



Major Research Project

Parenting, head injury and aggression:

Predictive pathways of offending in male young offenders

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Abstract

Adolescence is a risk period for offending and head injury (HI), with rates of HI in young offender populations frequently exceeding those in the community. Poor parenting practices have been associated with increased risk of offending and development of reactive and proactive aggression. Preliminary research suggests HI may discriminate offender profiles within young offenders, but the influence of HI on offending alongside parenting and aggression is less well known. This study explored the relationships between parenting practices, reactive and proactive aggression, HI and offending in a sample of male young offenders from a Young Offender Institute (n=98) using self report data. A history of at least one HI was reported by 73.5%, with 61.1% reporting a knock out from their worst HI. Poor supervision emerged as a key predictor: predicting knock out history, indicators of offending and reactive and proactive aggression. Repeated HI was predictive of reactive aggression and a knock out history predicted earlier age of first offence. The impact of HI on outcomes via neuropsychological sequelae or as a “marker” for contextual risk factors such as poor supervision and reactive aggression are examined. Clinical implications for young offenders are discussed.

Key Words: Young offender, head injury, parental supervision, prisoner health

Introduction

Overview

Factors contributing to offending are upper most in Government thinking and policy reform, with the aim of reducing offending and recidivism given increasing rates of incarceration and prison overcrowding (Ministry of Justice, 2012), particularly with young offenders (YO) (below 21 years). Multiple strands of research converge to inform understanding of criminal behaviour: biological, sociological, neurodevelopmental and psychological, to name a few (Karnik & Steiner, 2007). The influence of parenting practices on child outcomes is well researched. Specific aspects of parenting have been associated with criminal behaviour in children and adolescents (Farrington, 2005). Furthermore, aspects of parenting have been linked to the development of aggression subtypes (proactive and reactive aggression), which in turn are also emerging as influences of crime (Raine et al., 2006). However, HI¹ as a factor within this crime narrative is relatively neglected. This is despite its elevated prevalence among YO compared with the general population and its association with worse criminal profiles (Williams, Cordan, Mewse, Tonks, & Burgess, 2010). Head injury as a predictor of criminal behaviour, alongside the potential predictors of parenting practices and proactive and reactive aggression, remains unexplored in a sample of YO. The failure to explore these “partners in crime” in YO is all the more important given adolescence is a pivotal

¹ For the purpose of this study HI was defined as “nondegenerative, noncongenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairments of cognitive, physical and psychosocial functions with an associated diminished or altered state of consciousness” (Dawodu, 2007, p.1). Common causes include assaults, falls, road traffic accidents and sports related injuries (McMillan, 2010)

time for acquiring functional skills; possibly determining a young person's future life as one of further crime or not (Williams, Cordan et al., 2010). Consequently, the associations between parenting, aggression subtypes, head injury and indicators of offending were explored.

Parenting, Aggression and Crime

There is a wealth of research evidence supporting the contribution of parenting practices to the development of childhood aggression and youth offending (Gardner, Ward, Burton, & Wilson, 2003; Hodgins, Kratzer, & McNeil, 2001; Patterson & Stouthamer-Loeber, 1984; Rothbaum & Weiz, 1994; Schroeder, Bulanda, Giordano, & Cernkovich, 2006; Schroeder, Giordano, & Cernkovich, 2010; Webster Stratton, 1999). In Farrington's (2005) review of childhood risk factors for aggression and offending, he highlights the influence of low parental supervision, inconsistent discipline and low positive parenting. In combination these practices are indicators of the well researched authoritative parenting style (Baumrind, 1991), which also involves parents being responsive to a child's needs, encouraging good behaviour and setting clear boundaries, and has been linked to child adjustment (Maccoby & Martin, 1983).² Parental supervision has been defined as the quantity and accuracy of the information parents have about their adolescent's life (Dishion & McMahon, 1998). Low parental supervision, in particular, as an influential factor has been further supported by other studies (Griffin, Botvin, Scheier, Diaz, & Miller, 2000). Juvenile crime has been shown to peak in after school hours

² The use of parenting styles to define parenting practices was established predominantly using samples of American participants. However, research has shown these styles to be applicable to British participants as well (Shucksmith, Hendry, & Glendinning, 1995)

(Newman, Fox, Flynn, & Christenson, 2000, as cited in, Lord & Mahoney, 2007), which Lord and Mahoney (2007) explored in children aged six to ten years. They found the higher the level of self care (low parental supervision) the more externalising behaviors (aggressive in nature) teachers reported, but this was only for children from more deprived neighborhoods. The authors explained this finding as possibly resulting from unsupervised exposure to more dangerous higher risk environments. With a sample of children of a similar age, Elgar, Waschbusch, Dadds and Sigvaldason (2009), using the Alabama Parenting Questionnaire-9 (short form of the APQ, as used in this study), found inconsistent discipline, poor supervision and low positive parenting were all associated with oppositional behaviors in young children, many of which were characterized as aggressive in nature. However, it is difficult to know whether these findings would hold for YO at the upper limit of the age spectrum.

