The prevalence of traumatic brain injuries and the difference in behavioral and emotional factors among young offenders and non-offenders in Cape Town, South Africa

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Word Count:
Abstract: [299]
Main Body: [9232]

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Abstract

Traumatic brain injury is one of the leading causes of hospitalizations and deaths among children and adolescents. Results from international research shows that there may be high rates of TBIs among young offenders. However, limited data of this nature is available and there are no recent incidence rates of TBI generally in South Africa. Thus one of purposes this study was to determine whether the prevalence rate of TBI in a young offender sample is truly a function of being an offender or simply a reflection of the incidence of TBI in the general population in South Africa. Hence, I compared the prevalence of TBIs in offenders and non-offenders. This is important as SA has one of the highest levels of crimes and motor vehicle accidents globally, which are factors that lead to TBIs, and thus may affect the overall prevalence thereof. I also compared behavioral and emotional factors in offenders and non-offenders who had sustained a TBI. I employed a cross-sectional design. There were a total of 116 participants in the sample, with n = 58 in each group (offenders and non-offenders). I used the following measures: The Comprehensive Health Assessment Tool (CHAT), Beck Depression inventory (BDI-II), Alcohol Use Disorders Identification Test (AUDIT), Maudsley Addiction Profile (MAP), The Inventory of Callous-Unemotional Traits youth version (ICU), Reactive-Proactive Aggression Questionnaire (RPQ). The results showed that in the offender sample the prevalence of TBIs was 55.2% compared to 44.8% in the non-offender sample. Significant differences were found between offenders and non-offenders who had sustained a TBI in alcohol use, depressive symptoms, callous and unemotional behaviour, psychological symptoms and aggression. This study has shown that the prevalence of TBI in SA is generally high and suggests a need for rehabilitation programs among young offenders, and possibly more generally in the population too.

Keywords: Traumatic brain injuries; young offenders; prevalence rates; South Africa; behavioural factors; emotional factors

Introduction

Traumatic brain injury (TBI) is one of the leading causes of hospitalizations and deaths among children and adolescents (Gerring et al., 2009). Interestingly, various studies have demonstrated a strong correlation between sustaining a TBI and exhibiting offending behaviour in adolescents, with considerable symptom overlap (Williams, Cordan, Mewse, Tonks, & Burgess, 2010). Young offenders and TBI patients tend to exhibit very similar behaviour (e.g., poor impulse control). As a result, numerous studies have been conducted to understand the causes and the impact of TBI in relation to young offenders (Alexander et al., 2009; Cook et al., 2013).

Sustaining a TBI can create a huge burden in the lives of the affected ones, their families and societies, through associated economic, psychological and social sequelae (Hofman, Primack, Keusch, & Hrynkow, 2005). The causes of TBIs vary greatly, the major reasons including motor vehicle accidents (MVAs) and violence (Levin, 2004). Environmental factors such as socioeconomic status (SES) influence the prevalence and prognosis of TBIs (Hux, Bond, Skinner, Belau & Sanger, 1998). Additionally, various studies have found TBI rates to be particularly high in males (Farrer, Frost, & Hedges, 2013; Perron & Howard, 2008). Moreover, a large number of studies investigate TBIs using high-income countries (HIC) as a model. However, the incidence rates of TBI appear to be higher in low- and middle-income countries (LAMICs; Hofman et al., 2005; Levin, 2004; Williams et al., 2010). For instance, South Africa (SA) has one of the highest MVAs rates in the world, which is likely to increase the prevalence rate of TBIs (Levin, 2004). Research also suggests that there is a high prevalence of young offenders in SA (Lai et al., 2013). Given the aforementioned correlation and symptom overlap between TBI and young offenders, there is a need to determine the prevalence of TBIs particularly in relation to offending behavior in LAMICs. This will assist in determining if in fact young offenders are at a higher risk of sustaining a TBI or vice versa; that TBIs contribute to the prevalence of offending behaviour. Such information can assist in developing adequate interventions for the subgroup of the population most in need of attention.

Traumatic brain injury (TBI)

TBIs occur as result of an insult to the head, through a blow or a penetrating object that affects normal brain functioning. The extent of the damage of TBI is classified as mild, moderate or severe, most commonly differentiated based on the Glasgow Coma Scale (GCS) (Anderson, Catroppa, Morse, Haritou, & Rosenfeld, 2005; Ruff et al., 2009). The GCS

indicates the state of consciousness after sustaining a TBI (Babikian & Asarnow, 2009). Another useful measure used to assess the severity of TBIs is the period of loss of consciousness (LOC), if any, after a TBI. Researchers commonly report a dose-response relationship between TBI and outcome, i.e. the more severe the injury the poorer the outcome (Anderson et al., 2005; Schrieff, 2013).

TBIs can be caused by various factors such as MVAs, child abuse, violence, and sport injuries (Perron & Howard, 2008). The different mechanisms by which TBIs are caused impact the brain in different ways. For instance, open head injuries (e.g., from gunshot wounds) have higher risks of infections compared to closed head injuries (e.g., from being struck by or against an object). Thus, studying TBIs can be very complex and can yield inconsistent results, as each case is unique (Farrer et al., 2010).

TBI is particularly prevalent among males aged 14-26 years (Ponsford, Whelan-Goodinson & Bahar-Fuchs, 2007). As a vulnerable stage in development, adolescence appears to be a risky period for sustaining a TBI (Ponsford et al., 2007). The risk of sustaining a TBI is higher in this subgroup of the population as younger people tend to engage in more risky behaviours compared to older people, and males tend to be more aggressive and participate in more dangerous activities compared to females (Farrer et al., 2013).

In addition to the mechanism, location and severity of injury, factors such as the availability of rehabilitation programs, social support, education and SES have an impact on the outcomes of a TBI (Prigatano & Gray, 2007). Each of the aforementioned factors plays a specific role in determining outcome. For instance, with regards to the location of injury, if the frontal lobes are damaged, which occurs frequently given its neuroanatomical positioning, it is likely that there will be executive functioning deficits such as impulsivity and aggressive behavior (Baguley, Cooper, & Felmingham, 2006).

Furthermore, pre-injury behavior can be a predictor of post-injury functioning. For example, an aggressive child who abuses alcohol before sustaining a TBI is likely to increase alcohol abuse and become more aggressive post-injury (Farrer et al., 2013). Nevertheless, the initial aggression and substance use could be a risk factor for sustaining a TBI in the first place. Additionally, people from low SES backgrounds may have a slower rate of recovery as for many this implies a deprived background with poor education and social and medical support, which are crucial in the recovery process (Levin, 2004). The importance of environmental factors in recovery suggests that the outcomes of TBIs would be less favorable

in countries with limited availability of medical resources to aid in rehabilitation (Levin, 2004).

Researchers also postulate that the prevalence rates of TBIs in the LAMICs differ significantly from those reported in HICs, specifically in SA, where many risk factors are present, such as the high levels of crime and drug use (Hux et al., 1998). However, despite this likelihood there are no current published epidemiological rates for TBI in children in SA.

Numerous studies have been conducted to assess the outcomes associated with sustaining a TBI. Literature shows that TBIs can lead to a range of sequelae, including poor cognitive, behavioral and emotional outcomes (Babikan & Asarnow, 2009; Farrer et al., 2013; Schrieff et al., 2011). As the frontal lobe is the area frequently affected post-TBI, deficits often include poor impulse control, attentional and learning problems, and risk taking behaviour (Babikian & Asarnow, 2009). This in turn can translate into behaviors such as aggression and substance use (Farrer et al., 2013; Hodges, 2012). Additionally, post-injury emotional and psychiatric disorders (e.g., anxiety, apathy and depression; Perron & Howard, 2008) may also arise. These deficits increase the risk of being involved in violent behaviour and criminal activity (Farrer et al., 2013; Perron & Howard, 2008).

