participant. I attempted to assess each participant in a room, with as little surrounding noise as possible, in order to ensure that they were able to pay full attention and give their best performance on the tests. As only young offenders underwent Part 2, they were each assessed at the institution.

It was not possible to meet with parents / caregivers of participants in order to administer the parent questionnaires, namely the PNDQ and Demographic Questionnaire and Asset Index, due to a lack of resources or loss of contact with their child. Therefore, when the telephone numbers of parents / caregivers, were obtained these questionnaires were only administered telephonically if parents / caregivers were contactable.

Ethical considerations. The University of Cape Town's Psychology Department Research Ethics Committee approved this study (see Appendix J). The study was also

approved by the Western Cape Education Department (WCED; see Appendix K) so that the co-researcher and I could gain access to a sample of adolescents by approaching high schools in the Western Cape region. In addition, the senior management of the privately owned young offender institution that we approached in order to gain access to young offenders, also approved this study.

Once consent was obtained from the institution and the school, the parents / caregivers of participants were informed of the study and asked whether they would allow their child to consent to participation (see Appendix L). For young offenders, because their institution acts as their legal guardian and because they have little to no face-to-face contact with their parents / caregivers, consent from the institution was used as a proxy for parental consent. In some cases we were able to contact parents / caregivers of the young offenders telephonically, in order to obtain verbal consent by explaining the study procedure, as well as any risks and benefits associated with participation in the study. In addition to this, before each part of the study, each participant was asked for verbal and signed assent (Appendix I). The co-researcher and I explained the study procedure, risks and benefits to the participant in either English or Afrikaans, re-assuring potential participants of confidentiality and anonymity as well as voluntary participation.

We informed participants that information received from them was regarded as strictly confidential and that it would not be used for purposes other than research. We also re-assured them that their participation was voluntary; that they could withdraw from the study at any point with no penalty. This study did not make use of deception in any way. I assigned participants an identity number and all information regarding them was related to their number. In this way the anonymity of participants was protected at all times.

There are no known risks to participants according to the researcher's knowledge, although participants may have experienced fatigue throughout the testing and interview

procedure. Participants were allowed time to rest during the interviews and during the executive functioning battery of tests, in order to decrease the possible effects of fatigue. They were also given refreshments at the end of every session.

Statistical Analysis

I used the Statistical Package for the Social Sciences (SPSS) version 21.0 and version 22.0 to analyze the data for both Parts 1 and 2 of this study. Following convention, the level of significance was set at $p < .05$. A Bonferonni correction was not applied here. As the Bonferroni method is a stricter measure of significance, it increases the risk of making a Type II error, which is, missing an effect that may in fact exist. The effects investigated in public health research are often subtle, such as in the case of sustaining a mild TBI, and therefore when doing this kind of research it is common to make a Type II error, missing existing effects (Jacobson & Jacobson, 2001).

Part 1: Prevalence of TBI among young offenders and non-offenders. For the statistical analysis of Part 1, I first present the descriptive statistics. I then used one-way ANOVA's to compare the demographic variables between the young offender and non-offender groups. I used Levene's test of homogeneity and the Shapiro-Wilk test for normality to ensure that my variables met the assumptions for an ANOVA. If these assumptions were not upheld I computed the between-groups comparison using the non-parametric test, Mann-Whitney *U*, instead. I used one-way ANOVAs to assess the between group differences for continuous variables such as age and the Chi-square or Fisher's exact test for continuous variables such as language. I only used the Fisher's exact test where the expected cell counts for that variable were less than 5.

Part 2: Behavioural outcomes and executive functioning profiles of young offenders with TBI compared to young offenders without TBI. For the statistical analyses of Part 2, I followed a similar procedure as with Part 1. I first present the descriptive statistics

and then used one-way ANOVAs or non-parametric Mann-Whitney *U* tests, depending on whether the assumptions for an ANOVA were upheld, to compute the between group differences of young offenders who reported sustaining TBIs and those who did not report such an injury. I followed this procedure for both the behavioural outcomes and executive functioning measures, for the main and sub-analyses.

***Creating composites*.** The neuropsychology test battery I used to assess executive functioning of participants consisted of a large number of tests, and therefore many outcome variables (31). In order to preserve statistical power, it is important to reduce the number of analyses by reducing the number of outcome variables. Therefore, in order to reduce the number of outcome variables resulting from neuropsychological test batteries I created composites following a standardized hybrid method (Ferrett et al., 2010; Medina et al., 2007). First, the tests and outcome variables were arranged into domains based on theoretical assumptions and by their reliability as measured by Cronbach's α of or approaching, >.70. Second, I converted the dependent variables of each neuropsychology measure in these domains to z-scores. Third, I averaged these z-scores from individual measures in order to compute composite z-scores.

Following this method, I was able to reduce these variables to 3 composites, namely: a Generativity/Inhibition composite, an Attention composite, and an Inhibition composite.

***Effect size*.** I report the effect size of each of the between group comparisons in Part 2, by using the *r* statistic. This is a commonly used statistic that denotes effect size of statistical procedures. Values of the *r* statistic ranging from .10, .30, and .50 represent small, medium, and large effect sizes, respectively. The *r* statistic and Cohen's *d* can be used interchangeably and both can be used with either dichotomous or continuous variables (Field, 2009).

Missing data. In all analyses, I excluded missing cases pairwise. Therefore, I excluded a participant only when the analysis computed was concerned with the variable for

which that participant had missing information, as opposed to excluding that participant from all analyses (Field, 2009). Excluding cases pairwise was an appropriate way to deal with missing data in this research, as test outcomes are independent, i.e. the outcome from one test is not dependent on the outcome of another.

Results

The results are presented in two parts. First, in Part 1, I present both the prevalence of TBI generally, and then more specifically, I present on the prevalence of TBI with LOC that participants reported. Second, in Part 2, I present the analyses of behavioural outcomes as well as the executive functioning profiles of young offenders who reported sustaining TBIs compared to young offenders who did not report sustaining TBIs. I also report on these results for my sub-analyses (comparison between the TBI with LOC and TBI No LOC groups).

Part 1: Prevalence of TBI among Young Offenders and Non-offenders

Participant demographics. The sample of young offenders for Part 1of this thesis consisted of 106 participants. Twenty-seven non-offenders were recruited from a high school situated in the same area as the young offender institution, so as to ensure homogeneity between the groups with regard to SES.

For the young offender group the mean age, measured in years, was $M = 16.23$ ($SD = .91$). The mean age of the non-offender group, also measured in years, was $M = 15.37$ ($SD = 1.21$).These groups differed significantly on the variable of age ($U = 854.5$, $p = .001$). As the twenty-seven participants of the non-offender sample were matched on age with participants from the young offender sample, this significant difference in age may be accounted for by the large disparity in sample size between these two groups.

The overall sample consisted of 64 (48,1%) Afrikaans speaking and 69 (51.9%). English speaking individuals. In the young offender group 44 (41.5%) were Afrikaans speaking and 62 (58.5%) were English speaking. In the non-offender group, 20 (74.1%) were Afrikaans speaking and 7 (25.9%) were English speaking. There was a significant difference between these groups with regards to language ($\chi^2 = 9.14$, $p = .002$), but participants came either from an English or Afrikaans first language background and were tested in their home language so as to minimize any effects language may have on results. The young offender and non-offender groups were matched on the variables of sex, race, and SES, that is, participants from both groups were mixed-race males from low SES backgrounds. See Table 1.

Table 1

Demographic Characteristics of Young Offenders and Non-offenders (N =133)

	Group		
Variable	Young Offenders ($n = 106$)	Non-offenders ($n = 27$)	p
Age at assessment	16.23 (.91)	15.37 (1.21)	.001
Language			
English: Afrikaans	62:44	7:20	.002

Note: For Age at assessment data are presented in years, with standard deviations in parentheses; For Age at assessment mean rank of Young Offender group = 72.44 and of the Non-offender group = 45.65

Frequency of TBI

The frequency of TBI, as reported by participants in both the young offender and non-offender groups, is presented in Table 2. This table shows that 50% of all participants in the young offender sample reported sustaining a TBI, whereas 37% of non-offenders reported such an injury.

Table 2

Frequencies of TBI: Young Offenders vs. Non-offenders (N = 133)

Reported TBI	Group			
	Young Offender (*n* = 106)		Non-offender (*n* = 27)	
No TBI	53	(50.0)	17	(63.0)
TBI	53	(50.0)	10	(37.0)
Total	106	(100.0)	27	(100.0)

Note: Percentages are reported in parentheses.

Table 3 shows the frequency of TBIs reported that involved LOC compared to those injuries where there was no reported LOC. Table 3 also shows the different categories of LOC as indicated in the CHAT. The TBI No LOC group includes those participants who reported not having sustained a TBI (*n* = 70) as well as those who reported only being dazed and/or confused (*n* = 23).

In the young offender group (*n* = 106), of those who had sustained a TBI, 36 (33.96%) participants reported an injury with LOC. In the non-offender group (*n* = 27), 4 (14.81%) participants reported an injury with LOC. In both the young offender group and the non-offender group, most participants reported being dazed and confused. In the most severe category of injury (LOC > 60min), 13 (12.26%) young offenders and 2 (7.41%) non-offenders reported being unconscious for an hour or more after sustaining a TBI.

Table 3

Frequency of LOC in Young Offender and Non-offender Samples (N = 133)

	Groups			
	Young Offender (n = 106)		Non-offender (n = 26)	
No TBI	53	(49.8)	17	(63.0)
Dazed and Confused	17	(16.2)	6	(22.2)
No LOC Total	70	(66.0)	23	(85.2)
LOC < 5 min	10	(9.4)	0	(0.0)
5 min < LOC< 10 min	3	(2.8)	0	(0.0)
10 min < LOC< 30 min	8	(7.5)	1	(3.7)
30 min < LOC< 60 min	2	(1.9)	0	(0.0)
LOC > 60 min	13	(12.3)	2	(7.4)
LOC Total	36	(34.0)	3[a]	(11.1)

Note: LOC = loss of consciousness. The No LOC Total includes those who reported not sustaining a TBI as well as those who reported only being Dazed and/or Confused. [a]One TBI participant from the non-offender sample was uncertain about whether or not he lost consciousness. His LOC data could not be verified by his parent/guardian therefore this was recorded as missing data.

Part 2: Behavioural and Executive Function Outcomes of Young Offenders with TBI and Young Offenders without TBI

Main analysis (TBI vs No TBI): Participant demographics. I investigated the behavioural and executive function outcomes of young offenders by comparing those who had reported a TBI (TBI group; *n* = 38) and those who did not report sustaining a TBI (No TBI group; *n* = 36). Only the behavioural outcomes of 74 young offenders, from the sample of 106, were analyzed because these participants completed both the interview and executive functioning sessions of this research. Therefore, I could do complete analyses for these participants by incorporating both their behavioural and executive functioning data. The other 32 young offenders did not complete the executive functioning session entirely, mainly because they were released from the institution, but also due to time constraints of the project.

In terms of demographics, there was no significant difference between these groups with regards to age ($U = 609.00$, $p = .417$) or language $\chi^2 = .083$. The TBI and No TBI groups were also matched on general intellectual functioning as there were no significant differences between these groups with regards to VIQ, PIQ and FSIQ. The groups were of course also matched on sex, race, and SES (see Table 4).

Table 4

Demographic Characteristics of Young Offenders (N =74): TBI vs. No TBI

Variable	Group						
	TBI (n = 38)	Mean Rank	No TBI (n = 36)	Mean Rank	Test statistic	p	r
Age at assessment	16.30 (.97)	39.47	16.11 (.96)	35.42	609.00[b]	.417	-
Language							
English:Afrikaans	3:35	-	8:28	-	-	.083	-
General Intellectual Functioning							
VIQ	58.95 (5.9)	35.22	60.25 (7.09)	39.90	597.50[b]	.308	-0.12
PIQ	67.03 (10.77)	36.63	68.06 (10.80)	38.42	651.00[b]	.720	-0.04
FSIQ	61.37 (10.94)	36.30	61.50 (8.13)	38.76	638.50[b]	.622	-0.06

Note: For Age at assessment data are presented in years, with standard deviations in parentheses. [b]Mann-Whitney *U* test. VIQ = Verbal IQ; PIQ = Performance IQ; FSIQ = Full Scale IQ. For the qualitative descriptions of IQ scores see Appendix M.

I screened the sample for the following traits: substance use, alcohol consumption (AUDIT), depression and categories of depression (BDI-II). Young offenders with TBI differed significantly from those who have not reported sustaining TBIs on substance use (U = 469.00, p = .015; see Table 5). There was a small-to-medium effect size associated with this comparison (r = -0.28).