Stanger, Dumenci, Kamon and Burstein (2004) investigated the link between parenting practices and child rule breaking and aggressive behaviour using the Child Behaviour Checklist (a parent report questionnaire measuring internalizing and externalising behaviors in children and adolescents, Achenbach, 1991) in a sample of young children with substance abusing parents. They found medium effect sizes for the effects of poor parental supervision and inconsistent discipline on rule breaking behaviour (both were significant predictors) and for inconsistent discipline on aggression. Positive parenting subscales were not found to have an association with aggression. Poor supervision was only found to have a small effect size on child aggression, which the researchers explain as a potential artifact of the overlap between the parenting measure and child behaviour.

They also note that substance abusing parents may not be as accurate in their reporting of parenting and child outcomes. In a sample of males, mean age 17 years 2 months, Claes et al. (2005) found parental supervision mediated the link between parent-child emotional bonds and deviant behaviour (substance misuse and non-aggressive antisocial behaviour). However, the deviant outcome behaviors were not defined by contact with law enforcement operatives, interpreting the findings therefore as supportive of a link between poor parental supervision and crime would be misleading. It is evident that parenting practices, in particular poor parental supervision are powerful predictors of aggression and offending behaviour in young people. However, many studies employ parental report rather than child reports of parenting despite literature to suggest perceived parenting by the child is as, if not more closely associated with behavioural outcome (Lamborn, Mounts, Steinberg, & Dornbusch, 1991)³.

Parenting and proactive and reactive aggression.

Empirical support for the theoretical notion that aggressive or violent behaviour may not be a homogenous construct, but consist of distinct sub-types⁴ with different etiological pathways is gathering pace (Ferguson & Dyck, 2012) despite notable opposition (Bushman & Anderson 2001)⁵. Proactive aggression has its roots in Social Learning Theory (Bandura, 1973, as cited in, Hubbard et al., 2002) whereby aggression is

³ As Laborn et al., (1991) state “...our position is that subjective and objective assessment of parental behaviour each provide an important window on the child’s experience in the family, and that no one approach to the study of socialisation is inherently superior to the other. To paraphrase the Thomases’ dictum, if children define the conditions under which they are reared as real, they are real in their consequences (Thomas & Thomas, 1928).” (p1052)

⁴ see Appendix 1 point 1

⁵ see Appendix 1 point 2

characterized as a learned behaviour, instrumental, planned and goal oriented in nature, controlled by positive reinforcement (Dodge, 1991). Reactive aggression is characterized as a response to provocation, involving the over attribution of hostility to another's intentions, often involving the feeling of anger⁶ (Raine et al., 2006). It is derived from the frustration-aggression hypothesis (Berkowitz, 1993, as cited in, Hubbard et al., 2002) whereby high emotional arousal (threat, vulnerability for example) is experienced as a result of perceived frustration or provocation, culminating in an aggressive response.

With regards to specific parenting practices and subtypes of aggression, Vitaro, Brendgen and Barker (2006) point out the etiology of reactive and proactive aggression has been less examined. Dodge (1991) suggested proactive aggression could be encouraged by parental endorsement, through a lack of discipline or supervision which could be seen to encourage aggression for goal achievement. Conversely, reactive aggression could be promoted by parenting behaviour which disrupts attachment, such as a lack of warmth and unpredictability, thereby fostering vulnerability, hostility and aggression in later social relationships. However, proactive aggression could also be associated with harsh parenting if the child learns aggressive techniques as a means of controlling others (Vitaro et al., 2006), potentially through direct experience or vicarious learning (Huesmann & Taylor, 2006). Based on Dodge's (1991) model Brendgen (2001) predicted poor supervision would moderate the link between proactive aggression and delinquency-related violence (classified as instrumental in nature), whilst low parental warmth would moderate reactive aggression and intimate partner violence, which was supported in their sample of 525 Caucasian males aged 16-17 years. Using a sample of a very young age,

⁶ see Appendix 1 point 3

Vitaro et al. (2006) found harsh parenting was associated with reactive and proactive aggression, independent of child temperament (indicated by negative emotionality). Research is in the initial stages: it is evident that much is still to be discovered regarding the influence of parenting on specific subtypes of aggression, particularly within a YO sample using the young person's reported lifetime parenting experiences. Consequently, this study aimed to explore the influence of parenting practices (in particular parental supervision, inconsistent discipline and positive parenting) on indicators of crime and proactive and reactive aggression using self report measures in YO.