Young offenders

A young offender is a child or adolescent who has been accused of a criminal offence (Hux et al., 1998). Offenders frequently exhibit particular behaviours, which increase the risk of involvement in criminal and antisocial behaviour (Dalby, 1985). For instance, studies have shown that young offenders tend to be aggressive, suffer from depression and have poor impulse control (Dalby, 1985; Gerring et al., 2009). An example of a behaviour exhibited by offenders is the abuse of alcohol and drugs, which increases the risk for violence and accidents (Gerring et al., 2009). Difficulties, such as parents' marital, financial and childhood behavioral problems, and a family history of criminality are considered risk factors for engaging in offending behaviour (Liu, 2011). Internationally, the prevalence of offending behaviour is approximately 28% of the adolescent population. In SA, approximately 21% of adolescents have been involved in a fight and a significantly large number, 15.1 % of adolescents carry a weapon (Lai et al., 2013).

The relationship between TBI and young offenders

The results of numerous studies show that there is a strong correlation between TBI and offending behaviour (Hux et al., 1998; Perkes, Schofield, Butler, & Hollis, 2011). Such correlations may exist between TBI patients and offenders as both groups frequently exhibit similar behaviours such as aggression, lack of empathy and impulsivity or emotional and

psychiatric problems such as depression (Dalby, 1985; Kimonis et al., 2008). This overlap clouds the relationship between TBI and offending behaviour, especially in knowing which of the two factors precedes the other (Perkes et al., 2011). Consequently, researchers have attempted to define a causal relationship between sustaining a TBI and becoming a young offender, but there is no consensus on which factor precedes the other (Hux et al., 1998).

Adolescents who exhibit offending behaviour tend to engage in risky behaviours and hence are at a higher risk of suffering a TBI. Conversely, sustaining a TBI can lead to offending behaviours (Essau, Sasagawa & Frick, 2006). TBIs frequently result in deficits such as poor impulse control and aggression as a result of the anatomical vulnerability of the frontal lobes to injury. These outcomes increase the likelihood of individuals with TBIs engaging in risky behaviours (Kimonis et al., 2008). Therefore, when investigating the prevalence of TBIs in young offenders establishing direction of causality could be problematic and consequently influence interventions. For instance, if interventions are designed to attempt to reduce offending behaviour, which may result in TBI, the intervention might be ineffective if in fact the direction of causality is TBI leading to offending behaviour.

The prevalence of TBI among young offenders is relatively high, although varied. Some studies report prevalence as high as 50% and 67% and others a prevalence of 12.5% of TBIs in the offender population, however most studies report prevalence rates of TBI below 50% (Dalby et al., 1985; Farrer, et al., 2013; Hux et al., 1998; Lai et al., 2013). Although there are discrepancies in the reported prevalence rates of TBIs in young offenders, the prevalence of TBIs remains higher in young offenders when compared to non-offenders (Dalby et al., 1985; Farrer et al., 2013; Lai et al., 2013).

In trying to determine the prevalence of TBI in a young offender sample, information on the incidence of TBI in the wider population is required to understand whether the differences in the incidence of TBIs are a function of the young offender sample or simply of the country at large. In other words, this information is particularly important in South Africa, where no recent incident rates for TBI generally exist.

It is also necessary to identify what behavioral and emotional deficits are linked to TBIs and offending behaviour. Such information could assist in designing adequate rehabilitation programs to improve the quality of life of those vulnerable to the devastating effects associated with TBI (Luukkain, Riala, Laukkanen, Hakko & Rasanen, 2012).

For example, in a meta-analytic study conducted, 30.6 % of young offenders had a history of TBI with a period of LOC, and parents of these offenders had reported behavioural problems such as aggression (Farrer et al., 2013). Young offenders tend to exhibit more

proactive aggression compared to non-offenders (Raine et al., 2006). Proactive aggression refers to motivated or goal-directed aggression, such as attacking someone to hurt them. In contrast reactive aggression occurs as response to a provocation; as a self-defense action (Raine et al., 2006).

Similarly, studies on substance and alcohol use, antisocial behaviour and depression among young offenders and non-offenders show higher levels of each of these factors for young offenders than non-offenders (Essau et al., 2006; Perron & Howard, 2008). For instance, a study conducted by Perron and Howard (2008) revealed that the rates of TBIS, substance use and depression were significantly elevated in offenders compared to non-offenders. Additionally, Essau et al., (2006) have shown that antisocial behaviour is more frequently exhibited by offenders than non-offenders.

Moreover, etiological factors also differ between the two groups. The causes of TBIs in offenders and non-offenders differ significantly, particularly during adolescence, with sports injuries being the major cause of TBIs in non-offenders and MVAs and violence being the main causes of injury in the offender group (Farrer et al., 2013).

Aims and Hypotheses

The primary objective (and part 1) of this study was to investigate the prevalence of TBIs in a sample of young offenders and to compare these results to a sample of demographically matched non-offenders in SA. The main purpose thereof was to determine whether the prevalence rate of TBI in a young offender sample, as determined in previous related studies (Badul, 2012; Erasmus, 2013; Ockhuizen, 2014), is truly a function of being an offender or simply a reflection of the incidence of TBI in the general population in SA, which is unknown at this stage. In the previous related studies, the researchers collected data on the offender sample; hence, the focus of this study was to collect data for a matched non-offender sample. Furthermore, data on learning problems, callous-unemotional behaviour, depression, substance abuse, criminality and psychological health was taken into consideration to determine whether there were any differences in the general trends of these factors between offenders and non-offenders (part 2). Collecting data on these factors was also useful to investigate whether they have an influence on the TBI and offending behaviour relationship.

The following hypotheses were tested:

1a. The prevalence of TBIs (without associated LOC) is higher in young offenders when compared to non-offenders.

b. The prevalence of TBIs (with associated LOC) is higher in young offenders when compared to non-offenders.

2a. The prevalence of learning problems, callous-unemotional behavior, depression, criminality and substance abuse will be higher in young offenders with TBIs (without associated LOC) compared to non-offenders with TBIs.

b. The prevalence of learning problems, callous-unemotional behavior, depression, criminality and substance abuse will be higher in young offenders with TBIs (with associated LOC) compared to non-offenders with TBIs.

Methods

This study forms part of a larger ongoing study aimed at investigating the prevalence of TBIs and the differences in executive functions, behavioural, and emotional factors, between young offenders and non-offenders in Cape Town, South Africa.

The data for the offender sample has already been collected as part of previous studies (Badul, 2012; Erasmus, 2013; Ockhuizen, 2014). In one previous study (Erasmus, 2013) the collection of data on the non-offender sample was initiated, but few participants (including Afrikaans-speaking participants) were tested in the end due to time and resource constraints. The focus of the current study was to build on the previous studies by collecting data on a comparable number of non-offenders. Hence, I will outline the data collection procedure for the offender group but I will elaborate more on the methods used to recruit the non-offender group.

Research Design and Setting

The research design was quantitative and cross-sectional. The study was divided into two parts. In part 1a of the study, I compared the prevalence of TBIs among the offenders and non-offenders using the entire TBI sample. In part 1b I compared the prevalence of TBIs, which were reported with associated LOC, between offenders and non-offenders. In part 2a, I compared both offenders and non-offenders using the entire TBI sample in terms of learning problems, callous-unemotional behavior, depression, substance abuse, criminality and psychological health. In part 2b the same comparisons as part 2A were made, the only differentiating factor was the use of LOC as an inclusion criterion for the TBI groups. The research setting was a school that was situated in the same suburb as the young offender institution, where previous data for the larger project was collected. Interviews were conducted during school hours in classrooms at the school where the participants were enrolled.

Participants

The participants for this study constituted two groups: non-offenders and young offenders. In total, 116 participants were included in this research, with $n = 58$ in each of the aforementioned groups. Participants for the non-offender group included individuals who had not had any negative encounter with the law. In contrast, the offender sample included individuals who were awaiting trial or had been convicted of a crime.

Purposive and snowball sampling was used to collect data for the offender sample. The sample was drawn from a private institution for young offenders. These participants were coloured[1] males, aged 13 to 17, given that this description fitted a large majority of the young offenders in that institution. Data collection for these previous studies was collected in both English and Afrikaans, depending on the participant's first language. For the offender sample, a social worker who was unfamiliar with the hypothesis of the study randomly selected participants from a list of names which matched these criteria.