I removed the outliers, as identified by boxplots, and re-ran the analysis. Upon removal of the outliers categories of depression (U = 392.50, p = .018) was also significant. The difference between the other variables of these screening measures presented in Table 5 remained unchanged.

Table 5

Screening Measures: TBI vs. No TBI

Variable	*N*	TBI (n = 38)	No TBI (n = 36)	*F/U*	*p*	*r*
MAP						
Substance use	73[a]	2.26 (.98)	1.63 (1.19)	469.00[b]	.015*	-0.28
AUDIT						
Alcohol Consumption	41	12.23 (7.46)	12.26 (6.93)	0.000	.987	0.00
BDI-II						
Depression	73	29.71 (11.56)	26.23 (13.07)	1.46	.231	0.14
Categories of Depression	73	4.29 (1.37)	3.74 (1.63)	542.00[b]	.160	-0.16

Note: [b]Mann-Whitney *U*; for Substance use, mean rank of the TBI group = 42.16 and of the No TBI group = 31.40; for Categories of Depression, mean rank of the TBI group = 40.24 and of the No TBI group = 33.49. [a]There was missing data for one participant across all tests. For AUDIT, the questionnaire is only administered if the participant reports that they have consumed alcohol within the last year. The *r*-value presented here is an estimate of the effect size.
*p < 0.05. **p < 0.01. ***p < 0.001

Behavioural outcomes of TBI vs. No TBI. I investigated the following behavioural outcomes: antisocial, callous, uncaring and unemotional behaviour (ICU), aggression

(reactive and proactive aggression; RPQ), and internalizing and externalizing behaviours (CBCL).

The results are presented in Table 6. There were significant between-group differences on the following variables: criminal activity, the RPQ total, reactive aggression, and proactive aggression. In all cases, within this young offender sample, the TBI group had a significantly higher mean than the No TBI group. In other words, the TBI group had significantly more criminal activity, and had significantly more proactive and reactive aggression than participants in the No TBI group. There were small to medium effect sizes associated with these comparisons.

Table 6

Between-Groups Analysis of Behavioural Outcomes (N = 74): TBI vs. No TBI

Variable	*N*	TBI (n = 38)	No TBI (n = 36)	*F/U*	*p*	*r*
MAP						
Criminal activity	73[a]	1.26 (.86)	.89 (.76)	494.00[b]	.045*	-0.24
ICU Total	73	29.11 (10.63)	26.17 (9.29)	573.00[b]	.309	-0.12
Callous	73	8.61 (5.11)	7.51 (3.32)	572.00[b]	.302	-0.12
Uncaring	73	8.34 (5.96)	7.89 (4.86)	.13	.722	0.04
Unemotional	73	12.24 (6.10)	10.46 (5.32)	1.75	.190	0.16
RPQ Total	59	22.39 (10.52)	14.79 (9.02)	8.78	.004**	0.37
Reactive Aggression	59	12.35 (4.59)	9.00 (4.64)	7.77	.007**	0.35
Proactive Aggression	59	10.03 (6.74)	5.79 (5.07)	267.00[b]	.011*	-0.33

Note: [b]Mann-Whitney *U*; for Criminal activity, mean rank of the TBI group = 41.50 and of the No TBI group = 32.11; for ICU Total, mean rank of the TBI group = 39.42 and of the No TBI group = 34.37; for Callous, mean rank of the TBI group = 39.45 and of the No TBI group = 34.34; for Proactive Aggression, mean rank for the TBI group = 35.39 and of the No TBI group = 24.04. [a]There was missing data for one participant across all tests. For RPQ Total, Reactive and Proactive Aggression, fifteen participants could not complete this as they either did not want to participate anymore, were released from the institution, or sentenced to imprisonment during this time. The *r*-value presented here is an estimate of the effect size. *p < 0.05. **p < 0.01. ***p < 0.001

I removed the outliers, as identified by boxplots, and re-ran the analysis. The difference between all behavioural outcome variables remained unchanged.

Table 7 shows the between-groups comparison for the behavioural outcomes of young offenders who have sustained TBIs compared to those who have not, as measured by the CBCL.

These results show significant differences between the TBI group compared to the No TBI group in this sample of young offenders for: Externalizing Problems, including Defiant Behaviour and Rule Breaking. The TBI group had significantly higher means than the No TBI group with regards to these variables. Therefore, young offenders with TBIs show significantly more externalizing problems, including defiant and rule breaking behaviour than young offenders without TBIs. There are small to medium effect sizes associated with these comparisons. There were no significant differences between Social Problems, Anxiety, Internalizing Problems, Conduct Disorder, Aggression, and Total Problems. There were also small effect sizes associated with these comparisons.

I removed the outliers, as identified by boxplots, and re-ran the analysis. Upon the removal of outliers, Externalizing behaviour, including Defiant and Rule Breaking behaviour remained significant.

Table 7

Between-Groups Analysis for Behavioural Outcomes from the Child Behaviour Checklist (N = 71): TBI vs. No TBI

	TBI (n = 37)		No TBI (n = 34)		Test statistics		
CBCL Syndrome Profile	*M* (*SD*)	Mean rank	*M* (*SD*)	Mean rank	*U*	*p*	*r*
Internalizing Problems	2.27 (.90)	37.95	2.06 (.95)	33.88	557.00	.37	-0.11
Social Problems	1.95 (.94)	38.89	1.65 (.88)	32.85	522.00	.17	-0.16
Anxiety	1.73 (.87)	39.74	1.38 (.74)	31.93	490.50	.06	-0.22
Externalizing Problems	2.35 (.89)	40.82	1.82 (.97)	30.75	450.50	.02*	-0.27
Defiant Behaviour	1.73 (.90)	40.03	1.32 (.68)	31.62	480.00	.04*	-0.25
Conduct Disorder	2.03 (.96)	39.01	1.71 (.94)	32.72	517.50	.15	-0.17
Rule Breaking	2.16 (.91)	40.43	1.71 (.94)	31.18	465.00	.04*	-0.25
Aggression	1.81 (.91)	39.28	1.50 (.86)	32.43	507.50	.10	-0.19
Total Problems	2.32 (.88)	39.28	1.97 (.97)	32.43	507.50	.12	-0.19

Note: Means are reported with standard deviation in parentheses. There was missing data for 3 participants. One participant refused to continue with the study, another was released from the institution at the time of the study and the last participant's data is missing across all tests administered. The *r* value presented here is an estimate of the effect size.
*p < 0.05

Consideration of covariates. Given that the young offender TBI and No TBI groups differed significantly on substance use, this variable could be considered a covariate in the significant between-group analyses for behavioural outcomes described above. Hence, substance use, rather than TBI may contribute to the significant differences between criminal activity, aggression (including reactive and proactive aggression), externalizing problems, defiant, and rule breaking behaviour. However, the effect size for the substance use outcome was small-to-medium. Hence the effect that substance use possibly has on the results may be minor. Also, because this variable did not meet the basic assumptions for an ANCOVA, this procedure could not be computed.

Sub-analysis (TBI with LOC vs TBI No LOC): Participant demographics. In order to further investigate the effects of sustaining a TBI, I divided the sample of 74 young offenders according to those who reported LOC and those who did not report losing consciousness upon injury (including young offenders who reported just being dazed and confused). Table 8 presents the frequencies of young offenders who reported loss of consciousness and those who did not.

Table 8

Frequency of LOC (N = 74)

	Frequency	Percent
LOC	27	36.5
No LOC	47	63.5
Total	74	100

Note: The No LOC group includes those who reported just being Dazed and/or Confused after a blow to the head.

There was no significant difference between these groups with regards to age (U = 626.00, p = .92). The TBI with LOC and TBI No LOC groups also did not differ significantly with regards to general intellectual functioning. The language difference between these groups, using Fisher's exact test, was significant, p = .05. Each interview and test battery was administered in the participant's home language, ensuring that they fully understood questions and test instructions, therefore language will not have impacted negatively on their answers or performance (see Table 9).

Table 9

Demographic Characteristics of Young Offenders (N =74): TBI with LOC vs. TBI No LOC

Variable	Group						
	TBI with LOC (*n* = 27)	Mean Rank	TBI No LOC (*n* = 47)	Mean Rank	Test statistic	*p*	*r*
Age at assessment	16.21 (1.06)	37.81	16.21 (.91)	37.32	626.00[b]	.92	-
Language							
English:Afrikaans	1:26	-	10:37	-	-	.05	-
General Intellectual Functioning							
VIQ	58.37 (5.49)	33.69	60.28 (6.97)	39.69	531.50[b]	.207	-0.15
PIQ	65.56 (8.73)	34.87	68.66 (11.65)	39.01	563.50[b]	.424	-0.09
FSIQ	60.74 (11.52)	33.91	61.83 (8.44)	39.56	537.50[b]	.275	-0.13

Note: For Age at assessment data are presented in years, with standard deviations in parentheses. [b]Mann-Whitney *U*. VIQ = Verbal IQ; PIQ = Performance IQ; FSIQ = Full Scale IQ. For the qualitative descriptions of IQ scores see Appendix M.

Table 10 shows the results for the same screening measures used in the main analyses. Again, substance use was the only variable with a significant difference between the TBI with LOC and TBI No LOC groups. Upon the removal of outliers, as identified by boxplots, the results for substance use remained unchanged.

Table 10

Screening Measures for Young Offenders who report TBI with LOC (N = 74): TBI with LOC vs. TBI No LOC

Variable	*N*	TBI with LOC (n = 27)	TBI No LOC (n = 47)	*F/U*	*p*	*r*
MAP						
Substance Use	73[a]	2.33 (.96)	1.74 (1.16)	450.00[b]	.029*	-0.26
AUDIT						
Alcohol Consumption	41	12.38 (5.75)	12.16 (8.00)	.009	.926	0.01
BDI						
Depression	73	31.04 (12.00)	26.28 (12.34)	2.58	.113	0.19
Categories of Depression	73	4.33 (1.44)	3.85 (1.55)	503.00[b]	.163	-0.16

Note: [b]Mann-Whitney *U*; for Substance use, mean rank of the TBI with LOC group = 43.33 and of the TBI No LOC group = 33.28; for Categories of Depression, mean rank of the TBI with LOC group = 41.37 and of the TBI No LOC group = 34.43.[a]There was missing data for one participant across all tests. For AUDIT, the questionnaire is only administered if the participant reports that they have consumed alcohol within the last year. The *r*-value presented here is an estimate of the effect size. *p < 0.05. **p < 0.01

Table 11 shows the between group differences of behavioural outcomes for young offenders who reported TBI with LOC, compared to those who did not report an injury with LOC. The results show significant differences between young offenders who reported losing consciousness and those who did not on the following variables: criminal activity, aggression, including both reactive and proactive aggression. Young offenders who have TBIs that involved LOC report significantly more criminal activity and aggression than young offenders who did not report losing consciousness (including those who did not report

sustaining a TBI). There are small to medium effect sizes associated with these comparisons. See Table 11.Upon the removal of outliers, as identified by boxplots, the results for all variables remained unchanged.

Table 11

Between-Groups Analysis of Behavioural Outcomes for Young Offenders with LOC associated TBI (N = 74): TBI with LOC vs. TBI No LOC

Variable	*N*	TBI with LOC (n = 27)	TBI No LOC (n = 47)	*F/U*	*p*	*r*
MAP						
Criminal Activity	73[a]	1.41 (.80)	.89 (.80)	406.50[b]	.009**	-0.31
ICU Total	73	27.33 (9.70)	27.91 (10.36)	619.00[b]	.982	-0.00
Callous	73	7.22 (4.08)	8.59 (4.47)	498.50[b]	.159	-0.17
Uncaring	73	8.30 (5.50)	8.02 (5.44)	587.00[b]	.697	-0.05
Unemotional	73	11.81 (5.72)	11.13 (5.85)	.237	.628	0.06
RPQ Total	59	23.52 (9.51)	15.75 (10.05)	8.75	.004**	0.36
Reactive Aggression	59	12.78 (4.07)	9.47 (4.97)	7.15	.010**	0.33
Proactive Aggression	59	10.74 (6.38)	6.28 (5.72)	237.00[b]	.006**	-0.36

Note: [b]Mann-Whitney *U*; for Criminal activity, mean rank of the TBI with LOC group = 44.94 and of the TBI No LOC group = 32.34; for ICU Total, mean rank of the TBI with LOC group = 36.93 and of the TBI No LOC group = 37.04; for Callous, mean rank of the TBI with LOC group = 32.46 and of the TBI No LOC group = 39.66; for Uncaring, mean rank of the TBI with LOC group = 38.26 and for the TBI No LOC group = 36.26; for Proactive Aggression, mean rank for the TBI with LOC group = 37.70 and of the TBI No LOC group = 25.08.[a]There was missing data for one participant across all tests. For RPQ Total, Reactive and Proactive Aggression, fifteen participants could not complete this as they either did not want to participate anymore, were released from the institution, or sentenced to imprisonment during this time. The *r*-value presented here is an estimate of the effect size. *p < 0.05. **p < 0.01

Table 12 shows the behavioural outcomes as measured by the CBCL, between the TBI with LOC group and the TBI No LOC group. There were significant between group differences on the following variables: Social Problems, Anxiety, Defiant Behaviour, Aggression, Externalizing Behaviour, and Total Problems. The TBI with LOC group appeared to have significantly higher means than the TBI No LOC group on the above mentioned variables where significant between-group differences were found. This means that young offenders who reported having lost consciousness at the time of sustaining their TBI, have significantly more social problems, anxiety, externalizing problems such as defiant behaviour and aggression, and total problems overall; compared to young offenders who did not report losing consciousness when they sustained a TBI or who did not report sustaining such an injury at all. There are small to medium effect sizes associated with these comparisons. When I removed the outliers, as identified by boxplots, I found no change in the results regarding the behavioural outcomes as measured by the CBCL.