Proactive and reactive aggression and crime.

Raine et al. (2006) point out reduced inhibition and self control characteristic of reactive aggression might lead to greater problem behaviours; however, prospective research indicates a positive relationship between proactive aggression and later violence. Pulkinnen (1996) found support for a link between proactive aggression and criminality only. However, there were some methodological limitations. Firstly, the study did not employ a validated measure of reactive and proactive aggression. Moreover, the content validity of the items used to measure the aggression subtypes has been questioned, with some of the proactive items resembling potentially reactive responses (Frite, Raine, Stouthamer-Loeber, Loeber, & Pardini, 2009). Also using a prospective study design Vitaro, Gendreau, Tremblay and Oligny (1998) found proactive, but not reactive aggression at 12 years old predicted delinquency during mid-adolescence, but reactive aggression was found to reduce the risk of proactive aggression leading to delinquency

in participants who scored highly on both subtypes. With a view to rectifying some of these limitations, Raine et al., (2006) explored the differential correlates of reactive and proactive aggression and developed a reliable and valid brief self report measure of the subtypes (The Reactive Proactive Aggression Questionnaire [RPQ], as used in this study). Reactive aggression was more endorsed than proactive aggression. Reactive and proactive aggression were associated with delinquency (increased convictions), but only proactive aggression was associated with violent behaviour⁷. It is evident that research in this field is still in its infancy, but perhaps as Karnik and Steiner (2007) put it: research to date indicates reactive aggression may be most common amongst YO, but proactive is most feared⁸. This study aimed to increase knowledge in this area by looking at the relationships between proactive and reactive aggression and indicators of crime.

There is likely to be little doubt that parenting practices are associated with the development of aggression and offending in young people and aggression in young people is a risk factor for later crime. The influence of HI as a predictor of crime alongside these factors is perhaps less well established.

Epidemiology of Head Injury

Head injury is the leading cause of death and disability in children and young adults (Tagliaferri, Compagnone, Korsic, Servadei, & Kraus, 2006). Prevalence rates vary, but it is estimated that 5-25% of individuals in the general population have suffered a HI

⁷ see Appendix 1 point 4

⁸ see Appendix 1 point 5

(Farrer & Hedges, 2011; Silver, Kramer, Greenwald, & Weissman, 2001). Childhood and adolescence appear particularly risky periods⁹. Yates, Williams, Harris, Round, and Jenkins (2006) found UK brain injury rates higher in childhood (up to 20 years of age) than in adulthood. McKinley et al. (2008) suggest these figures may be an underestimate due to a lack of official documentation. Further difficulties in establishing an accurate epidemiology of HI arise from the varying definitions of HI across professional groupings and inconsistencies in reporting of HI. Consequently, figures are likely to be an underestimate, indicating child and adolescent HI could be a “silent epidemic” (Perna, 2002).

With regards to YO Williams, Cordan et al. (2010) recorded a self report rate of 65% (n=197) across HI severities (46% reported a knock out). A recently completed study found a slightly higher rate of 70% of which 41% reported a knock out (Davies, Williams, Hinder, Burgess, & Mounce, 2012). Slightly lower rates of HI were found when comparing a group of non-offending young people with a sample of YO: 40% and 50% respectively (Huxx, Bong, Skinner, Belau, & Sanger, 1998). It is acknowledged reliance on somewhat more subjective reports of HI may lead to an inflation of prevalence rates. However, work by Schofield, Butler, Hollis and D'Este (2011) found self reported HI rates were similar in accuracy to hospital records in a sample of prisoners. Coupled with the difficulties tracing medical records, self-report remains a popular data collection method in offender based research.