I recruited the non-offender sample from a high school in Cape Town. The school principal provided me with a list of names, ages and racial categories of all the learners in the school. Participants were then selected from the list based on the demographic criteria that matched those of offender sample. The inclusion criteria for participants for the non-offender sample included being coloured, male, fluent in English and aged 13-17 years. As mentioned, the learners were sampled from school situated in the same area as the offender institution, in order to control for SES. The non-offender sample was matched and thus homogenous with the offender sample in terms of age, race, language, sex, and SES. Moreover, the sample was taken from an English medium school, thus, it was expected that participants had a minimum understanding of the language, which was sufficient to respond to the questionnaires. They should also not have had previously diagnosed mental and learning disabilities, Attention Deficit Hyperactivity Disorder (ADHD) or medical health problems such as epilepsy, stroke, diabetes or any condition that might have affected their performance on the tests.

Measures

The questionnaires used in this research included the Comprehensive Health Assessment Tool (CHAT), Beck Depression inventory (BDI-II), Alcohol Use Disorders Identification Test (AUDIT), Maudsley Addiction Profile (MAP), The Inventory of Callous-Unemotional Traits youth version (ICU), Reactive-Proactive Aggression Questionnaire

[1] A racial category used in South Africa for persons with mixed ancestry.

(RPQ). They were all administered in English. These measures are described below in the order that these were administered.

The Comprehensive Health Assessment Tool (CHAT). This test was designed by the Offender Health Research Network specifically to screen for neurological disabilities, substance use and the mental and physical state of adolescents who have had an encounter with the justice system (Offender Health Research Network, 2014). An alternative version of this questionnaire has been developed to be utilized with adolescents who have never had problems with the justice system. Likert-scales, and open-ended and closed ended questions are included in this questionnaire. It assesses the presence of a TBI, and the cause and severity of the injury (Offender Health Research Network, 2014). It screens for TBIs by assessing post-concussion symptoms such as loss of consciousness and confusion period. The CHAT can also be used to assess associated mental and physical symptoms linked to TBI (Offender Health Research Network, 2014).

This questionnaire is still under development; hence psychometric data is limited. However, it has shown to have good content validity for screening for mental and physical health needs. The CHAT has a specificity of 59% for physical health assessment and 79% for mental health assessment, when it was compared to a standard examination by a doctor (Offender Health Research Network, 2014). Furthermore, as it is a relatively new measure, it has not been used in various countries. In SA, it has only been utilized in unpublished studies (Badul, 2012; Erasmus, 2013). However, it has been used in England with adolescents as a sample (Chitsabesan et al., 2013).

Alcohol Use Disorders Identification Test (AUDIT). The AUDIT is a short questionnaire consisting of 10 questions developed by the World Health Organization to detect whether the alcohol consumption of an individual has reached a hazardous level (Willacy, 2014). It screens for alcohol consumption, dependency and other alcohol-related problems. It was developed for international use and six European countries were included in the validation process for the AUDIT. It is specifically used to assess the drinking patterns of individuals for a timeframe of one year. It has been used in SA before with students as a sample. The AUDIT has a good internal consistency of r=.86 established by the test-retest correlation (Babor, Higgins-Biddle, Saunders & Monteiro, 2001). This questionnaire also has good reliability of α =.79 (Babor et al., 2001).

Maudsley Addiction Profile (MAP). This is a short structured interview, which takes approximately 15 minutes to complete, and it is mainly used for treatment outcome research (Marsden et al., 1998). Its major objective is to assess whether people have problems

with substance abuse, engage in health risk behaviors, their psychological and physical health and their social and personal functioning. It has good test-retest reliability with a coefficient of r=.94. Literature has also shown that it has good content and face validity (Marsden et al., 1998). It has only been used in SA in unpublished studies (Badul, 2012; Erasmus, 2013).

Beck Depression Inventory (BDI-II). This is a multiple-choice questionnaire consisting of 21-items, from which the respondent selects a sentence that best describes how they have been feeling in r the past two weeks of their lives. It is widely used to assess the severity of depression. It consists of cut-off points with scores from 0 to 13 signifying minimal depression, 14 to 19 being moderate depression, and so forth (Rodrigues-Gomez, Davila-Martinez & Collazo-Rodriguez, 2006). It is a valid and reliable test with an internal consistency of α=.91. It has also shown to have high test-retest reliability with Pearson r =.93. Moreover, it is culturally sensitive; it has been used in rural and urban areas in various countries such as Canada, Spain and Korea (Rodrigues-Gomez et al., 2006). An additional benefit of including this questionnaire is that it has previously been used with a sample of TBI patients (Rodrigues-Gomez et al., 2006). It has been used in SA, mostly in relation to depression associated with HIV/AIDS (Kagee, Nel, & Saal, 2013)

The Inventory of Callous-Unemotional Traits youth version (ICU). This questionnaire consists of 24 Likert-scale items and it is used to assess three traits: uncaring traits, callousness, and unemotional traits. These traits have been implicated in antisocial and aggressive youths (Kimonis et al., 2008). It has good internal consistency with α =.77 (Essau et al., 2006; University of New Orleans, 2011). It has only been used in SA in unpublished studies (Badul, 2012; Erasmus, 2013). However, this questionnaire will be useful in detecting the different behavioral tendencies between offenders and non-offenders, as it has been modified specifically to be used with young offenders (Essau et al., 2006).

Reactive-Proactive Aggression Questionnaire (RPQ). This is a short questionnaire with 23 items in scale form. The scores vary from 0 (never) to 3 (often), which ask respondents how often they engage in specific behaviours. It has been developed to test children starting from the age of 7 years. Its main objective is to identify tendencies for aggressive behaviour, both reactive and proactive aggression. It has a good internal consistency of .83. Research has also shown that the RPQ has good construct and convergent validity (Raine et al., 2006). It has been used in SA in an unpublished study (Erasmus, 2013).

Parent Questionnaire and Asset Index. I used this 17-item questionnaire to assess the SES of participants by asking parents about their general annual income (Appendix A). It also includes questions about their living conditions, such as if they own a house and if they

have access to running water. Basic information such as age, ethnicity and sex are also included in the questionnaire. It was developed for use specifically in a South African context. Evidence suggests that it has good reliability of α=.92 (Myer, Stein, Grimsrud, Seedat, & Williams, 2008).

Procedure

Before data collection began, a meeting was arranged to explain to the rationale of the study and gain approval from the school principal. The principal was willing to allow the data collection at specified times that were not disruptive to the learners' study and test schedules. After briefly clarifying the purpose of the study to the principal and selecting participants from the list of all learners matching the demographics of the offender sample, consent forms were sent to the parents of the selected learners. In total, 159 consent forms were sent out (Appendix B). However, only 54 were returned. Only one parent did not provide consent to their child's participation in the research.

The data collection took place in a small and quiet office at the school to minimize distractions. The purpose of the study was verbally explained to each learner and they were asked if they were willing to participate in the study. If they agreed to participate, they were asked to sign an assent form (Appendix C). The interview process took 45 minutes to 1 hour each depending on the pace of each learner. The learners were told that if they did not want to answer some of the questions then they were not obliged to. They were also told to ask any questions regarding the questionnaires if they found these too complex and could not understand what certain questions meant. Most of the questionnaires were administered by the interviewer to ensure that there was no misinterpretation of the questions. However, some of these forms, the BDI-II, the ICU and the RPQ, the learners could complete by themselves with the assistance of the researcher when necessary.

At the end of the interview, the participants were thanked and asked to take the Parent Questionnaire and Asset Index home and give it to their parents to complete and to return the next day.

Statistical Analysis

I used SPSS version 2.2 to analyze all the data. For part 1 of the study I used descriptive statistics to analyze the prevalence rate of TBIs (with or without associated LOC). I looked at the differences in frequency of TBIs in offenders and non-offenders to establish the prevalence rate. I also used Chi-square tests to investigate if the occurrence of TBI differed significantly between offenders and non-offenders

For part 2 of the analysis, I used analysis of variance (ANOVA) to investigate between group (offenders and non-offenders) with TBIs (with or without associated LOC) differences in learning problems, callous-unemotional behavior, depression and psychological health. The data was checked to ensure relatively normal distributions and homogeneity of variances. To investigate the differences in substance use and criminality (categorical data) I used chi-squared and frequencies. All tests were run using a significance level of $\alpha = .05$

Ethical Considerations

This research was approved by the Research Ethics Committee of the Department of Psychology at the University of Cape Town and The Western Cape Education Department (Appendix D).