Consideration of covariates. Given that the TBI with LOC and TBI No LOC groups differed significantly on substance use, this variable could be considered a covariate in the significant between-group analyses for behavioural outcomes described above. Hence, substance use, rather than TBI with reported LOC may contribute to the significant differences between criminal activity, aggression (including reactive and proactive aggression), externalizing problems, defiant behaviour, social problems, anxiety, and total problems. However, the effect size for the substance use outcome was small-to-medium. Hence the effect that substance use possibly has on the results may be minor. Also, because this variable did not meet the basic assumptions for an ANCOVA, this procedure could not be computed.

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Table 12

Between-Groups Analysis for Behavioural Outcomes from the Child Behaviour Checklist (N = 71): TBI with LOC vs. No LOC

	TBI with LOC (n = 26)		TBI No LOC (n = 45)		Test statistics		
CBCL Syndrome Profile	*M* (*SD*)	Mean rank	*M* (*SD*)	Mean rank	*U*	*p*	*r*
Social Problems	2.19 (.94)	43.75	1.58 (.84)	31.52	383.50	.007**	-0.32
Anxiety	1.85 (.88)	42.42	1.40 (.75)	32.29	418.00	.018*	-0.28
Internalizing Problems	2.38 (.85)	40.62	2.04 (.90)	33.33	465.00	.118	-0.19
Defiant Behaviour	1.81 (.90)	42.04	1.38 (.75)	32.51	428.00	.023*	-0.27
Conduct Disorder	2.08 (.93)	40.08	1.76 (.96)	33.64	479.00	.156	-0.17
Rule Breaking	2.19 (.90)	41.04	1.80 (.94)	33.09	454.00	.086	-0.20
Aggression	1.92 (.89)	41.88	1.51 (.87)	32.60	432.00	.034*	-0.25
Externalizing Problems	2.46 (.81)	42.87	1.89 (.98)	32.03	406.50	.017*	-0.28
Total Problems	2.46 (.81)	41.94	1.98 (.97)	32.57	430.50	.04*	-0.24

Note: TBI No LOC = young offenders who have not sustained a TBI or lost consciousness. Means are reported with standard deviation in parentheses. There was missing data for 3 participants. One participant refused to continue with the study, another was released from the institution at the time of the study and the last participant's data is missing across all tests administered. The *r* value presented here is an estimate of the effect size.

*p < 0.05 **p < 0.01

Executive Functioning Analysis of Young Offenders with TBI compared to Young Offenders without TBI

The results for the executive functioning profiles of young offenders are presented in Table 13. I reduced the total number of 31 outcome variables from 31 to 3, using composite variables. These 3 composite variables were: Generativity/Inhibition Composite, Attention Composite, and Inhibition Composite. Table 13 shows the between-group analyses on these composite variables of executive functioning. There were no significant between-group differences regarding the executive functioning composites (see Appendix N for breakdown and detailed analyses of the composites).

Table 13

Between-Groups Analysis of Executive Functioning Composites: TBI vs. No TBI (N = 74)

Neuropsychological Composites	Groups				*F*/*U*	*p*	*r*
	n	TBI	*n*	No TBI			
Generativity/Inhibition Composite (α = .764)	38	-.09 (.77)	36	.10 (.90)	.922	.34	0.01
Attention Composite (α = .818)	37	.19 (1.17)	36	-.19 (.65)	531.50[b]	.138	-0.17
Inhibition Composite (α = .678)	34	.13 (.77)	33	-.12 (.74)	446.00[b]	.149	-0.18

Note: Means presented with standard deviations in parentheses. [b]Mann-Whitney *U*; for the Attention Composite, mean rank of the TBI group = 40.64 and of the No TBI group = 33.26; for the Inhibition Composite, mean rank of the TBI group = 37.38 and of the No TBI group = 30.52. For the Attention Composite, data was missing for one participant. For the Inhibition Composite, data was missing for seven participants. One participant's data was incomplete for this subtest, two others refused to complete the session, and the remaining four were released from the institution before they could complete the assessment. The *r*-value presented here is an estimate of the effect size.

Sub-analysis: Loss of Consciousness. I further investigated the possible effects of TBI on executive functioning by dividing the sample according to young offenders who had reported LOC and those who had not, as I did with the behavioural analysis above (see Table 9 for demographics). The results for the comparison between the TBI with LOC group and TBI No LOC group are presented in Table 14.

There were no significant differences between the TBI with LOC subgroup and TBI No LOC subgroup with regards to the executive functioning composites. There are mostly small effect sizes associated with these comparisons (see Appendix O for detailed analyses of composites).

Table 14

Between-Group Analysis of Executive Functioning Composites for Young Offenders who reported TBI with LOC vs. No report of LOC (N=74)

	Groups						
Neuropsychological Composites	*n*	TBI with LOC	*n*	TBI No LOC	*F*/*U*	*p*	*r*
Generativity/Inhibition Composite	27	-.14 (.81)	47	.08 (.85)	1.21	.274	0.01
Attention Composite	26	.28 (1.29)	47	-.16 (.70)	496.50[b]	.187	-0.15
Inhibition Composite	26	.21 (.77)	41	-.11 (.74)	400.00[b]	.087	-0.21

Note: TBI No LOC = young offenders who have not sustained a TBI and those who reported just being dazed and/or confused; means presented with standard deviations in parentheses. [b]Mann Whitney *U*. For the Attention Composite, mean rank of TBI with LOC group = 40.52 and of the TBI No LOC group = 34.23; for the Inhibition Composite, mean rank of TBI with LOC group = 39.12 and of the TBI No LOC group = 30.76.For the Attention Composite, data was missing for one participant. For the Inhibition Composite, data was missing for seven participants: one participant's data was incomplete for this subtest, two others refused to complete the session, and the remaining four were released from the institution before they could complete the assessment. The *r* value here is an estimate of the effect size.

Discussion

The purpose of this research was twofold. In the first part of this study, the aim was to determine the prevalence of TBI in a sample of young offenders by comparing the incidence of TBI in that sample to a matched non-offender group in the Western Cape. In the second part of this study, the aim was to investigate the antisocial behaviour of young offenders specifically, by investigating their behavioural outcomes, as well as creating and comparing executive functioning profiles of those who reported sustaining TBIs and those who did not, within that group.

Although TBI is known to be a common occurrence in South African society, incidence rates in the general population are largely unknown. Hence, incidence rates of TBI in South African young offenders have also not yet been determined to date. It is important for the incidence of TBI to be established in young offender populations as information of this nature may better inform us of their antisocial behaviour as well as the cycle of re-offending, given that TBI is often associated with socially maladaptive behaviour (Eslinger et al., 2004; Moffitt, 1993; Perron & Howard, 2008; S. Anderson et al., 1999; Williams et al., 2010).

Recent research conducted amongst young offenders does not investigate the direct neurocognitive functioning of those who have sustained TBIs. The effect of TBI on cognition is an important aspect of consideration, as altered brain function may have a direct impact on the behavioural management of offenders with regards to rehabilitation and re-offending. In their assessment of TBI and offenders, Williams and colleagues (2010) suggest that the possible neuropsychological dysfunction of offenders with TBI may lead to poor management of their behaviour and reciprocate the cycle of re-offending. These authors explain that young offenders who have sustained TBIs may have dysexecutive syndromes whereby their ability to pay

attention and inhibit inappropriate behaviour is compromised. These young offenders may lack the capacity to regulate their emotions and learn new behaviours.

In this discussion I summarize the findings of this research for each part of this thesis and how these relate to international studies of this topic. I discuss the value of these findings, the limitations of this study and recommend direction for future research of this nature.

Part 1: Prevalence of TBI among Young Offenders and Non-offenders

I hypothesized that there would be a higher prevalence rate of TBI in the young offender sample than in the non-offender sample. This hypothesis was supported. In the young offender sample the prevalence rate of TBI was 50%. The prevalence rate of TBI for the non-offenders was 37%. These findings are consistent with other international studies that have found a high prevalence of TBI amongst offenders ranging from 46% to 87% (Barnfield & Leathem, 1998; Hux, et al., 1998; Miura et al., 2005; Sarapata et al., 1998; Slaughter et al., 2003; Turkstra et al., 2003; Williams et al., 2010).

In their study of TBI amongst inmates, Slaughter and colleagues (2003) found that 87% of their sample had reported sustaining a TBI. Williams et al. (2010) also found a prevalence rate above 50% in their sample of young offenders, with 65.1% of the young offenders in their study reporting TBIs. In a meta-analysis of the prevalence of TBI amongst offenders, 64.41% of males across all studies included in this meta-analysis, were reported as having sustained TBIs (Shiroma, Ferguson, & Pickelsimer, 2010).

Not all international researchers who have investigated the prevalence of TBI in young offenders have included a comparison non-offender group; this omission of a comparison group is usually because the prevalence rates of TBI in those larger populations are well documented. Hence, it is clear whether the rate of TBI among the young offender samples is indeed a function

of the offender population rather than society at large. In South Africa, the last reported incidence rate for TBI was more than a decade ago (Bruns & Hauser, 2003), and that study was specific to the Johannesburg area. Hence, we do not know the current incidence rates for TBI in South Africa generally, or in the Western Cape specifically, and thus, when determining the prevalence rate in any special population here, one cannot say with certainty whether this is the actual prevalence rate of that population or a reflection of the TBI incidence in the population at large. There are a lack of epidemiological studies regarding TBI in South Africa, and although there have been studies that have detailed the rate of admissions of patients with TBI over a specified period of time (Alexander et al., 2009) there is still no current data available specifically documenting the incidence rate of TBI in South Africa.

Therefore, in order to investigate the incidence rates of TBI in a special sample (i.e. young offenders) in South Africa more accurately, I did so in the context of the general population by including a matched non-offender sample.

The findings suggest that adolescents who are offenders are more likely to report sustaining a TBI than adolescents who are not classified as young offenders. Young offenders, particularly from low socioeconomic backgrounds, may be more likely than non-offenders to sustain TBIs as they may live more carefree lives due to a variety of pre-morbid factors such as engaging in criminal activity and coming from dysfunctional families (Colman, Kim, Mitchell-Hertzfeld, & Shady, 2009; Hux et al., 1998; Moffitt & Henry, 1989; Parker & Morton, 2009). These factors may be especially likely for the sample of young offenders in this study, considering the culture of gangsterism in South Africa. Interpersonal and inter-gang violence is prominent in this society, particularly amongst young people in the mixed-race, or as often

referred to, 'coloured'[2]community (Reckson & Becker, 2005). Many young offenders mentioned either their allegiance to or encounter with a gang in their community during the research interviews.

Hence, on the one hand, being a young offender may create a vulnerability to sustaining TBIs. On the other hand, however, a TBI may lead to impulsive and risky behaviour and consequent delinquent behaviour, characteristic of young offenders, due to the pathophysiology of the injury. For instance, damage to the frontal lobes is common with TBI. Organic frontal impairment is often associated with irritability and aggression, lack of insight into one's own behaviour, and impulsivity with less calculated and planned actions. A TBI may also result in poor moral judgment (Dooley et al., 2008; Rochat et al., 2010; Turkstra et al., 2003). Therefore, due to the behavioural aspects that are associated with a TBI, one might expect a higher rate of TBI amongst young offenders compared to the general young adult population. The direction of possible causality, however, cannot be determined from the results presented here, as this study was not designed to determine the sequence of TBI and the onset of offending behaviour.

The high prevalence rate of TBI observed in the young offender sample warrants attention, particularly because other studies have reported a similar pattern of TBI prevalence amongst offenders around the world, and because these findings may have very important implications for understanding re-offending behaviour and for the rehabilitation of offenders back into their communities (Williams et al., 2010).