⁹ see Appendix 1 point 6

Parenting and Head Injury

Much research has focused on parenting and general childhood injury and not HI specifically. Research has linked a lack of parental supervision with increased risk of childhood injury (Morrongiello & Dawber, 1998; Morrongiello & House, 2004; Schwebel & Bounds, 2003). Supervision in this context is seen as taking an active role in preventing hazardous engagement with the environment thereby decreasing opportunity for HI. Schwebel and Barton (2004) report on a growing literature linking high quality parental supervision with lower rates of childhood injury. As they point out, most studies have employed young children, and furthermore rely on parent reports of parenting practices, it is unclear therefore, whether these findings would translate to adolescents. Consequently, the effects of parenting practices, as perceived by the YO, on severity and frequency of HI were explored in this study. If parenting practices are found to be predictive of HI this provides an important target for intervention to protect vulnerable young people from acquiring a HI and adding a further risk factor for poor developmental outcomes associated with ineffective parenting practices.

Head Injury and Crime

The elevated level of HI in YO is suggestive of a link between HI and crime. Further to this, research has found HI can discriminate *within* offender groups, indicating worse criminal profiles compared to offenders without HI¹⁰. Williams, Mewse et al. (2010) explored rates of HI in a sample of adult offenders and found a self report rate of 65%

¹⁰ see Appendix 1 point 7

across HI severities. A HI was also associated with a younger age of first offence (16.4 years of age versus 20.1 years of age) and higher rates of repeated offending. The authors conclude HI to be a major health condition in prison populations. Establishing a causal effect of HI on age of first offence requires longitudinal research. A population based cohort study ($n > 12000$) in Finland found children who suffered a HI before 12 years of age engaged in criminal activity at a significantly younger age compared to those who had a HI after 12 years of age thus establishing a temporal order between HI and age of first offence. These authors note however, that unidentified factors such as ADHD and poor parental control may have explained the link (Timonen et al., 2002).

Kenny and Lennings (2007) gathered data pertaining to a number of areas with a sample of YO (mean age 17 years 2 months), including HI and violent offending. They found a history of HI was significantly associated with severe violent offending and not moderate, mild or non-violent offending. They explain this link as arising from severe violent offences displaying more disinhibited aggression and HI being a marker of disinhibition, thereby increasing the risk of severe violence. Whilst the authors should be praised for raising the distinction between different types of aggression, evidence suggests severe violent acts may be more closely associated with planned (proactive) aggression (Raine et al., 2006).

Perron and Howard (2008) explored the correlates of HI (loss of consciousness greater than 20 minutes) in 720 YO (mean age 15.5 years). Young offenders with a history of HI reported earlier onset of criminal behaviour and more criminal acts in the previous year.

The authors acknowledged reliance on self report measures may have compromised reliability, but highlighted the large sample size and response rate increased confidence in the findings. Similarly, Williams, Cordan et al. (2010) found YO (mean age 16.67 years) with HI reported more convictions and greater violence in convictions if they had suffered three or more HI compared to YO who suffered less than three HI or no HI . The authors suggest neuropsychological dysfunction, in areas such as executive functioning, may be one of the mechanisms by which HI influences crime: however, they acknowledge they did not collect such data to corroborate this. Research in this area is relatively sparse; however, these findings with adolescent males suggest HI may be able to distinguish worse criminal profiles within a YO population, this study explored whether further support could be found for this.

Head Injury and Reactive and Proactive Aggression

Head injury resulting in damage to the frontal and temporal regions of the brain has been linked with increased aggression in children (Andrews, Rose, & Johnson, 1998). Berlin, Rolls and Kischka (2004) studied patients with orbitofrontal damage and found increased impulsivity and increased reports of subjective anger in comparison with damage elsewhere in this region of the brain. Although this research did not employ measures of aggression subtypes, impulsivity and anger are characteristic of reactive aggression in young people (Raine et al., 2006). Dooley, Anderson, Hemphill and Ohan (2008) highlight that research on aggression in adolescence post HI, using theoretically driven measures, is scant. They compared a sample of adolescents who had suffered a HI

approximately 8.3 years prior (n=11) to a matched comparison group (n=28) on a number of outcomes. Using the self-report RPQ they found the HI sample reported more reactive and proactive aggression. The authors put this down as an artifact of the high correlation between reactive and proactive aggression scores ($r=0.63$). Interestingly using another scale designed to measure the form and function of aggression, HI participants reported more reactive-overt aggression in response to provocation and not to acquire objects or to threaten or intimidate others: reflective of the distinction between reactive and proactive aggression, respectively. The sample size was small, which reduces generalisability of the findings, yet statistically significant results were obtained, supporting the use of measures sensitive to the theoretical distinction of aggression subtypes. Given these initial findings and the scarcity of research on HI and aggression subtypes, further exploration is warranted. As a result, the effect of HI on reactive and proactive aggression in YO was explored.