This study did not involve deception. Details of the research provided in the consent form included information about the voluntary nature of participation, the rationale, and importance of the study, that withdrawal from the study was possible without penalty, as well as the anonymity and confidentiality of all information. Additionally, as participants were minors, signed consent forms from their parents were obtained. Assent forms were also given to the participants. Caregivers and participants were allowed to ask any questions they had with regards to the research before they signed any form. This was important as some questionnaires were of a sensitive nature. These questions included aspects such as their alcohol consumption or possible drug use, which they might have not been willing to share.

There were no known physical or psychological risks associated with individuals participating in this study. However, as the interview was at times lengthy, participants were allowed rest periods whenever they felt fatigued.

Results

The results of this study are presented in two sections. In Part 1, I present a comparison of the prevalence rates of TBIs in the young offender and non-offender samples, first using the entire sample (part 1a) and then (part 1b) only those participants who reported TBIs associated with LOC. In part 2a, I compared the offender and non-offender samples who reportedly sustained a TBI, on learning problems, callous-unemotional behaviour, depression, criminality and substance abuse. Again, for these comparisons, in part 2a, I included the entire TBI sample in the analyses and in part 2b only those participants who reported LOC associated with their TBI.

Participant Demographics

Overall, 116 participants formed the sample for this research, with 58 being non-offenders and 58 young offenders. The participants in the two groups were matched on age, race, sex and language. All participants were coloured males and were able to converse in English. The ages ranged from 13-17 (M = 15.88, SD =1.00) for both groups. Due to the low response rate of the parents on the parent questionnaire for both offenders and non-offenders it was not possible to specifically match participants on SES using the asset index and demographic questionnaire. However, the school in which data from the non-offender sample was collected is in the same area as the young offender institution, and thus the SES may be assumed to be at least somewhat similar. In total only 28 demographic and asset index forms were completed by the parents. Table 1 reports the annual income of those 28 parents for both offenders and non-offenders. These few forms were used as an estimate for the general income for the whole sample.

Table 1: *Descriptive statistics: Young offenders vs. Non-offenders Parental Annual Income*

Annual Income	Offender	Non-offender	Total
R0	1	0	1
R1-R5000	5	6	11
R5000- R25 000	5	5	10
R25 000-R100 000	0	2	2
R 100 00+	4	0	4
Total	15	13	28

Part 1: Prevalence of TBIs (with or without associated LOC): Offenders vs. non-offenders

According to hypothesis 1a of this research, the prevalence of TBIs would be higher in the young offender sample than in the non-offender sample. The descriptive statistics (see Table 2) showed that in the young offender sample the prevalence of TBIs was 55.2% (32/58) compared to 44.8% (26/58) in the non-offender sample. These results appear to provide evidence to support hypotheses 1 of this study. However, when I ran a chi-square analysis of

group membership (TBI vs. no TBI in the offender and non-offender groups), the results were not significant, χ^2 (1, N = 58) = .63, p = .43. The results are however in the expected direction.

Table 2. *Presence of TBIs: Descriptive Statistics*

	Presence of TBI		
	No	Yes	Total
Non-offender	32 (55.2)	26 (44.8)	58
Offender	26 (44.8)	32 (55.2)	58
Total	58	58	116

Note: percentages in brackets.

For hypothesis 1b, I compared only those young offenders and non-offenders who had reported a LOC associated with their sustained TBI. Table 3 shows the differences in severity according to categories of the CHAT of the reported TBIs between offenders and non-offenders. Results shows that majority of the non-offenders (61.54%) reported only feeling dazed or confused compared to 31.25 % of the offender sample. In contrast, in the non-offender sample 68.75% reported having a period of LOC compared to 30.77% of the non-offenders, providing further support for hypothesis 1.

Table 3. *Descriptive Statistics: Severity of TBI: Offenders vs. Non-offenders*

	Young offenders (n=32)	Non-offenders (n=26)	Total
TBI (D&C)	10 (31.25)	16 (61.54)	26
TBI with LOC	22 (68.75)	8 (30.77)	30
LOC<5 min	7 (21.88)	3 (11.54)	10
LOC>5>10 min	1 (3.13)	1(3.85)	2
LOC>10>30 min	5 (15.63)	2 (7.69)	7
LOC>30>60 min	9 (28.13)	2 (7.69)	10
Total	32	24	56

Note: Percentages in brackets; D&C (Dazed and Confused); LOC (Loss of Consciousness)

Table 4 shows the frequencies of the main causes of TBIs in offenders and non-offenders. Most TBIs for the young offender group occurred as a result of assaults and fights (59.4%) compared to only 15.30% in the non-offender sample. The main cause for injury in the non-offender sample is sport injuries (26.90%), which accounts for only 3.10% in the offender sample.

Table 4. *Causes of TBI: Offenders with TBI vs. Non-offenders with TBI*

Cause	Offender		Non-offender	
Road Accident	6	(18.80)	2	(7.70)
Fall sober	5	(15.60)	6	(23.10)
Sport	1	(3.10)	7	(26.90)
Assault	11	(34.40)	1	(3.80)
Fight	8	(25.00)	3	(11.50)
Unknown	1	(3.10)	7	(26.90)
Total	32		26	

Note: Percentages in brackets

Similarly, Table 5 shows the frequencies of the main causes of TBIs (associated with LOC) in offenders and non-offenders. The major causes of TBIs in offenders were assaults (34.40%) compared to only 3.80% in the non-offender sample.

Table 5. *Causes of TBI: Offenders with TBI vs. Non-offenders with TBI associated with LOC*

Cause	Offender		Non-offender	
Road Accident	5	(22.73)	2	(25.00)
Fall sober	3	(13.64)	2	(25.00)
Sport	1	(4.55)	2	(25.00)
Assault	8	(36.36)	1	(12.15)
Fight	5	(22.73)	0	(00.00)
Unknown	1	(4.55)	1	(12.15)
Total	22		8	

Note: Percentages displayed in brackets

Part 2a: Between group Comparisons: Young offenders and non-offenders with TBI (without associated LOC) on behavioural and emotional factors

According to hypothesis 2a of this research, the prevalence of learning problems, aggression, callous-unemotional behavior, depression, criminality and substance abuse would be higher in young offenders with TBIs compared to non-offenders with TBIs. From the 116 participants there were 58 who had sustained a TBI, of which 32 were offenders and 26 were non-offenders. Table 6 reports the descriptive statistics for language and age for offenders and non-offenders with TBIs. The groups were matched on sex, race and language. There were no significant differences between the two groups in terms of age, $F(1,56) = .12$, $p = .73$ or in terms of language, $\chi^2 (1, N = 58) = 1.55$, $p = .21$.

Table 6. *Descriptive Statistics: Language and Age of offenders and non-offenders with TBI*

	Language		Age			Total
	English	Afrikaans	Mean	St. Dev	Range	
Offender	17	15	16.09	1.03	13-17	32
Non-offender	18	8	16.00	.98	13-17	26

For the categorical variables such as reported levels of criminal activity and substance use, I conducted chi-squares. For criminal activity no significant difference was found, $\chi^2 (2, N = 32) = 1.19$, $p = .55$. Although crime levels did not have a significant difference more offenders (34.38% (11/32)) reported being involved in multiple crimes compared to non-offenders (11.54% (3/26)). Similarly, there was no significant difference for substance use

when comparing the two groups, χ^2 (2, N = 32) = 4.56, p = .10. Again, while significant differences were not found more offenders (84.38% (27/32)) reported substance use compared to non-offenders (80.77% (21/26)).