Severity of Injury. This research was modelled on a study done by Williams and colleagues (2010). These researchers were interested in the prevalence of TBI in a sample of young offenders and in studying the behavioural aspects of these young offenders. Therefore, I based the measures used in this study on those that were used by Williams et al. (2010). These

[2] Term used in South Africa to denote persons of mixed ancestry.

measures included the CHAT, which was used to establish the prevalence rate of TBI. As a measure of self-reported TBI, the CHAT has different categories of severity listed according to the length of LOC. Thus, in this study, I used these categories of LOC as stated in the CHAT to measure the seriousness of an injury with LOC > 60 min denoting the most severe injury and Dazed or Confused denoting the injury of mildest severity.

According to the literature there are various ways of determining the severity of a TBI. These include the patient's score on the Glasgow Coma Scale (GCS), which denotes their level of consciousness (Teasdale & Jennett, 1974), the length of loss of consciousness, and a measure of the period of post-traumatic amnesia (PTA; Van Zomeren & Van Den Burg, 1985). These scores were not accessible for inclusion in the current study. Although the CHAT does not make use of GCS scores, it does however provide an estimation of severity in terms of the length of loss of consciousness. As this study was not particularly focused on severity of injury, making use of the CHAT to help determine an approximation of severity was sufficient in serving the purpose of this research.

A higher percentage of offenders than non-offenders reported an injury associated with LOC. In the young offender sample, 34.3% of participants reported a TBI with LOC, whereas in the non-offender sample, only 14.8% reported a similar injury. In the young offender sample, the highest reported percentage for TBI with LOC was in the most severe category (12.3%) whereas in the non-offender sample the highest percentage of TBIs reported was in the Dazed and/or Confused category (22.2%). The highest percentage of TBI reported in the most severe category of LOC amongst young offenders compared to non-offenders, implies that more young offenders than non-offenders reported more serious injuries. The dose-response relationship between TBI and outcome is well documented in the literature, such that the more severe the injury, the

greater the behavioural and cognitive sequelae (Horneman & Emanuelson, 2009; Hux et al., 1998; Muscara et al., 2009; Perron & Howard, 2008; Williams et al., 2010).

Therefore, young offenders who have sustained TBIs in this sample may present with higher rates of antisocial behaviour and poorer outcomes on cognitive tasks given the higher rates of more serious injuries reported.

Part 2: Behavioural and Executive Function Outcomes of Young Offenders with TBI Compared to Young Offenders without TBI

General intellectual functioning.

Main analysis: TBI group vs. No TBI group. There were no significant differences between young offenders in the TBI and No TBI groups with regards to IQ. However, for each of the measures of general intellectual functioning, the mean rank of the No TBI group was higher than that of the TBI group. Young offenders in the No TBI group generally performed better across all measures of IQ. Although there are small effect sizes associated with these comparisons (which means that they may be negligible), the data are in the expected direction.

Generally, VIQ was low and ranged from 55 (Extremely Low) to 79 (Low Average), for PIQ results ranged from 55 (Extremely Low) to 99 (Average), and FSIQ scores ranged from 52 (Extremely Low) to 109 (Average). The FSIQ score of 109 was an outlier. There was no difference in statistical significance when this outlier was removed.

Sub-analysis: TBI with LOC group vs. TBI No LOC group. Regarding the LOC sub-analysis, the same pattern as for the main analysis was seen across all WASI-IV subtests. Although there is no significant between-group differences, the data are in the expected direction as the mean rank of the TBI No LOC group is slightly higher than the mean rank of the TBI with

LOC group in each case. There are small effect sizes associated with these comparisons, however, which means that this difference between the means may be negligible.

Participants generally had low IQ scores including scores that were Extremely Low and Low Average, although there were some scores in the Average range. Finding low IQ scores is common amongst individuals from low SES backgrounds and amongst young offenders (Koolhof et al., 2007; Lynam & Moffitt, 1995; Moffitt, Gabrielli, Mednick, & Schulsinger, 1981; White et al., 1989). These low IQ scores may be because adolescents from such backgrounds may have a poor baseline due to environmental and social factors such as lack of schooling and lack of intellectual stimulation during their developmental stages. Previous research has also provided evidence for low family income predicting offending behaviour and an association between low SES backgrounds, poor schooling and verbal low IQ scores (Parker & Morton, 2009).

Furthermore, many of these young offenders reported that they either had never been schooled before, or that they have been out of the school system for a number of years, and for a variety of reasons, including their engagement in criminal activity. Their lack of schooling may also have impacted on their performance on measures of general intellectual functioning and other measures. Moreover, the range of IQ scores that I observed amongst participants may also be due to the fact that some young offenders were in school for longer periods of time than others. Therefore, observing low IQ scores in this population may be associated with a variety of external factors other than sustaining TBIs.

However, Babikian and Asarnow (2009) show, through their meta-analysis, that sustaining a TBI may also negatively affect one's IQ, depending on the severity of the injury. According to their research, intellectual functioning appeared most sensitive to TBI. Therefore,

one may expect low IQ scores in TBI and young offender populations. Despite the overwhelming literature on the cognitive sequelae of sustaining a TBI, I did not find a significant difference in IQ for the main analysis (TBI and No TBI groups), as well as for the sub-analysis (TBI with LOC and TBI No LOC groups). The effect sizes associated with these comparisons were very small. I may not have found a significant difference regarding IQ due to the use of a Westernized IQ measure and different first language administration.

Behavioural outcomes.

Main analysis: (TBI vs. No TBI). I hypothesized that young offenders with TBI would score more poorly on the following measures: ICU, RPQ, and CBCL, than young offenders who did not report sustaining TBIs. I compared two groups on these measures. The groups were matched on race, sex, age, language, IQ and SES. The groups differed significantly on substance use but not on alcohol consumption and depression. In terms of outcome, the results showed that young offenders who reported sustaining TBIs had higher levels of aggression, including both reactive and proactive aggression, more criminal activity, and externalizing problems such as defiant and rule breaking behaviour. These groups did not differ on antisocial behavior as measured by the ICU. Therefore, the hypothesis was partially confirmed.

Sub-analysis: (TBI with LOC vs. TBI No LOC). For the sub-analysis between young offenders who reported TBI with LOC compared to those who did not report an injury with LOC, there were no significant differences between the TBI with LOC group and TBI No LOC group with regards to all demographic variables. The groups did however differ significantly on substance use but not on alcohol consumption and depression. I hypothesized the same behavioural trend as I did for the main analysis. This hypothesis was again partially confirmed. Young offenders who reported TBI with LOC had significantly higher levels of aggression,

including both proactive and reactive aggression, more criminal activity, externalizing behaviour problems such as defiant and aggressive behaviour, and significantly more total problems, anxiety, and social problems (as measured by the CBCL), than their peers in the TBI No LOC subgroup. For all of the outcomes noted above, the small-to-medium effect sizes indicate that, should the sample size have been larger, a stronger association might have been seen.

I discuss the results of each of the behavioural outcome measures below, for both the main analysis (TBI group vs. the No TBI group) and sub-analyses (TBI with LOC vs. the TBI No LOC group).

Antisocial behaviour. I investigated the antisocial behaviour of young offenders by using the MAP and the ICU. I used the MAP to determine criminal activity (such as theft, fraud and selling of illegal drugs). I used the ICU to determine antisocial tendencies in young offenders such as callous, uncaring, and unemotional behaviour. I discuss antisocial behaviour with regards to both of these measures.

The significant results seen for criminal activity in both the main and sub-analyses, is supported by international literature stating that offenders who have sustained TBI's are more likely to engage in criminal activity and substance use. Moreover, considering the dose-response relationship, TBIs of increased severity may result in higher levels of delinquent behaviour such as aggression, criminal activity, and substance use (Barnfield & Leathem, 1998; Perron & Howard, 2008; Sarapata et al., 1998; Williams et al., 2010).

The fact that there was no significant difference in antisocial behaviour, measured by the ICU, between the TBI and No TBI groups, as well as between the TBI with LOC and TBI No LOC groups, shows that antisocial behaviour cannot solely be attributed to an association with TBI as adolescents who have not reported sustaining TBIs also had high antisocial scores. In

other words, these results and previous literature indicate that being antisocial is not necessarily, always linked with sustaining a TBI. This finding is supported by literature on the development of antisocial behaviour, which suggests multiple causative factors for this kind of behaviour. Factors such as substance use and criminal activity due to peer relations may contribute to the development of antisocial behaviour which is often observed in young offenders and other adolescents (Hux et al., 1998; Moffitt, 1993). Furthermore, high levels of antisocial behaviour in all subgroups for this sample can simply be linked to being a young offender.

The TBI vs. No TBI group and the TBI with LOC vs. TBI No LOC group comparisons both yielded significant results with regards to aggression, with the TBI and TBI with LOC groups reporting higher levels of aggression than the No TBI and TBI No LOC groups.

Reactive and Proactive Aggression. Multiple studies reviewed by Brower and Price (2001) support the association between frontal lobe impairment and aggressive behaviour. Considering the pathophysiology of TBI and that the frontal lobes are neuroanatomically vulnerable to injury, sustaining a TBI often results in damage either directly to these frontal areas or indirectly by damage to their connecting brain structures. Sustaining a TBI that has caused either direct or indirect frontal impairment is often associated with poorly controlled aggression. In the current study I investigated the aggression of young offenders using the RPQ. This Likert-scale measures two kinds of aggression, namely: reactive aggression and proactive aggression.

The behavioural outcomes regarding aggression show that young offenders who report having sustained TBIs are more likely to respond aggressively in both an uncontrolled (reactive aggression) as well as a controlled and pre-meditated way (proactive aggression).

In their study of aggression in adolescent males who have sustained TBIs, Dooley and colleagues (2008) found that participants with TBI showed significantly more reactive and

proactive aggression post-injury than non-injured matched controls. This finding of increased aggression reported by individuals who have sustained TBIs, including young offenders, is commonly found in international literature (Bergeron & Valliant, 2001; Cole et al., 2008; Dooley et al., 2008; Dyer, Bell, McCann, & Rauch, 2006; Farrer & Hedges, 2011; Perron & Howard, 2008).

Furthermore, the results of the current study also show significant results for overall aggression, proactive and reactive aggression, for the TBI with LOC group compared to the TBI No LOC group. This significant result of aggression for the TBI with LOC group is in accordance with the dose-response relationship, and is supported by international literature on TBI and aggression (Cole et al., 2008).

CBCL behavioural outcomes. Young offenders without TBI had a mean rank lower than those with TBI for each of the CBCL variables, suggesting that the data are in the expected direction. In other words, young offenders with TBI are more likely to engage in the internalizing and externalizing behaviours measured by the CBCL.

Young offenders in the TBI group had more scores in the clinical range than young offenders in the No TBI group. Most young offenders with TBI scored in the clinical range for Internalizing Problems, Externalizing Problems, Rule Breaking, Conduct Disorder, and Total Problems. For young offenders without TBI the highest frequency in the clinical range was for Internalizing Problems only. Thus, young offenders in the TBI group performed more poorly on measures of the CBCL than young offenders in the No TBI group. Further, there were significant between group differences for Defiant Behaviour, Rule Breaking behaviour, Aggression, and Social Problems for young offenders with TBI.

These significant results, as well as higher frequencies of scores in the clinical range for the TBI group was expected, and is supported by international literature. Multiple studies on adolescents who have sustained TBIs have alluded to an association between TBI and externalizing behaviours. These researchers suggest that young people who have sustained a significant injury to the head, affecting brain function, are likely to experience adverse behavioral outcomes such as increased aggression and defiant behaviour post-injury (Brower & Price, 2001; Cole et al., 2008; Dooley et al., 2008; Dyer et al., 2006; Eslinger et al., 1995; Eslinger et al., 2004; Farrer & Hedges, 2011; Jacobs & Anderson, 2002; Morrell, Morbitz, Jain, & Jain, 1998; P. Anderson, 2002; Rochat et al., 2010; S. Anderson et al., 1999; Slaughter et al., 2003; Wood & Rutterford, 2004; Yeates et al., 2004). Moreover, it is not surprising that young offenders who reported more severe TBIs (TBI with LOC group) displayed more adverse behavioural outcomes as measured by the CBCL. This may be explained by the dose-response relationship. One might expect lower levels of social and behavioural functioning from those with more severe injuries (McKinlay et al., 2008; Sonnenberg et al., 2010; Williams et al., 2010).

Substance use. In all of the significant between-group analyses discussed above (for criminal activity, the RPQ, and CBCL), the groups not only differed on one of the independent variables (i.e. presence of TBI or not, or presence of TBI with LOC or not) but also on the rate of substance use. This finding is not surprising given the association between substance use and young offenders generally (Basson & Mawson, 2011; Brunelle, Brochu, & Cousineau, 2000) and the relationship between substance use and criminal activity, aggression including reactive and proactive aggression, and externalizing behaviour problems such as defiant and rule breaking behaviour outcomes (Basson & Mawson, 2011; Brunelle, Brochu, & Cousineau, 2000; Williams et al., 2010).

Executive Functioning Profiles of Young Offenders with TBI Compared to Young Offenders without TBI

I hypothesized that young offenders who reported sustaining TBIs would display more executive dysfunction than young offenders who do not report having sustained TBIs, as measured by neuropsychological tests and analyzed by the 3 composites: Generativity/Inhibition, Attention, and Inhibition. This hypothesis was not supported for both the main and sub-analyses.

For the main analysis, there were no significant differences between the TBI group and No TBI group with regards to any of the tests from the neuropsychological battery. The TBI group had a higher mean rank than the No TBI group for the Attention and Inhibition composites, although the difference between the means of these groups was not statistically significant, suggesting that these data are in the expected direction. There were small effect sizes associated with all these between group comparisons, which means that they may be negligible. The same trend was seen across all measures of cognitive function for the sub-analysis.

Upon further inspection of the tests that make up the composites, however, the NEPSY-II Switching Total Completion Time variable, part of the Inhibition composite, was significant for the TBI with LOC vs. TBI No LOC group. However, I did not find a consistent pattern of similar results across other timed tasks, nor did the groups differ significantly in terms of accuracy on this switching task. No other significant between-group comparisons were seen on other neuropsychological measures.

Summary of results. The results show that there is a higher prevalence of TBI among young offenders than their non-offender peers. These results suggest that the rate of TBI observed in the young offender sample is not simply a function of the general population but that there is an association between TBI and offending behaviour. I have also found that young

offenders who have sustained TBIs are more likely to engage in criminal activity, and to be aggressive. Young offenders with TBI are also more likely than those without TBI to have externalizing problems such as defiant and rule breaking behaviour, total problems, social problems, and have higher levels of anxiety.

For the measures of executive functioning, although there was no significant difference between those with TBI and those without, the data were in the expected direction; that is, young offenders with TBI generally performed poorer than young offenders without TBI on tests of executive functioning.

Limitations and Directions for Future Research

Perhaps the most obvious limitation of this study was establishing the prevalence rate of TBI using a self-report measure. Self-report measures may be problematic for a number of reasons such as a) social desirability bias, b) inaccurate information relating to over- or underreporting of TBI and other behavioural aspects relating to offending behaviour, or c) lack of information. Despite the ways in which such measures may be problematic, international literature supports self-report as a widely used and accepted method of identifying and establishing the prevalence rate of TBI amongst offenders (Morrell et al., 1998; Perron & Howard, 2008; Sarapata et al., 1998; Shiroma et al., 2010; Slaughter et al., 2003; Williams et al., 2010). The self-report measure that I used was particularly designed and validated for assessing the mental and physical status of young offenders. I chose to use this measure as it has been validated as a reliable measure, and it has been successfully used in other internationally recognized research of TBI prevalence amongst young offenders (Williams et al., 2010). However, one might agree that it is important to verify these reports with the parents or caregivers of participants and / or with medical records. Although efforts were made to collect

this information from the former source, the parents / caregivers of participants in this study were largely uncontactable, which limited this kind of verification.

Due to time and resource constraints, access to medical records to verify reports of TBI was also limited. Accessing medical records would involve identifying the hospital to which each participant in the young offender institution was admitted across the Western Cape. Once these hospitals are identified, one would then have to gain access to their medical folders by first obtaining permission from the head neurologist and ethics committee at each hospital. In future, studies on young offenders that make use of self-reported TBI to determine the prevalence thereof should ideally make use of medical records in order to clinically validate the TBI status and severity of individuals.

Making use of medical records and gaining access to the GCS score of individuals with TBI will also help to accurately determine the severity of the TBI. The GCS score is a reliable clinical measure of the level of consciousness at the time of injury. This measure is helpful because it is a standardized clinical measure that is widely used and has been internationally accepted as a reliable and accurate measure of TBI severity. The severity of injury could not be explicitly stated in this research because the categories of LOC as indicated on the CHAT were used as a guideline in determining the seriousness of the TBI. For future research, determining the severity of TBI may be pertinent to understanding the neuropsychological and behavioural sequelae of such injuries.

A second important limitation is the size of the non-offending sample as compared to the sample of young offenders was relatively small ($N = 27$). This disparity in sample sizes was due to time and resource constraints and may have implications for the comparison of prevalence rates between the offender and non-offender samples. However, being able to compare the

prevalence of TBI across a young offender and non-offender population has successfully been done for the first time in South Africa in the current study, and suggests that TBI is more prevalent amongst young offenders than their non-offending peers.

A third limitation is that data for the young offender sample was only collected at one institution in Cape Town. Access to state-owned institutions is very restricted in South Africa. Limited access to young offenders is an important issue to be addressed by future researchers in this field, as greater access to a variety of young offender institutions would increase the generalizability of the results to the larger population of young offenders in the Western Cape.

A fourth limitation is that I could not tease apart the effects of substance use and TBI on behavioral and executive functioning outcomes in this study. The variable of substance use did not meet the basic assumptions for a covariate analysis, therefore I could not compute ANCOVAs. However, the effect size for this variable was small-to-medium and thus it may have had only a minimal effect on outcomes. Additionally, the significant difference in language between participants may have affected their results and should be considered in future research. Participants were however assessed in their home language.

A fifth limitation is that many young offenders were suspicious of the purpose of the research, regardless of the researchers' best efforts to thoroughly explain the aims of the study and that their participation would be anonymous, voluntary and confidential. Participants often held to their own convictions that the interviews and cognitive assessments would bear consequences to their ongoing legal trials. This false belief by participants may have resulted in the disclosure of socially desirable responses in the interview sessions, and may have caused underperformance in the cognitive assessments due to test anxiety. Moreover, some young

offenders had a higher level of education than others. This may also have impacted on their performances in assessments.

A sixth limitation may be the lack of investigation of executive functioning profiles of non-offenders. Previous studies have suggested an association between low IQ, executive dysfunction and delinquency (Eslinger et al., 2004; Hux et al., 1998; Koolhof et al., 2007; S. Anderson et al., 1999; White et al., 1989). However, according to my knowledge, the interaction between TBI, delinquency and executive functioning has not yet been compared between young offenders and non-offenders. In the current study, I assessed the executive functioning profiles of young offenders only, in order to begin to explore the contribution of TBI to such outcomes among young offenders. Future studies should aim to expand this comparison to young offenders and their non-offending counterparts. It is important to compare the executive functioning of young offenders to that of non-offenders in future research as it will help to clarify the role, as well as the behavioural consequences, of sustaining a TBI in offending behaviour.

A seventh limitation is the lack of investigation into causality. I did not assess when the TBI occurred, as this study was not designed to investigate causality or direction of the onset of antisocial behaviour. I primarily investigated the relationship between TBI and antisocial behaviour in that order; that sustaining a TBI may contribute to the occurrence of antisocial behaviour. Given the pathophysiology associated with sustaining TBIs and the vulnerability of the frontal lobes, damage to these areas often have a profound effect on behavioural functioning. Thus some form of antisocial behaviour is often observed in those who have sustained TBIs (Eslinger et al., 2004; Hux et al., 1998; S. Anderson et al., 1999; Schrieff et al., 2013; Williams et al., 2010). On the other hand, young offenders, due to their lifestyle and existing behaviour, may be more likely to sustain TBIs. There are many factors, such as socioeconomic background,

parenting, and personality that may lead to an individual becoming an offender and a TBI is one of these. Although this study could not determine causality, the design I used was sufficient to meet the aims of this research which included identifying the presence of TBI in a young offender sample, and addressing an important limitation of the study it was based on, i.e. assessing the executive functioning profiles of young offenders (Williams et al., 2010). Williams and colleagues (2010) note this as a limitation and emphasize the importance of direct neuropsychological assessments as a critical tool for effective rehabilitation and reintegration of young offenders back into society.

Future research in this field should be aimed at longitudinal designs. Assessing adolescents from childhood onwards may be more beneficial in understanding the development of antisocial behaviour and the impact of TBI (Moffitt, 1993).

Lastly, I also acknowledge the role of possible biases in my research that may have affected my results (such as assessor and language bias). With regards to assessor bias, it was difficult to control for this factor, as there was more than one individual who conducted interviews due to the sample size of this project. In terms of language bias, we tried to control for this by assessing participants in their home language. Of course, I acknowledge the possible effects of using Westernized tests in a non-Westernized population. However, due to the lack of culturally sensitive measures, it is common practice for researchers in non-Westernized populations to make use of Westernized tests and validated translations thereof, or interpreters.

Summary and Conclusion

Sustaining a TBI is often associated with persistent antisocial behaviour (Cole et al., 2008; Dooley et al., 2008; Eslinger et al., 2004; Hux et al., 1998; Perron & Howard, 2008; S. Anderson et al., 1999; Sarapata et al., 1998; Slaughter et al., 2003; Turkstra et al., 2003;

Williams et al., 2010). This association suggests a high prevalence rate of TBI in offending populations. The results from Part 1 of this thesis were consistent with this trend. Considering the context of South Africa as a LAMIC, a country with exceptionally high crime rates (South African Police Service 2010/2011) and with one of the highest MVA rates in the world (Levin, 2004), a major risk factor for TBI, research and results of this nature, are pertinent in this context.

Furthermore, the results of this study highlight the importance of investigating the cognitive and behavioural sequelae of young offenders who have sustained TBIs. Young offenders who have sustained TBIs may be more aggressive and have more irresponsible and irrational behaviour than young offenders without TBIs (Barnfield & Leathem, 1998; Basson & Mawson, 2011; Morrell et al., 1998; Williams et al., 2010). Being aware of the executive functioning of young offenders with TBI is necessary to better understand their offending behaviour. This knowledge is crucial for the planning of rehabilitation programs, the re-integration of young offenders back into society, and for the behavioural management of such offenders in the cycle of re-offending (Cole et al., 2008; Hux et al., 1998; Morrell et al., 1998; Williams et al., 2010).

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Appendix A

Parent Information Questionnaire and Asset Index

PARENT QUESTIONNAIRE AND ASSET INDEX

GENERAL INFORMATION

Full name (Parent):	
Telephone:	Work: ( ) Home: ( ) Cell:
Home Language:	
Full name (Child):	
Gender:	M F
Date of Birth:	
Grade:	

HOUSEHOLD INCOME: (Please circle appropriate number)

Household income per year:	1. R0 2. R1 – R5 000 3. R5001 – R25 000 4. R25 000 – R100 000 5. R100 001+

PARENTAL EDUCATION: (Please circle appropriate number)

	Biological mother	Biological father	Guardian
Highest level of education reached? Mark one response for each person as follows:			
1. 0 years (No Grades / Standards) = No formal education (never went to school)	1.	1.	1.
2. 1-6 years (Grades 1-6 / Sub A-Std 4) = Less than primary education (didn't complete primary school)	2.	2.	2.
3. 7 years (Grade 7 / Std 5) = Primary education (completed primary school)	3.	3.	3.
4. 8-11 years (Grades 8-11 / Stds 6-9) = Some secondary education (didn't complete high school)	4.	4.	4.
5. 12 years (Grade 12 / Std 10) = Secondary education (completed senior school)	5.	5.	5.
6. 13+ years = Tertiary education (completed university / technikon / college)	6.	6.	6.
7. Don't know	7.	7.	7.

Hollingstead categories:	Biological mother	Biological father	Guardian
1. Higher executives, major professionals, owners of large businesses)	1.	1.	1.
2. Business managers of medium sized businesses, lesser professions (e.g. nurses, opticians, pharmacists, social workers, teachers)	2.	2.	2.
3. Administrative personnel, managers, minor professionals, owners / proprietors of small businesses (e.g. bakery, car dealership, engraving business, plumbing business, florist, decorator, actor, reporter, travel agent)	3.	3.	3.
4. Clerical and sales, technicians, small businesses (e.g. bank teller, bookkeeper, clerk, draftsperson, timekeeper, secretary)	4.	4.	4.
5. Skilled manual – usually having had training (e.g. baker, barber, chef, electrician, fireman, machinist, mechanic, painter, welder, police, plumber, electrician)	5.	5.	5.
6. Semi-skilled (e.g. hospital aide, painter, bartender, bus driver, cook, garage guard, checker, waiter, machine operator)	6.	6.	6.
7. Unskilled (e.g. attendant, janitor, construction helper, unspedified labour, porter, unemployed)	7.	7.	7.
8. Homemaker	8.	8.	8.
9. Student, disabled, no occupation	9.	9.	9.