The results for all other comparisons in terms of outcome (continuous) variables between the young offenders and non-offenders with TBI are presented in Table 7. There were no significant differences between the young offenders and non-offenders with TBI in terms of health symptoms although these results were in the expected direction with the young offender group reporting higher scores for as compared to the non-offender group. However, significant differences were found in terms of alcohol use, depressive symptoms, and psychological symptoms, with the offenders showing higher alcohol use, more depressive symptoms, and more psychological symptoms than the non-offenders. Significant differences were also seen in the ICU, when all three factors, callous, unemotional and uncaring traits, are combined with young offenders displaying more callous-unemotional behaviour compared to non-offenders. However when each behaviour is measured separately there is no significant difference in the uncaring behaviour. The results also show that there is a significant difference in the levels of aggression between the offenders and the non-offenders who had sustained a TBI. When measured individually, the groups had significant differences in both reactive and proactive aggression, again, with offenders displaying more proactive and reactive aggression compared to non-offenders.

Thus, when looking the non-offenders and offenders who had sustained a TBI, there was a difference in alcohol use, depressive symptoms, callous and unemotional behaviour, psychological symptoms and reactive and proactive aggression, in the expected direction.

Table 7. *Behavioral and Emotional Measures: Offenders vs. Non-offenders with TBI*

Outcome Variable	Offender (n=32)		Non-offender (n=26)		Statistics			
	Mean	St. Dev	Mean	St. Dev	*F*	*df*	*p*	*r*
Health Symptoms	8.28	(5.62)	6.54	(4.69)	1.60	57	.21	.17
Psychological Symptoms	11.53	(6.72)	7.46	(5.25)	6.37	57	.01	.32
AUDIT	12.65	(6.86)	8.25	(6.21)	5.33	46	.03	.33
BDI	28.47	(12.63)	12.38	(8.41)	30.96	57	.00	.60
ICU	28.40	(11.46)	21.92	(7.67)	6.09	57	.02	.31
Callous	9.60	(5.67)	6.50	(3.34)	6.02	57	.02	.31
Uncaring	7.87	(6.12)	7.69	(5.41)	0.01	57	.91	.02
Unemotional	10.93	(5.72)	7.70	(4.14)	5.87	57	.02	.31
RPQ	23.59	(10.13)	12.15	(7.17)	18.83	42	.00	.56
Proactive Aggression	10.35	(6.63)	3.03	(3.81)	21.14	42	.00	.58
Reactive Aggression	13.25	(3.91)	9.38	(3.24)	8.99	42	.01	.42

Part 2b: Between group comparisons: Young offenders and non-offenders with TBI associated with a LOC in behavioural and emotional factors.

From the sample, 22 offenders and 8 non-offenders had sustained a TBI with a reported period of LOC. The results show that there was no statistical differences between offenders and non-offenders with a TBI involving a period of LOC in terms of age, F (1, 28) = .07, p = .78 or in terms of language, χ^2 (1, N = 30) = 0.53, *p* = .47. Thus they were matched on age, sex and language. Table 8 presents the descriptive statistics for language and age.

Table 8. *Descriptive Statistics: Language and Age of offenders and non-offenders with TBI with period of LOC*

	Language		Age			Total
	English	Afrikaans	Mean	St. Dev	Range	
Offender	9	13	16.00	1.11	13-17	22
Non-offender	4	4	16.12	1.36	13-17	8

For criminal activity no significant difference was found, χ^2 (2, N = 23) = 2.17, *p* = .34. However, more offenders (50.00% (11/22)) reported being involved in multiple crimes compared to non-offenders (25.00% (2/8)). For substance use a significant difference was also not found, χ^2 (2, N = 23) = 5.30, *p* = .07. Again although significant differences were not found, more offenders (54.54% (12/22)) reported substance use multiple times compared to non-offenders (37.5% (3/8)).

The results for all other comparisons in terms of outcome variables between the young offenders and non-offenders with TBI associated with a LOC are presented in Table 9.

The only significant differences found between these two groups were in depression scores and proactive aggression. All other results were not significant but were in the expected direction in terms of the reported means, with the exception of the Uncaring component of the ICU.

Table 9. *Behavioral and Emotional Measures: Offenders vs. Non-offenders with TBI with period of LOC*

Outcome Variable	Offender (n=32)		Non-offender (n=26)		Statistics			
	Mean	St. Dev	Mean	St. Dev	F	*df*	*p*	*r*
Health Symptoms	8.39	(5.95)	7.43	(5.03)	.15	1	.70	.07
Psychological Symptoms	12.61	(6.72)	9.86	(6.64)	.90	1	.35	.18
AUDIT	13.62	(5.69)	10.00	(8.08)	1.53	1	.23	.26
BDI	29.26	(13.04)	26.30	(13.24)	5.74	1	.02	.41
ICU	26.22	(9.34)	22.29	(11.35)	.83	1	.36	.17
Callous	8.26	(5.73)	5.71	(3.09)	1.25	1	.27	.21
Uncaring	8.09	(5.61)	10.42	(7.74)	.78	1	.38	.16
Unemotional	9.87	(5.48)	6.00	(4.58)	2.86	1	.10	.30
RPQ	22.86	(9.09)	14.28	(10.06)	3.88	1	.06	.42
Proactive Aggression	10.00	(6.03)	3.86	(4.81)	5.48	1	.03	.47
Reactive Aggression	12.86	(3.53)	10.43	(5.88)	1.41	1	.25	.26

Discussion

Summary and Interpretation of Findings

Part 1a and b: Prevalence - Self-reports of TBIs. The main purpose of this part of the study was to establish the prevalence of TBIs in young offenders and non-offenders. Because there are no incident rates of TBIs in young offenders in SA (or society at large for that matter), a sample of non-offenders was included as a control group in this research. The results showed that the prevalence of TBI is higher in the young offenders (55.2%) when compared to the non-offenders (44.8%), although not significantly so. The results are however in the expected direction, at least descriptively, lending support to the main hypothesis on the prevalence of TBIs. I also looked at the differences in terms of the severity of the TBIs reported by the two groups, and particularly at the number of participants across the two groups who reported a period of LOC. Most studies have used LOC as an indicator of TBI and it has been suggested to be quite accurate in the absence of medical verifications (Farrer et al., 2013). As expected, the results showed that the prevalence of TBI associated with a LOC is higher in offenders (68.75%) when compared to non-offenders (30.77%).

Although studies looking at the prevalence of TBIs in young offenders yield inconsistent results, varying from a prevalence of 12.5% to 67%, most studies report a prevalence below 50% (Farrer et al., 2013; Perron & Howard, 2008). In the current study, the prevalence of TBI was 55.2% in the offender sample. Moreover, in the non-offender sample the prevalence rate is also quite high as it is 44.8%. These results suggest that the prevalence rate of TBI is generally high in South Africa. This outcome may be due to the fact that risk factors such as high rates of violence and MVAs, which are major cause of TBIs, are present in the country (Hux et al., 1998; Levin, 2004; Luukkain et al., 2012). Thus a comparison between offenders and non-offenders who have sustained a TBI could aid in gaining insight into why differences in the prevalence of TBI exist between offenders and non-offenders.

Most of the studies investigating prevalence rates of TBIs are based in HICs. The current research was done in a LAMIC in a low SES area which may be one of the factors affecting the high prevalence rates. A number of studies report higher incident rates of TBIs in low SES areas as more risk factors may be present (e.g., such as high levels of violence; Farrer et al., 2013; Levin, 2004). However, it is necessary to be cautious when comparing the prevalence of TBIs of different studies as each study may measure and classify the severity of TBIs differently. For instance some young offender-related studies may require parent or medical verification to classify a head injury as a TBI while for other studies self-report of TBI is sufficient. However, studies which only classify a head injury as a TBI if parent or

medical verification is available may be too stringent and not identify milder forms of TBI (Farrer et al., 2013). For this particular study medical or parental corroboration of the presence of TBI was not required, self-reports were used to record TBIs.