PARENTAL EMPLOYMENT: (Please circle appropriate number)

MATERIAL AND FINANCIAL RESOURCES (ASSET INDEX): (Please circle appropriate number)

Which of the following items, in working order, does your household have?

Items	Yes	No
1. A refrigerator or freezer	1.	1.
2. A vacuum cleaner or polisher	2.	2.
3. A television	3.	3.
4. A hi-fi or music center (radio excluded)	4.	4.
5. A microwave oven	5.	5.
6. A washing machine	6.	6.
7. A video cassette recorder or dvd player	7.	7.

Items	Yes	No
1. Running water	1.	1.
2. A domestic servant	2.	2.
3. At least one car	3.	3.
4. A flush toilet	4.	4.
5. A built-in kitchen sink	5.	5.
6. An electric stove or hotplate	6.	6.
7. A working telephone	7.	7.

Which of the following do you have in your home?

Do you personally do any of the following?

Items	Yes	No
1. Shop at supermarkets	1.	1.
2. Use any financial services such as a bank account, ATM card or credit card	2.	2.
3. Have an account or credit card at a retail store	3.	3.

Appendix B

Pediatric Neuropsychology Developmental Questionnaire

NEUROPSYCHOLOGY RESEARCH HISTORY SHEET

Child's Name: _____ Date of Birth: _____Age: _____

PREGNANCY AND BIRTH

What complications, if any, were there during the *pregnancy*?

What *medicines* (prescribed or non-prescribed) were taken during pregnancy?

If the birth was earlier or later than the *expected date*, please specify.

What complications, if any, were there during the *birth*? What *type* of birth?

Were there any difficulties with *bonding*?

What was your baby's *weight*? _____

What complications, if any, were there in the *newborn period*?

What *feeding* difficulties, if any, were there? Are there any currently?

What *sleeping* difficulties, if any, were there? Are there any currently?

DEVELOPMENT

At what age did your child:

sit unaided? _____
crawl? _____
walk unassisted? _____
dress and undress unassisted? _____
button own clothes? _____
tie shoe laces? _____
say their first word? _____
use 2 words together? _____
write own name? _____

Were there any problems with *motor, speech or co-ordination* development?At what age was your child *dry by day*?

_____

At what age was your child *dry by night*? _____

What problems, if any, were there with *bowel and bladder* control?

Were there any early *separations* from you?

Please list any *illnesses* and problems with *hearing* or *vision* that your child has/had.

What, if any, problems have there been with your child's *behaviour*?
Has your child ever been referred to a *Psychologist/Psychiatry* service?

What *type* of school does your child attend?

Do you currently have, or have you had, any concerns about your child's *performance* at school?

Have there been any *emotionally difficult* experiences for your child?

FAMILY COMPOSITION

Including names and ages of your *other children* (and state if any are half or step brothers or sisters).

Genogram:

Level of *attainment* at school of siblings:

PARENTS' DETAILS

	Mother	Father
Name		
Relationship (e.g. mother, step-mother)		
Age		
Occupation		
Highest educational level		

Please give any details of any medical or *mental health problems* you or your family of origin may have had.

MEDICATIONS

What *medication* is your child currently receiving?

Please feel free to mention anything else you would like to bring to our attention.

[Observations of child:

Name of History-Taker: _____ Date: _____ Signed: _____

Appendix C

The Alcohol Use Disorders Identification Test

ID :_____ Date: _____

The Alcohol Use Disorders Identification Test: Self-Report Version

Administer if participant has used alcohol within the last year.

PATIENT: Because alcohol use can affect your health and can interfere with certain medications and treatments, it is important that we ask some questions about your use of alcohol. Your answers will remain confidential so please be honest.

Place an X in one box that best describes your answer to each question.

Questions	0	1	2	3	4
1. How often during the last year have you had a drink containing alcohol?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
2. During the last year, how many drinks containing alcohol have you had on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more
3. During the last year, how often do you have six or more drinks on one occasion?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
4. How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
5. How often during the last year have you failed to do what was normally expected of you because of drinking?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
7. How often during the last	Never	Monthly or	2-4 times a	2-3 times a	4 or more

year have you had a feeling of guilt or remorse after drinking?		less	month	week	times a week
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week
9. Have you or someone else been injured because of your drinking?	No		Yes, but not in the last year		Yes, during the last year
10. Has a relative, friend, doctor, or other health care worker been concerned about your drinking or suggested you cut down?	No		Yes, but not in the last year		Yes, during the last year
Total					

Appendix D

Maudsley Addiction Profile

SECTION B: SUBSTANCE USE

(A) Enter whether used in the past 30 days
(B) [Card 2] Record number of days used in past 30 days
(C) Enter amount used on typical using day in past 30 days
(D) Record route(s) of administration

Note: Record grammes/money equivalent for amount consumed; probe fully for alcoholic drinks and record type(s), brand, size (e.g. small/large can; pint/half-pint; size measures for spirit).

FREQUENCY OF USE IN THE PAST 30 DAYS

1 day only	2 days only	3 days only	Once every week	2 days a week	3 days a week	4 days a week	5 days a week	6 days a week	Every day
1	2	3	4	9	13	17	21	26	30

Oral	Snort/sniff	Smoke/chase	Intravenous
1	2	3	4

Type	Yes/No	No of times past 30 days	Amount used on a typical day	Route(s) of administration
(1) Alcohol				
(2) Heroin				
(3) Illicit methadone				
(4) Illicit benzodiazepine Specify				
(5) Cocaine powder				
(6) Crack/rock cocaine				
(7) Amphetamines				

SECTION C: HEALTH RISK BEHAVIOUR

Injected drugs in the past 30 days?	Yes/No
If no injecting in the past 30 days skip to sexual behaviour items	
(1) Days in the past 30 days injected drugs (days)	☐
(2) Times injected on a typical day in past 30 days (times)	☐
(3) Times injected with a needle/syringe already used by someone else (times)	☐

Had penetrative sex in the past 30 days and not used condom? Yes/No

If no non-condom sex in the past 30 days skip to health items

(4) How many people had sex with and not used condom (people) ☐

(5) Times had sex when not used condom (times) ☐

SECTION D: HEALTH SYMPTOMS

(1) **Physical health symptoms**

Past 30-day frequency	Never	Rarely	Sometimes	Often	Always
(a) Poor appetite	☐	☐	☐	☐	☐
(b) Tiredness/fatigue	☐	☐	☐	☐	☐
(c) Nausea (feeling sick)	☐	☐	☐	☐	☐
(d) Stomach pain	☐	☐	☐	☐	☐
(e) Difficulty breathing	☐	☐	☐	☐	☐
(f) Chest pain	☐	☐	☐	☐	☐
(g) Joint/bone pain	☐	☐	☐	☐	☐
(h) Muscle pain	☐	☐	☐	☐	☐
(i) Numbness/tingling	☐	☐	☐	☐	☐
(j) Tremors (shakes)	☐	☐	☐	☐	☐

(2) Psychological health symptoms

Past 30-day frequency	Never	Rarely	Sometimes	Often	Always
(a) Feeling tense	☐	☐	☐	☐	☐
(b) Suddenly scared for no reason	☐	☐	☐	☐	☐
(c) Feeling fearful	☐	☐	☐	☐	☐
(d) Nervousness or shakiness inside	☐	☐	☐	☐	☐
(e) Spells of terror or panic	☐	☐	☐	☐	☐
(f) Feeling hopeless about the future	☐	☐	☐	☐	☐
(g) Feelings of worthlessness	☐	☐	☐	☐	☐
(h) Feeling no interest in things	☐	☐	☐	☐	☐
(i) Feeling lonely	☐	☐	☐	☐	☐
(j) Thoughts of ending your life	☐	☐	☐	☐	☐

SECTION E: PERSONAL/SOCIAL FUNCTIONING

In relationship with a partner in the past 30 days? Yes/No

If no partner in the past 30 days skip to relatives items

(1) The number of days that you had contact with your partner (i.e. saw them or talked to them on the telephone) ☐

(2) On how many of these days was there conflict between you? (i.e. had major arguments etc.) ☐

Tick here if no relatives or no contact with any in the past month ☐

(3) The number of days that you had contact with your relatives (i.e. saw them or talked to them on the telephone) ☐

(4) On how many of these days was there conflict between you? (i.e. had major arguments etc.) ☐

Tick here if no contact with any friends in past month ☐

(5) The number of days that you had contact with your friends (i.e. saw them or talked to them on the telephone) ☐

(6) On how many of these days was there conflict between you? (i.e. had major arguments etc.) ☐

(7) Days had paid work in past 30 days ☐

(8) Days missed from work because of sickness or unauthorised absence ☐

(9) Days formally unemployed in the past 30 days ☐

(10) Crime involvement in the past 30 days ☐

	Yes/No	Days in the past month	Number of times on a typical day
(a) Selling drugs	☐	☐	☐
(b) Fraud/forgery	☐	☐	☐
(c) Shoplifting	☐	☐	☐
(d) Theft from a property	☐	☐	☐
(e) Theft from a person	☐	☐	☐
(f) Theft from a vehicle	☐	☐	☐
(g) Theft of a vehicle	☐	☐	☐

END OF INTERVIEW

Appendix E

Comprehensive Health Assessment Tool

DRAFT NEURODEVELOPMENT AND TRAUMATIC BRAIN INJURY SCREEN: PART 5

GUIDANCE

- This provides a framework for the systematic assessment of neurodevelopmental disorders and traumatic brain injury needs within the secure estate to identify opportunities for further assessment and intervention. Ensure the interview room offers privacy, is quiet, comfortable and has access to all the appropriate equipment.

- If the young person is temporarily impaired e.g. by intoxication, medication, or injury. It may be necessary to conduct the assessment at a later date. For those with language or learning difficulties etc. continue with assessment but document concerns/difficulties. Explain to the young person who you are and that your role is to help identify any health problems that require further attention.

- Explain that this is part of the Comprehensive Health Assessment Tool (CHAT) which will continue over the next few days and that this will result in a plan which the young person will be involved in developing.

- Explain that health information is confidential and is only shared with the persons responsible for the care and treatment of the young person unless the existence or likelihood of significant harm to the young person or other people is identified. Refer to *When to share information – Best practice guidance for everyone working in the youth justice system*'(Department of Health 2008; www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_084703

- Explain that if problems are identified, that treatment may be offered and that the options, benefits and risks of each proposed treatment will be explained and their permission or their parents'/legal guardian permission will be sought as appropriate.

- Explain that it may be necessary to ask other people who know the young person for information they have so that a complete health profile is created.

GUIDANCE ON CHAT PATHWAY

- Every young person admitted will be seen by a member of health care staff and receive a comprehensive neurodevelopmental disorder and traumatic brain injury assessment using this tool within **14 DAYS** of arrival.
- This will be completed by an appropriately trained professional. This may include a staff member from a range of different professional backgrounds but they must have training to assess for health needs.
- Prior to interview with the young person, review their notes and discuss their presentation/functioning with a staff member who knows them well to obtain any relevant information. Look for any evidence of special schooling, school difficulties/exclusions, early developmental problems, injuries, reports that may indicate learning disability, speech and language or social communication difficulties (autistic spectrum disorders).
- Refer to other parts of the CHAT to inform the care plan.

Young Persons Details

<table>
<tr><td colspan="2">Surname:</td><td colspan="2">Preferred Name:</td></tr>
<tr><td colspan="2">Forenames:</td><td colspan="2">NHS Number:</td></tr>
<tr><td colspan="2">Admission Number:</td><td>Gender:</td><td>DOB: / /</td></tr>
<tr><td colspan="2">Date & time of Reception Health Screening:</td><td colspan="2">Date & time of this Assessment:</td></tr>
<tr><td>Completed by (print your name):</td><td>Your designation:</td><td colspan="2">Your signature:</td></tr>
<tr><td colspan="4">Assessment of Capacity</td></tr>
<tr><td colspan="4">Young people aged 16-17 are presumed in law to have capacity to give consent for themselves.

Young people under 16 can give consent, but only if they are able to fully understand what is proposed, and weigh up the information they are given.
An assessment of capacity must be undertaken when a young person is under the age of 16 and does not want to involve parents/guardian. Young people aged 16-17 with learning difficulties or mental health issues must also be assessed.
If a young person has been assessed as having capacity to consent, capacity should be re-assessed each time an assessment is completed.</td></tr>
</table>

Tick **No** or **Yes** as appropriate for each question, and include additional notes	**No**	**Yes**
Does the young person have capacity to give consent for assessment? (provide details)		
Is the young person currently impaired? e.g. intoxication/injury/disability (provide details)		
Does consent need to be obtained by parent/legal guardian/person holding parental responsibility?		

Name of professional completing capacity assessment: Signature:
Date:

Name of countersign: Signature:
Date:

Consent Process (seek written or verbal consent depending on current practice)

Who is providing consent? (please tick) Young person ☐ Parent/legal guardian/person holding parental responsibility ☐

Consent for Assessment: If consent is refused state 'consent declined' and date

I understand that the information I provide as part of the Comprehensive Health Assessment Tool will remain confidential to those staff involved in my care and treatment unless there is a concern that either myself or other people are at possible risk of harm

Name: Signature: Date:	**Verbal Consent** Tick if agreed ☐

Consent for Information Sharing: If consent is refused state 'consent declined' and date

I understand that information may be requested from outside agencies in order ensure that the assessment of my health is accurate and comprehensive.

I understand that in order to gain appropriate information from outside agencies, it may be necessary to share information about my current health issues.

I understand that wherever possible, permission will be sought from me to approach outside agencies for information but where delays may compromise my health, staff may approach outside agencies without my permission.

Name: Signature: Date:	**Verbal Consent** Tick if agreed ☐

Consent for Parent/Guardian/Person holding parental responsibility Involvement: If consent is refused state 'consent declined' and date

I understand that information may be requested from my parents/carers in order to ensure that the assessment of my health is accurate and as comprehensive as possible.

I understand that my parents/ carers will be informed of my current health care issues and treatment needs in order to support my care and treatment.

Young person's name: Young person's signature: Date:	**Verbal Consent** Tick if agreed ☐

If consent is refused for assessment, information sharing or parental involvement state that consent was declined and outline the reasons here:

Traumatic Brain Injury

GUIDANCE

This section focuses specifically on Traumatic Brain Injury. Traumatic Brain Injury – is when the head receives a severe blow or jolt, for example in an accident, fall or assault, the brain can be damaged. There are other forms of Acquired Brain Injury which may have been caused by a stroke, haemorrhage, infection, hypoxic/anoxic brain injury and medical accidents. These are not included here, but check whether the young person has experienced any of these as they may influence their presentation.

Any loss of consciousness over 20 minutes or repeat loss of consciousness on more than three occasions (any length of time) where the young person has experienced symptoms following the injury:-

- **Review physical health/medical records and CHAT assessment (contact GP if necessary).**
- **Discuss with health worker need for further assessment of acquired brain injury (persistent symptoms for 3 months following a head injury requires further assessment and investigation while recent head injury also requires medical advice)**
- **For all traumatic head injuries take account of this in the care plan e.g daily living skills and occupational functioning**

Tick **No** or **Yes** as appropriate for each question and include additional notes	**No**	**Yes**
Have you ever had an injury to the head that caused you to be knocked out and/or dazed and confused E.g. from a fall, blow to the head (including boxing or fighting) or road traffic accident. If Yes, please explain: If no: move onto next section		

How many times have you been knocked out and/or dazed and confused? For each occasion ask how it happened. When was the last occasion?		
Did you seek any medical attention after being knocked out and/or dazed and confused? If Yes, what treatment did you receive? Did you have to stay in hospital?		

Tick boxes that describe the worst time s/he has been knocked out and/or dazed and confused

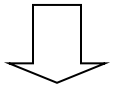
	Dazed or confused	Unconscious for < 5 min	Unconscious for > 5 but < 10 min	Unconscious for > 10 but <30 min	Unconscious for > 30 but < 60 min
Road accident (as a pedestrian, cyclist or by car)					

Fall when sober							
Fall when under the influence of drink/drugs							
Sports injury e.g boxing							
Fight							
Other							

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer from any of the symptoms below. As many of these symptoms can occur normally, we would like to compare yourself now with before the accident. For each one please check the box that best describes your experiences.

Compared with before the accident, do you NOW suffer from:-

	Not experienced at all	No more of a problem	A mild problem	A moderate problem	A severe problem
Headaches					
Feelings of dizziness					
Nausea and/or vomiting					
Forgetfulness, poor memory					
Poor concentration					
Confusion					
Fogginess					
Difficulties recalling everyday events					



Summary and Notes:e.g. severity, frequency, causes and any symptoms

Learning Disability

GUIDANCE

Have access to a magazine and non-digital clock (wrist watch or wall clock in room). Include information from other staff working with the young person currently and your observational skills for questions in italics. Some questions will be more accurately answered from information from notes prior to the interview with the young person.

- If diagnosis of learning disability already made include in care plan.

- If not diagnosed but presents with possible learning needs or learning disability discuss with education team or Mental Health team (psychologist/psychiatrist or senior nurse) if further specialist assessment required.

Tick **No** or **Yes** as appropriate for each question and include additional notes	No	Yes
Have you struggled with schoolwork? (if yes:-clarify whether in primary, secondary school or both-provide details below)		
Did you have any additional support in lessons?		
Do you have a statement of special educational needs?		
Did you attend a specialist school (non-mainstream)? (provide details below)		
Has anyone told you that you have a learning disability or learning needs?		
Have you ever been in contact with specialist learning disability services?		
Do you struggle with reading or writing? (show them a story in a magazine and discuss it with them)		
Can you make beans and toast on your own? *Does the young person need significant coaching in order to complete tasks e.g making beans on toast?*		
Can you get ready to go out on your own? *Can the young person only maintain their daily routine (e.g washing/getting to*		

school or work) with imposed structure or prompting?		
Can the young person attend to personal hygiene independently?		
Can the young person tell the time? (check using non digital clock)		
Is the young person excessively vulnerable within their peer group?		
Does the young person have difficulties following the conversation? *Does the interviewer need to rephrase the questions to clarify? (always check whether the young person has understood the information- use your observational skills)*		
Does the young person have difficulties expressing themselves? (use your observational skills)		
Are there any accompanying records that indicate that the young person has an IQ<70 (learning disability) or learning needs (generalised or specific)?		
Information Confirm information with parent/carer or other professional (provide details below)		

Appendix F

Inventory of Callous-Unemotional Traits

ICU
(Youth Version)

Name: _____

Date Completed: _____

Instructions: Please read each statement and decide how well it describes you. Mark your answer by circling the appropriate number (0-3) for each statement. Do not leave any statement unrated.

	Not at all true	Somewhat true	Very true	Definitely True
1. 1 express my feelings openly.	0	1	2	3
2. What I think is "right" and "wrong" is different from what other people think.	0	1	2	3
3. I care about how well I do at school or work.	0	1	2	3
4. I do not care who I hurt to get what I want.	0	1	2	3
5. I feel bad or guilty when I do something wrong.	0	1	2	3
6. I do not show my emotions to others.	0	1	2	3
7. 1 do not care about being on time.	0	1	2	3
8. I am concerned about the feelings of others.	0	1	2	3
9. I do not care if I get into trouble.	0	1	2	3
10. I do not let my feelings control me.	0	1	2	3
11. I do not care about doing things well.	0	1	2 _	3
12. I seem very cold and uncaring to others.	0	1	2	3
13. 1 easily admit to being wrong.	0	1	2	3
14. It is easy for others to tell how I am feeling	0	I	2	3
15. I always try my best.	0	1	2	3
16. I apologize ("say I am sorry") to persons I hurt.	0	1	2	3
17. I try not to hurt others' feelings.	0	1	2	3
18. I do not feel remorseful when I do something wrong.	0	1	2	3

19. I am very expressive and emotional.	0	1	2	3
20. I do not like to put the time into doing things well.	0	I	2	3
21. The feelings of others are unimportant to me.	0	I	2	3
22. I hide my feelings from others.	0	I	2	3
23. I work hard on everything I do.	0	I	2	3
24. 1 do things to make others feel good.	0	I	2	3

Unpublished rating scale by Paul J. Frick, Department of Psychology, University of New Orleans (pfrick@uno.edu) .

Appendix G

Reactive Proactive Aggression Questionnaire

What is your name:

Instructions: There are times when most of us feel angry or have done things we should not have done. Rate each of the items below by putting a circle around 0 (never), 1 (sometimes), or 2 (often). Do not spend a lot of time thinking about the items, just give your first answer. Make sure you answer all of the items.

How often have you…	Never	Sometimes	Often
Yelled at others when they have annoyed you	0	1	2
Had fights with others to show who was on top	0	1	2
Reacted angrily when provoked by others	0	1	2
Taken things from other students	0	1	2
Gotten angry when frustrated	0	1	2
Vandalized something for fun	0	1	2
Had temper tantrums	0	1	2
Damaged things because you felt cross	0	1	2
Had a gang fight to be cool	0	1	2
Hurt others to win a game	0	1	2
Become angry or mad when you don't get your way	0	1	2
Used physical force to get others to do what you want	0	1	2
Gotten angry or mad when you lost a game	0	1	2
Gotten angry when others threatened you	0	1	2
Used force to obtain money or things from others	0	1	2
Felt better after hitting or yelling at someone	0	1	2
Threatened and bullied someone	0	1	2
Made rude phone calls for fun	0	1	2

Hit others to defend yourself	0	1	2
Gotten others to gang up on someone else	0	1	2
Carried a weapon to use in a fight	0	1	2
Gotten angry or mad or hit others when teased	0	1	2
Yelled at others so they would do things for you	0	1	2
Threatened and bullied someone	0	1	2
Made rude phone calls for fun	0	1	2
Hit others to defend yourself	0	1	2
Gotten others to gang up on someone else	0	1	2
Carried a weapon to use in a fight	0	1	2
Gotten angry or mad or hit others when teased	0	1	2
Yelled at others so that they would do things for you	0	1	2

Thank you for your help!

Appendix H

School Recruitment Letter

UNIVERSITY OF CAPE TOWN

Department of Psychology

University of Cape Town, Rondebosch, 7701, South Africa
Telephone (021) 650-4605
Fax: (021) 650-4104

Date

Dear Parent

Traumatic Brain Injury: Research study at your child's school

Researchers from the Department of Psychology at the University of Cape Town have arranged to conduct a study of Traumatic Brain Injury (TBI) and youth well-being at your child's school.

Currently, we are conducting research regarding TBI and children's behaviour which goes along with it. What we require is information from children who have acquired a TBI, as well as those who have not sustained a TBI. This process includes the completion of a quick interview with your child. Further, in the future, we would aim to include parental questionnaires and medical histories of children. We would assess the neuro-development of your child with simple paper and pen assessments as well in a subsequent interview.

We would like to invite your child to fill in a questionnaire during an ordinary school period. They will be asked questions about their relationships, experiences, health and behaviours. This is a voluntary exercise and your child will be able to choose whether or not to participate. If they do participate, they will be free to withdraw from the study at any time, or to leave out certain questions. If they choose not to participate, this will have no effect on how your child will be treated at school.

All information provided by your child will be anonymous and confidential. They will not be asked to put their name on the questionnaire, and the information from all learners who participate will be combined in the presentation of the results. As a result, no child who participates in the research will be personally identifiable.

If you do *not* want your child to participate in this study, please fill in the reply slip below and return it to school by 30 July 2013. If you do not respond we will take that as permission for your child to participate.

Thank you for your cooperation.

Yours sincerely

Principal Investigator

If you have any questions or complaints about this study, please contact:

Ju-Reyn Ockhuizen
Psychology Masters student
Tel: 083604 3918
E-mail: ockhuizen.j@gmail.com

Leigh Schrieff
Project Supervisor
E-mail: l.e.schrieff@gmail.com

Pieter Erasmus
Tel: 0845048360
E-mail: p.erasmus@live.com

I **do not** wish for my son / daughter to participate in the research study being conducted by the UCT Psychology Department at my child's school.

Child's Name: _____
Class: _____
Parent's / Guardian's Name: _____
Signature: _____ Date: _____

Appendix I

Participant Assent Form

ASSENT TO PARTICIPATE IN RESEARCH

We are inviting you to be in our research study. We would like to learn more about traumatic brain injuries and associated behaviours of young people. In order to do this, we are talking to young people who have had such an injury and also to those who have never had such an injury.

If you agree to be in this study we will ask you to meet with us twice. During the first session, we will ask you to answer some questions about your life. These may be very personal questions about your behaviour. This session will last approximately 1 hour. During the second session, we will ask you to do some table-top tasks with us that will help us to understand your thinking and behaviour better. This session will be approximately 2 hours long.

Taking part in this study will not place you at risk in any way. These activities will not harm you, but some of them may be long and you may feel tired at times. If you do, you can stop and rest at any time. There will be no penalty if you choose not to be part of this study or if you choose to stop being part of it. Other than receiving refreshments during the sessions and being compensated at the end of the second session for your participation, there are no known benefits to taking part in this study. You will, however, be helping us to better understand behaviours associated with having a traumatic brain injury.

Your identity will not be revealed and all the information you give will be strictly confidential. It will only be used for academic research purposes; such as in a research report.