The main causes of TBIs among the young offenders were fights and assaults (59.40%). These etiological factors only accounted for 15.30% of TBIs for the non-offenders. Conversely, the main cause for TBIs in the non-offenders was sports injuries (26.90%) while this factor only accounted for 3.10% in the offender sample. Thus these results are consistent with international studies which have shown that the main causes for TBI in offenders would be due to violence while in non-offenders would due to sports injuries (Hux et al., 1998; Levin, 2004; Luukkain et al., 2012).

Part 2a. Between group comparison: Comparing young offenders and non-offenders with TBI on learning problems, callous-unemotional behavior, depression, criminality and substance abuse. Literature on the outcomes of TBI and on young offenders describe various cognitive, emotional and behavioural sequelae (Farrer et al., 2013; Gerring et al., 2009; Perkes et al., 2011; Schrieff et al., 2011). Studies also suggest that there are certain pre-injury factors that may influence the outcomes of a TBI such as SES, intellectual ability, and prior delinquent behaviour (Farrer et al., 2013; Prigatano & Gray, 2007). Additionally, studies comparing the consequences of TBIs on offenders and non-offenders suggest that the consequences are much more debilitating in offenders than non-offenders due negative pre-injury and post-injury factors such as family history of criminality and poor social support (Farrer et al., 2013; Perkes et al., 2011).

The results from this research are consistent with various other studies which have found significant differences in behavioural and emotional factors between offenders and non-offenders who have sustained a TBI (Farrer et al., 2013; Hux et al., 1998; Prigatano & Gray, 2007). In this study, significant differences were found in depression, psychological symptoms (e.g. suicidal thoughts and low self-esteem), callous-unemotional behaviour, reactive and proactive aggression and alcohol use.

In a meta-analytic study conducted, comparing aggressive behaviour in offenders and non-offenders, parents of young offenders with TBIs often report more behavioural control deficits compared to non-offenders with TBIs, hence leading to more aggressive behaviour (Farrer et al., 2013). The results of this study are consistent with this international study suggesting that aggression is more prevalent in offenders than non-offenders as a significant difference was found in both reactive and proactive aggression between the two groups (offenders and non-offenders with TBIs). Aggressive behaviour increases the chances of

being involved fights and accidents which in turn increases the risk of the offender sustaining another TBI.

Additionally, the ICU measures callous-unemotional traits which are strongly correlated to antisocial behaviour and conduct problems (Essau et al., 2006). These traits are also linked to violent behaviour. This measure has been widely used with young offenders. Literature has revealed that young offenders generally score high in this measure (Essau et al., 2006). Thus the results of this study are consistent with other studies as the results showed a significant difference between offenders and non-offenders in terms of callous-unemotional traits.

Moreover, a similar study to the current one, also comparing the outcomes of TBI in offenders and non-offenders found that anxiety, substance use and depression were significantly higher in offenders than non-offenders (Perron & Howard, 2008**).** Although the results from the current study in terms of depression, psychological symptoms and alcohol use are consistent with those results, those related to substance use generally are inconsistent. The results from this study have shown that there are no significant differences in substance use between the two groups. Again, these results may be inconsistent due to the fact that most international studies are conducted in HIC contexts and there are much higher reported rates of substance use in low SES areas like the context for the current study (Levin, 2004).

Interestingly, the study conducted by Lukkain et al., (2012) suggests that criminal activity would be much higher in offenders than non-offenders. The results of this study provide evidence to the contrary, as no significant difference was found between the offenders and non-offenders. However, this may be due to the fact that crime levels are generally high in SA (Hux et al., 1998). In addition, the measure used for criminality only provided information on the frequencies of such behaviour and not the severity thereof. The descriptive results for this variable do show that more offenders than non-offender engage in multiple criminal activities, but not the extent of those crimes, which might be significantly more serious than those committed by the non-offender group.

Part 2b. Between group comparison: Comparing young offenders and non-offenders with TBI associated with LOC on learning problems, callous-unemotional behavior, depression, criminality and substance abuse. As mentioned above, existing research suggests that there are various behavioural and emotional deficits, some of which can be associated with TBIs which are higher in offenders than non-offenders (Farrer et al., 2013; Gerring et al., 2009; Perkes et al., 2011; Schrieff et al., 2011). However, in this particular study, when LOC was taken into account the only significant differences found

were in proactive aggression and depression between the groups. Although still supporting hypothesis 2, the results comparing offenders and non-offenders with TBIs associated with LOC are inconsistent with most similar international studies (Farrer et al., 2013; Gerring et al., 2009; Perkes et al., 2011; Schrieff et al., 2011). The reason for this inconsistency may be due to different sample sizes in the offender and non-offender group, and the reduced number of participants in each group, but especially in the non-offender group. Alternatively, it may also be that other studies do not separate those who report milder forms of TBI from those who report more severe injuries.

Although the definition of a TBI can include both experiencing a period of LOC or altered state of conscious, the length of LOC can also be used to measure severity of injury. Longer periods of LOC denote more severe injuries (Farrer et al., 2013; Schrieff et al., 2011). The lack of significant differences between the groups on psychological symptoms and anti-social behavior suggest that these participants are more similar across the two groups than those who sustain milder injuries. The eight non-offender participants in this sub-analysis sustained their injuries as a results of falls when sober (2), road accidents (2), sports injuries (2), assaults (1) and unknown (1). These results must however be interpreted with caution given the limitations in sample size.

Limitations and recommendations for future research

There were various limitations associated with this study. The first limitation is linked to establishing the prevalence of TBI which was done by retrospective self-reports. It did not include medical or parental corroboration. For instance some of the participants might have reported a minor knock to the head, which did not lead to a TBI and thus be included in the TBI group, possibly inflating the prevalence rates of TBIs reported. Some of the participants were too young when they suffered the injury and could not provide the full details of the event. Studies have shown that absence of medical verification makes it challenging to detect a TBI and to determine the accuracy of a self-reported TBI (Farrer et al., 2013). However, most of the international studies have relied on self-reports specifically with the offender population as it is very difficult to get access to medical or parental verification (Farrer et al., 2013). It may be challenging to get medical records from young offenders who have been institutionalised and parent verification may not be possible as they do not live with their parents. Many adolescents may not even visit the hospital, especially after milder forms of injury.

Moreover, the severity of TBI was not determined by an objective measure, but rather by self-reports according to categories provided in the CHAT. These categories ranged from

mild (e.g. dazed/confused) to severe categories (associated with varying periods of LOC), and were not recorded in accordance with more traditional measures like the GCS. I did not have access to this kind of information without hospital verification. Hence, LOC was not a necessary inclusion criterion in order to be included in either TBI (young offender or non-offender) group in the first part of the analysis (1a). When LOC was taken into account in the secondary analysis (1b), the sample size was reduced. Research and literature on TBI often associate a TBI with a period of LOC (Farrer et al., 2013). The reason for using the CHAT was because it was developed in the context of this kind of research by researchers working on similar populations (Offender Health Research Network, 2014). It is also easily administered. Also, the aim of relying just on self-report of TBI was to ensure that the varying types of TBIs even the milder forms which often go unnoticed, were reported. In future, researchers should aim to verify the self-report of TBI with parent or medical records to ensure the accuracy of the reported TBI. This will make the results more accurate and reliable.

Another limitation was related to the sampling of the non-offenders. Although selection criteria were set, i.e. in order for participants to take part in the research they had to be coloured males, aged 13 to 17 years, the response rate from participants' parents was very low. For the non-offender sample, 156 consent forms were sent to those participants who matched the criteria, however only 53 consent forms were returned. This might have had an effect on the sample used and may have resulted in response bias. For instance some of the students might not have given the consent forms to their parents. Others might have given to their parents but the parents might not have wanted their child to participate in the research. There might be various reasons linked to this outcome. For instance, those parents who wanted their child to participate in the research might have already had the belief that their child had a problem and that being part of the study would help identify that problem. Thus those who participated from the school might have been the most problematic students which would evidently influence the results of the study.