If you sign this paper it means that you would like to take part in this study. If you would not like to take part in this study, you do not have to sign this form. It is up to you. Before you say whether you want to be part of this study or not, I will answer any questions that you may have. If you have a question later that you didn't think of now, you can ask me next time.

I would like to take part in this study:

Signature of Participant _____ Date _____

Signature of Investigator _____ Date _____

Appendix J

University of Cape Town, Psychology Department Research Ethics Committee Approval

DEPARTMENT OF PSYCHOLOGY

REPORT OF THESIS COMMITTEE

Student Name: (HELEN) JU-REYN OCKHUIZEN

Student #: OCKHEL001

Degree: MA NEUROPSYCHOLOGY

Title (as proposed) THE PREVALENCE OF TBI AND AN INVESTIGATION OF EXECUTIVE FUNCTIONING AMONG THOSE THAT HAVE SUSTAINED A TBI) IN A SAMPLE OF JUVENILE DELINQUENT BOYS

Supervisor: LEIGH SCHRIEFF

Co-supervisor: –

Committee members: PROF. MARK SOLMS

DR. LAUREN WILD

DR. SUSAN MALCOLM-SMITH

WE:

1. Approve the proposal, and recommend that the student continue with the research.

2. (2.) Approve the proposal, and recommend that the student may continue with the research. However, we recommend that change(s), as noted below, be incorporated in the research, to the satisfaction of the supervisor.
   Assent form adapted ;

3. (3.) Approve the proposal in terms of its ethical implications. If necessary, explanatory notes appear below.

4. Find the proposal unsatisfactory, for the reason(s) listed below. The student is hereby requested to re-present the proposal to a departmental thesis committee by _____.

NOTES:

Appendix K

Letter of Ethical Approval from the Western Cape Department of Education

Audrey.wyngaard2@pgwc.gov.za

tel: +27 021 467 9272

Fax: 0865902282

Private Bag x9114, Cape Town, 8000

wced.wcape.gov.za

REFERENCE: 20130304-7069

ENQUIRIES: Dr. A. T. Wyngaard

Miss Helen Ockhuizen
4 Teddington Court
Teddington Road
Rondebosch
7701

Dear Miss Helen Ockhuizen

RESEARCH PROPOSAL: THE PREVALENCE OF TRAUMATIC BRAIN INJURY (TBI) AND AN INVESTIGATION OF EXECUTIVE FUNCTIONING (AMONG THOSE WHO HAVE SUSTAINED A TBI) IN A SAMPLE OF JUVENILE DELINQUENT BOYS

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Approval for projects should be conveyed to the District Director of the schools where the project will be conducted.
5. Educators' programmes are not to be interrupted.
6. The Study is to be conducted from **06 March 2013 till 28 September 2013**

7. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).

8. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?

9. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.

10. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.

11. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.

12. The Department receives a copy of the completed report/dissertation/thesis addressed to:

The Director: Research Services
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000

We wish you success in your research.

Kind regards.
Signed: Dr. Audrey T. Wyngaard

Directorate: Research
DATE: 04 March 2013

Appendix L

Parent Consent Form

Informed Consent to Participate in Research and Authorization for Collection, Use, and Disclosureof Questionnaire and Other Personal Data

You are being asked to take part in a research study. This form provides you with information about the study and seeks your authorization for the collection, use and disclosure of questionnaire data, as well as other information necessary for the study. The Principal Investigator (the person in charge of this research) or a representative of the Principal Investigator will also describe this study to you and answer all of your questions. Your participation is entirely voluntary. Before you decide whether or not to take part, read the information below and ask questions about anything you do not understand. By participating in this study you will not be penalized or lose any benefits to which you would otherwise be entitled.

1. **Name of Participant ("Study Subject")**

_____

2. **Title of Research Study**

   The Prevalence of Traumatic Brain Injury (TBI) and an Investigation of ExecutiveFunctioning (among those who have sustained a TBI) in a Sample of Male Young Offenders.

3. **Principal Investigator and Telephone Number(s)**

   Ju-ReynOckhuizen

Masters Student

Department of Psychology

University of Cape Town

083 604 3918

Leigh Schrieff

Supervisor

Department of Psychology

University of Cape Town

021 650 3708

4. Source of Funding or Other Material Support

National Research Foundation (NRF)

5. What is the purpose of this research study?

The purpose of this research is to investigate the prevalence of traumatic brain injury (TBI) among juvenile delinquents in South Africa and to assess their executive functioning through tests of executive functioning. The association between TBI and aggression and inhibition will be measured.

6. What will be done if you take part in this research study?

The purpose and procedure of the study will be explained to you. You will be asked to complete a parent/caregiver information and socio-economic status questionnaire, and a questionnaire about your child's developmental history.

You will then be asked to complete two additional questionnaires that will look atyour child's behaviour, and at how you and your family have coped with your child's injury. You will be allowed to take breaks when necessary.

If you have any questions now or at any time during the study, you may contact the Principal Investigator listed in #3 of this form.

7. If you choose to participate in this study, how long will you be expected to participate in the research?

Completing the questionnaires will take place during one session, which should not last longer than two (2) hours.

If at any time during the session you wish to stop your participation, you are free to do so without penalty.

8. How many people are expected to participate in the research?

150

9. What are the possible discomforts and risks?

There are no known risks associated with participation in this study. Should you get tired during the study, you will be allowed to rest. Refreshments will be available to you.

If you wish to discuss the information above or any discomforts you may experience, you may ask questions now or call the Principal Investigator listed in #3 of this form.

10a. What are the possible benefits to you?

You or the child in your care may or may not personally benefit from participating in this study. Should behavioural problems be identified during the process of this study, you will be referred to the appropriate services.

10b. What are the possible benefits to others?

The information gained from this research study will help improve our understanding of the offending behaviour of juvenile delinquents with TBI, particularly their relationship in relation to aggressive behaviours and the executive function of inhibition.

11. If you choose to take part in this research study, will it cost you anything?

Participating in this study will not cost you anything.

12. Will you receive compensation for taking part in this research study?

There will be no compensation for taking part in this study

13a. Can you withdraw from this research study?

You are free to withdraw your consent and to stop participating in this research study at any time. If you do withdraw your consent, there will be no penalty.

If you have any questions regarding your rights as a research subject, you may phone the Psychology Department offices at 021-650-3430.

13b. If you withdraw, can information about you still be used and/or collected?

Information already collected may be used.

15. Once personal and performance information is collected, how will it be kept secret (confidential) in order to protect your privacy?

Information collected will be stored in locked filing cabinets or in computers with security passwords. Only certain people have the right to review these research records. These people include the researchers for this study and certain University of Cape Town officials. Your research records will not be released without your permission unless required by law or a court order.

16. What information about you may be collected, used and shared with others?

This information gathered from you will be demographic information, information on your child's developmental history, and records of your responses to questionnaires regarding your child's behaviour, and the experience by your family in relation to your child's accident.If you agree to be in this research study, it is possible that some of the information

collected might be copied into a "limited data set" to be used for other research purposes. If so, the limited data set may only include information that does not directly identify you. For example, the limited data set cannot include your name, address, telephone number, ID number, or any other numbers or codes that link you to the information in the limited data set.

17. How will the researcher(s) benefit from your being in the study?

In general, presenting research results helps the career of a scientist. Therefore, the Principal Investigator and others involved this research project may benefit if the results of this study are presented at scientific meetings or in scientific journals.

18. Signatures

As a representative of this study, I have explained to the participant the purpose, the procedures, the possible benefits, and the risks of this research study; and how the participant's performance and other data will be collected, used, and shared with others:

_____ _____

Signature of Person Obtaining Consent and Authorization Date

You have been informed about this study's purpose, procedures, possible benefits, and risks; and how your performance and other data will be collected, used and shared with others. You have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time.

You voluntarily agree to participate in this study. You hereby authorize the collection, use and sharing of your performance and other data. By signing this form, you are not waiving any of your legal rights.

_____ _____

Signature of Person Consenting and Authorizing Date

Please indicate below if you would like to be notified of future research projects conducted by our research group:

_____ (initial) Yes, I would like to be added to your research participation pool and be notified of research projects in which I might participate in the future.

Method of contact:

Phone number: _____

E-mail address: _____

Mailing address: _____

_____

Appendix M

Qualitative Descriptions of WASI IQ Scores

Qualitative Descriptions of WASI IQ Scores

IQ Score	Qualitative Description
130 and above	Very Superior
120-129	Superior
110-119	High Average
90-109	Average
80-89	Low Average
70-79	Borderline
69 and below	Extremely Low

Note: Qualitative descriptions and scores taken from the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999)

Appendix N

Outcome Variables used for making up Composites: TBI vs. No TBI

Table M

Variables making up Neuropsychological Composites: Between-group Comparisons for TBI vs. No TBI (N = 74)

	TBI			No TBI			Test Statistics		
	n	*M* (*SD*)	Mean Rank	*n*	*M* (*SD*)	Mean Rank	*F/U*	*p*	*r*
Generativity/Inhibition Composite (α = .764)									
Design Fluency Generativity	38	-.13 (.84)	35.72	36	.14 (1.14)	39.38	616.50[a]	.458	-0.09
Design Fluency Inhibition	38	.01 (.94)	37.49	36	-.01 (1.07)	37.51	683.50[a]	.996	0.00
Design Fluency Switching	38	-.15 (1.00)	00.00	36	.16 (.99)	00.00	1.72	.195	0.15
Attention Composite (α = .818)									
Color Trails Time at Condition 1	37	.24 (1.24)	41.65	36	-.25 (.59)	32.22	494.00[a]	.058	-0.22
Color Trails Time at Condition 2	37	.13 (1.16)	38.96	36	-.14 (.80)	34.99	593.50[a]	.424	-0.09
Inhibition Composite (α = .678)									
NEPSY Inhibition Total Completion Time	35	.11 (1.15)	36.14	33	-.11 (.82)	32.76	520.00[a]	.480	-0.09
NEPSY Inhibition Total Errors	35	-.03 (.97)	34.29	33	.03 (1.05)	34.73	570.00[a]	.926	-0.01
NEPSY Switching Total Completion Time	34	.21 (1.10)	37.88	33	-.22 (.84)	30.00	429.00[a]	.098	-0.20

NEPSY Switching Total Errors	34	.16 (1.00)	37.49	33	-.16 (.99)	30.41	442.50[a]	.137	-0.18
Note: [a]Mann Whitney *U*. For the Attention Composite, data was missing for one participant. For the Inhibition Composite, data was missing for seven participants. One participant's data was incomplete for this subtest, two others refused to complete the session, and the remaining four were released from the institution before they could complete the assessment. The r value is an estimate of the effect size.									

Appendix O

Outcome Variables used for making up Composites: TBI with LOC vs. TBI No LOC

Table N

Variables making up Neuropsychological Composites: Between-group Comparisons for TBI with LOC vs. TBI No LOC (N = 74)

	TBI with LOC			TBI No LOC			Test Statistics		
	n	*M* (*SD*)	Mean Rank	*n*	*M* (*SD*)	Mean Rank	*F/U*	*p*	*r*
Generativity/Inhibition Composite (α = .764)									
Design Fluency Generativity	27	-.19 (.85)	34.46	47	.11 (1.07)	39.24	552.50[a]	.349	-0.11
Design Fluency Inhibition	27	-.08 (.93)	35.83	47	.04 (1.04)	38.46	589.50[a]	.607	-0.06
Design Fluency Switching	27	-.16 (1.04)	00.00	47	.09 (.97)	00.00	1.07	.304	0.12
Attention Composite (α = .818)									
Color Trails Time at Condition 1	26	.35 (1.36)	42.58	47	-.20 (.67)	33.91	466.00[a]	.095	-0.20
Color Trails Time at Condition 2	26	.21 (1.27)	38.90	47	-.12 (.81)	35.95	561.50[a]	.568	-0.07
Inhibition Composite (α = .678)									
NEPSY Inhibition Total Completion Time	26	.20 (1.07)	39.13	42	-. 12 (.95)	31.63	425.50[a]	.128	-0.19
NEPSY Inhibition Total Errors	26	.06 (.96)	36.54	42	-.04 (1.03)	33.24	493.00[a]	.502	-0.08
NEPSY Switching Total Completion Time	26	.39 (1.17)	41.06	41	-.25 (.80)	29.52	349.50[a]	.018*	-0.29

NEPSY Switching Total Errors	26	.16 (1.00)	37.42	41	-.10 (1.00)	31.83	444.00[a]	.252	-0.14

Note: [a]Mann Whitney *U*. For the Attention Composite, data was missing for one participant. For the Inhibition Composite, data was missing for seven participants. One participant's data was incomplete for this subtest, two others refused to complete the session, and the remaining four were released from the institution before they could complete the assessment. The *r*-value is an estimate of the effect size.
*$p < 0.05$