Another possible limitation related to the study was the use of only one school and one young offender institution which affects the generalizability of the results of this study. There might have been factors only present in this particular school and institution that may differ greatly from other schools and institutions. For instance, the school in which data was collected was well equipped, with good teachers and good facilities. There are other schools in the same SES area which might not have the same facilities. However, the offender sample was closely matched to the non-offender sample, thus homogeneity was promoted and

facilitated the comparison of data between groups. In order to make the results of future research generalizable to the wider population, it would be necessary to collect data from various schools and institutions. This would provide with a much larger sample from which participants could be randomly selected and reduce possible selection biases. Moreover, having larger samples would also increase the statistical power and further increase the generalizability of the results.

An additional limitation to this study was the use of a cross-sectional design and as a result the causal relationship between TBI and offending behaviour could not be investigated or determined. Hence, the results cannot determine whether TBI leads to offending behaviour or vice versa; that offending behaviour increases the risk for TBI. With the results from this study the only inferences that can be made are correlational and the symptom overlap between young offenders and TBI patients. Future research projects could aim to do a meta-analytic study in order to determine the causal relationship between TBI and offending behaviour. The results of such a research would be of great importance and facilitate the development of effective intervention programs.

Despite the aforementioned limitations, this study is one of only a few of its nature conducted in a LAMIC. Hence, it is an important initial step in contributing to future studies in this context, especially in terms of gauging the prevalence of TBI among young offenders in South Africa.

Statement of significance

TBIs are one of the leading causes of hospitalizations and deaths around the world. Individuals at greatest risk are young males from a low SES backgrounds (Ponsford et al, 2007). Moreover, there is a strong correlation between being an offender and sustaining a TBI and yet, the relationship between these two factors is far from being understood. All that is known is that there is a great symptom overlap. Hence, research in this field is necessary. Moreover, most of the research in this field has been conducted in HIC settings, which might not be applicable to LAMICs like South Africa. Thus this research can be considered an important starting point aimed at establishing the prevalence of TBIs in young offenders in a SA by using a comparable control group. The results of this study have shown that that the prevalence rate of TBI is generally high in SA, in both young offenders and non-offenders. Thus, this research suggests that in a South African context the risk for a sustaining a TBI may be greater compared to other HICs. Hence, when developing intervention programs to reduce the rates of TBI and to provide rehabilitation to those who have sustained a TBI, the

greater potential societal issue regarding TBI as well as a specific focus on young offenders, should be taken into account.

Additionally, this research provided information on the differences in the behavioural and emotional deficits associated offenders and the non-offenders who report sustaining TBIs. This information is important in moving forward with this research as it is clear that factors other than just sustaining a TBI may contribute to behavioural outcomes among young offenders.

References

Alexander, T., Fuller, G., Hargovan, P., Clarke, D. L., Muckart, D. J., & Thompson, S. R. (2009).An audit of the quality of care of traumatic brain injury at a busy regional hospital in South Africa.*Sajs Articles, 47*(4), 120-126.

Anderson, V. A., Catroppa, C., Morse, S. A., Haritou, F., & Rosenfeld, J. V. (2005). Functional plasticity or vulnerability after early brain injury? *Official Journal of the American Academy of Pediatrics*, 116(6), 1374-1382.

Babikian, T., &Asarnow, R. (2009). Neurocognitive outcomes and recovery after pediatric TBI: a meta-analytic review of the literature. *Neuropsychology, 23*(3), 283-296.

Babor, T., F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). *The Alcohol Use Disorder Identification Test: Guidelines for use in primary care* (2nd ed.). World Health Organisation-Department of Mental Health and Substance Dependence.

Badul, A. (2012). *The prevalence of traumatic brain injury in a South African, juvenile delinquent sample.* Unpublished Honours thesis, University of Cape Town, Cape Town, South Africa.

Baguley, I. J., Cooper, J., &Felmingham, K. (2006). Aggressive behavior following traumatic brain injury: How common is common? *Journal of Head Trauma Rehabilitation, 21*(1), 45-56.

Child behavior checklist (2009). Retrieved from http://knowledgex.camh.net/amhspecialists/Screening_Assessment/screening/screen_CD_youth/Pages/CBCL.aspx

Chitsabesan, P., Lennox, C., Theodosiou, L., Law, H., Bailey, S., Shaw, J. (2013). The development of the comprehensive health assessment tool for young offenders within the secure estate. *The Journal of Forensic Psychiatry & Psychology*, *25*(1), 1-25.

Cook, G. L., Hanten, G., Orsten, K. D., Chapman, S. B., Li, X., Wilde, E. A., Schnelle, K. P., & Levin, S. H. (2013). Effects of moderate to severe traumatic brain injury on anticipating consequences of actions in adolescents: a preliminary study. *Journal of the International Neuropsychological Society, 19*, 508-517.

Dalby, J. T. (1985). Criminal liability in children.*Canadian Journal of Criminology*, *27*, 137-145.

Erasmus, 2013. Investigating the prevalence rates of traumatic brain injury and associated behavioral and emotional outcome variables in adolescent male young offenders in Cape Town. Unpublished honours thesis, University of Cape Town, Cape Town, South Africa.

Essau, C. A., Sasagawa, S., & Frick, P. J. (2006). Callous-unemotional traits in a community sample of adolescents. *Assessmebt,13, 454-469.*

Farrer, J. T., Frost, R. B., & Hedges, W. D. (2013). Prevalence of traumatic brain injury in juvenile offenders: A meta-analysis. *Child Neuropsychology, 19*(3), 225-234.

Gerring, J. P., Grados, A. M., Slomine, B., Christensen, J. R., Salorio, C. F., Cole, W. R., & Vasa, R. A. (2009). Disruptive behaviour disorders and disruptive symptoms after severe paediatric traumatic brain injury. *Brain Injury, 23*(11), 944-955.

Hodges, E. (2012). *Parenting, head injury and aggression: Predictive pathways of offending in male offenders*. Unpublished doctoral dissertation,University of Exter, Devon, United Kingdom

Hofman, K., Primack, A., Keusch, G., &Hrynkow, S. (2005). Addressing the growing burden of trauma and injury in low- and middle-income countries.*American Journal of Public Health, 95*(1), 13-17.

Hogrefe (n.d.). Behavior rating inventory of executive function- ages 5-18 (BRIEF). Retrieved from http://www.hogrefe.co.uk/behaviour-rating-inventory-of-executive-function-ages-5-18-brief.html

Hux, K., Bond, V., Skinner, S., Belau, D., & Sanger, D. (1998). Parental report of occurrences and consequences of traumatic brain injury among delinquent and non-delinquent youth.*Brain Injury, 12*(8), 667-681.

Kagee, A., Nel, A., & Saal, W. (2013). Factor structure of the Beck Depression Inventory-II among South Africans receiving antiretroviral therapy, *AIDS Care, 26*(2), 257-262.

Kimonis, E. R., Frick, P. J., Skeem. J. L., Marsee, M. A., Cruise, K., Munoz, L. C., Aucoin, K. J.,& Morris, A. S. (2008). Assessing callous-unemotional traits in adolescent offender: Validation of the inventory of callous-unemotional traits.*International Journal of Law and Psychiatry, 31,* 241-252.

Lai, H. M., Graham, J. W., Caldwell, L. L., Smith, E. A., Bradley, S. A., Vergnani, T., Wegner, L., & Mathews, C. (2013). Linking life skills and norms with adolescent substance use and delinquency in South Africa.*Journal of Research on Adolescence, 23*(1), 128-137.

Levin, K. (2004). Pediatric traumatic brain injury in South Africa: some thoughts and considerations. *Rehabilitation in Practice, 26*(5), 306-314.

Liu, J. (2011). Early health risk factors for violence: conceptualization, evidence, and implications. *Aggression and Violent Behavior, 16*, 63-73.

Luukkain, S., Riala, K., Laukkanen, M., Hakko, H., &Rasanen, P. (2012).Association of traumatic brain injury with criminality in adolescent psychiatric inpatients from Northern Finland.*Psychiatry Research, 200,* 767-772.

Marsden, J., Gossop, M., Stewart, D., Best, D., Farrel, M., Lehmann, P., Edwards, C., &Strang, J. (1998). The Maudsley Addiction Profile (MAP): A brief instrument for assenting treatment outcome. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9926574

Myer, L., Stein, D. J., Grimsrud, A., Seedat, S. & Williams, D. R. (2008). Social determinants of psychological distress in a nationally-representative sample of South African adults. *Soc Sci Med, 66*, 1828-40.

Ockhuizen, H. J. (2014). 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. Unpublished master's thesis, University of Cape Town, Cape Town, South Africa.

Offender Health Research Network (2014).Comprehensive health assessment tool. Retrieved from http://www.chimat.org.uk/resource/item.aspx?RID=126554

Perkes, I., Schofield, P. W., Butler, T., & Hollis, S. J. (2011). Traumatic brain injury rates and sequelae: A comparison of prisoners with a matched community sample in Australia. *Brain Injury, 25*(2), 131-141.

Perron, B. E., & Howard, M. O. (2008).Prevalence and correlates of traumatic brain injury among delinquent youths.*CriminalBehaviour and Mental Health, 18*, 243-255.

Ponsford, J., Whelan-Goodinson, R., &Bahar-Fuchs, A. (2007). Alcohol and drug use following traumatic brain injury: A prospective study. *Brain Injury, 21*(13-14), 1385-1392.

Prigatano, G. P., & Gray, J. A. (2007). Parental concerns and distress after pediatric traumatic brain injury: A qualitative study. *Brain injury, 21*(7), 721-729.

Raine, A., Dodge, K., Loeber, R., Gatzke-Kopp, L., Lynam, D., Reynolds, C., Stouthamer-Loeber, M. & Liu, J. (2006). The reactive-proactive aggression questionnaire: Differential correlates of reactive and proactive aggression in adolescent boys. *Aggressive Behavior, 32*, 159-171.

Rodrigues-Gomez, J., Davila-Martinez M., & Collazo-Rodriguez, L. (2006). Factor structure of the Beck Depression Inventory-Second Edition (BDI-II) with Puerto Rican elderly. Retrieved from: http://www.ncbi.nlm.nih.gov/pubmed/17203709

Ruff, R. M., Iverson, G. L., Barth, J. T., Bush, S. S., Brosheke, D. K., & NAN Policy and Planning Committee (2009). Recommendations for diagnosing a mild traumatic brain injury: A national academy of neuropsychology education paper. *Archives of Clinical Neuropsychology*, 24, 3-10.

Schrieff, L., Donald, K., & Thomas, K. (2011).Cognitive and behavioral outcomes after traumatic brain injury in children. *Continuing Medical Education, 29*(4), 160-161.

Schrieff, L. (2013). *Investigating severe pediatric traumatic brain injury in South Africa: A demographic profile of admissions, brain oxygenation and neuropsychological outcomes and attention-training intervention*. Unpublished doctoral dissertation, University of Cape Town, Cape Town, South Africa.

University of New Orleans (2011).Inventory of Callous-Unemotional Traits. Retrieved from http://labs.uno.edu/developmental-psychopathology/ICU.html

Willacy, H. (2014). Alcohol use disorders identification test (AUDIT). Retrieved from http://www.patient.co.uk/doctor/alcohol-use-disorders-identification-test-audit

Williams, W. H., Cordan, G., Mewse, A. J., Tonks, J., & Burgess, C. N. (2010). Self-reported traumatic brain injury in male young offenders: A risk factor for re-offending, poor mental health and violence? *Neuropsychological Rehabilitation, 20*(6), 801-812.

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, unspedifiedlabour, 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

Consent Form

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

Your child is 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 child's participation is entirely voluntary. Before you decide whether or not your child can take part of the study, read the information below and ask questions about anything you do not understand. By participating in this study your child will not be penalized or lose any benefits to which he or she would otherwise be entitled.

1. Name of Participant ("Study Subject")

_____

2. Title of Research Study

The prevalence of traumatic brain injuries among young offenders in Cape Town, South Africa

3. Principal Investigator and Telephone Number(s)

Priscila Kheraj

Honours Student

Department of Psychology

University of Cape Town

0723537353

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) in young offenders and non-offenders. The behavioral outcomes of TBIs in offenders and non-offenders will also be measured and compared.

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 parent information and socio-economic status questionnaire, and a questionnaire about their behaviour.

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 or your child wishes to stop your participation, you are free to do so without penalty.

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

180

9. What are the possible discomforts and risks?

There are no known risks associated with participation in this study. Should your child get tired during the study, they will be allowed to rest. If you wish to discuss the information above or any discomforts you or your child 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 behavioral 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 adolescent behaviour who have sustained a TBI and the prevalence rate of TBIs.

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?

You will receive R50 for both your's and your child's participation

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 021 650-3417 .

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 and records of your responses to questionnaires regarding your child's behavior. 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 child's 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 your child's participation 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

Method of contact:

Phone number: _____

E-mail address: _____

Mailing address: _____

_____

_____

Appendix C

Assent Form

We are inviting you to be part of our research study. We want to learn more about traumatic brain injuries and the effects they might have on behaviours of young people. We are collecting information from young people who have and have not had an injury to compare their behaviours.

If you agree to participate in this study we will ask you to meet with us once. We will conduct an interview and administer a few questionnaires with you that will last approximately two hours. We will ask you some questions about your life and your behaviour. With your permission, two questionnaires will be given to your parent/guardian and he or she will provide us with feedback on your behaviour and socioeconomic status.

Taking part in this study will not harm you in any way. The questionnaires included in this study have no known risks. You may feel tired as some of the questionnaires are long, but you are free to take breaks and rest after each questionnaire if you would like to. If you decide not to take part in the study or decide to stop before the study ends there will be no negative consequences.

There are no direct benefits to participating in this study; however you will be helping us understand behavioural outcomes associated with a traumatic brain injury.

Your identity will be kept anonymous and all information you provide will remain confidential. The information you provide will only be used for research purposes.

If you sign this paper it means that you are willing to participate in this study. If you do not want to take part in this study do not sign this paper. If you have any questions, feel free to ask. If you forget to ask me something, you can also ask me next time.

I would like to participate in this study:

Signature of Participant _____ Date _____

Signature of Investigator _____ Date _____

Appendix D

Western Cape Education Department Ethics Application Form

Navrae Enquiries Imibuzo	Dr RS Cornelissen		Wes-Kaap Onderwysdepartement
Telefoon Telephone Ifoni	021 - 467-2286		Western Cape Education Department
Faks Fax Ifeksi	021 - 425-7445		ISebe leMfundo leNtshona Koloni

APPLICATION TO CONDUCT RESEARCH IN PUBLIC SCHOOLS WITHIN THE WESTERN CAPE

Applicant details			
Title:	Miss	Surname	Kheraj
First name(s):	Priscila	Gender:	F
Name of organisation (directorate if WCED):			
Contact person:			
Address:	1 Main Road, Kenilworth Postal code: 7708		
Telephone number:		Cell number:	723537353
Fax number:		E-mail address:	khrpri001@myuct.ac.za
Name of institution:	University of Cape Town		
Student number:	KHRPRI001	Degree/ Diploma:	Honours
Supervisor's name:	Dr Leigh Schrieff	Tel no of supervisor:	(021) 650 3708
Year of registration	2014	Year of completion:	2014
Specialisation:		Faculty:	Humanities

Title of research:	The prevalence of traumatic brain injuries among young offenders in Cape Town, South Africa
Research question:	This research will be looking firstly, at the prevalence of TBI in non-offenders and compare it to a offenders sample; and then; it will look at the differences in behavioral outcomes between the two groups who have sustained a TBI This will be done by using various behavioral tests.
Respondents:	Learners and Parents
Name(s) of education institution(s):	Kleinvlei Secondary School, Kleinvlei , CT, 7100; Eersterivier Secondary School, High Places, CT, 7100; Forest Heights High School, Forest Heights, CT, 7100; Forest Heights Primary School, Forest Heights, CT, 7100; Chris Hani Secondary School, CT, 7100; Stratford Primary School, Clairwood Kleinvlei; Oostenberg Good Hope Christian School, Oostenberg.
Research period in education institutions:	
Start date:	May
End date:	October
Signature:	Priscila Kheraj
Date:	12/05/2014

FOR OFFICIAL USE ONLY

Date approved:_____ Approved by:_____

Reference number:_____