It is clear there exists an intricate web of links between HI and offending. In addition to the factors discussed in this review there are a number of other influences likely to impact on the association between HI and offending, for example: schools support; the nature and location of the HI; pre-injury vulnerabilities, such as ADHD; and mental health status. The presence or absence of this multitude of risk factors will determine the trajectory of adjustment for young people following a HI. This study identified parenting, aggression and HI as potential pathways to offending based on current understanding of these factors in young offender samples.

Summary and Hypotheses

Parenting practices are a key player in the development of youth offending and childhood aggression. There is also suggestion poor supervision may be associated with an increased risk of HI. Head injury has been associated with increased levels of reactive aggression and worse criminal profiles in adolescent males. However, HI as a predictor of criminal behaviour, alongside the potential predictors of parenting practices and proactive and reactive aggression, remains unexplored in a sample of YO. Furthermore, screening for HI on entry to the custodial system remains poor and is largely left out of policy documents (see, for example, Home Office, 2008, and Lord Bradley, 2009). A more thorough understanding of this complex set of risk factors will provide targets for intervention and the potential to reduce offending rates. It is hypothesised therefore that poor parenting will be associated with worse offending profiles and aggression, with poor supervision alone being associated with HI. Head injury will be associated with reactive aggression and both HI and aggression will be associated with worse criminal profiles.

Method

Participants

Ninety eight male young offenders were recruited from a Young Offenders Institute (YOI), which provides a secure environment for young people (15-21 years) who have been convicted of an offence. Participants ranged from 16 to 18 years of age (*M* 16.87, *SD* .64). A total of 105 participants were asked to participate, six declined, resulting in a response rate of 94.3%, one further participant failed to reach the inclusion criteria, culminating in a final sample of 98 (93.3% of all those approached). The majority of participants described their ethnic background as White (56.8%).

Inclusion/Exclusion Criteria.

Participants were included if they were male and aged between 16-21 years. Exclusions were made on the basis of active suicidal ideation, active psychosis, English not as first language, severe visual or hearing impairments precluding ability to complete the tasks, a congenital Learning Disability, diagnosis of Asperger's or ASD and a medical health condition that may affect cognitive functioning, e.g. epilepsy, diabetes¹¹.

Design

This study employed a between subjects cross sectional design recruited using an opportunistic sampling strategy.

¹¹. See Appendix 2 point 1

Measures

The following measures were administered.

Head Injury Profiles***Presence of head injury.***

Participants were asked “Have you ever had an injury to the head that caused you to be knocked out and/or dazed and confused for a period of time?” They were also asked their age in years when they had their first and worst injuries (worst head injury operationalised as injury incurring greatest loss of consciousness [LOC]). Participants were also asked how the injury occurred: road accident, road accident in stolen car, fall when sober, fall under the influence of a substance, sports injury, fight, other non-criminal activity, other criminal activity.

Severity of head injury.

If the answer to the above was yes participants were asked to estimate the duration of their LOC from the following: up to five minutes, 5-10 minutes, 10-30 minutes, 30-60 minutes or over 60 minutes.

Frequency of head injury.

If participants answered yes to having received an injury to the head they were asked to indicate how many times this had occurred (‘Once’, ‘Twice’, ‘Three times’, ‘Four times’ or ‘More than four times’).

Criminal Profiles

Total number of convictions.

Participants were asked to make one selection from a range of options to indicate what their current conviction was for: 'Burglary', 'Shoplifting/Theft', 'Violent Offences', 'Joyriding', 'Fraud/deception', 'Drug offences', 'Sexual offences', 'other' (score 1). They were then asked to recall the number of previous convictions they had for these offences, from a set of frequency options: 'None' (score 0), 'Once' (score 1), 'Twice' (score 2), 'Three times' (score 3) or 'More than three times' (score 4). The number of convictions was summed to create a Total Convictions score with a minimum of one¹².

Age of first offence.

Participants were asked for their age in years when they received their first criminal conviction¹³.

Frequency of past violence.

Participants indicated the number of previous convictions for violent offences from the following options: 'None' (score 0), 'Once' (score 1), 'Twice' (score 2), 'Three times' (score 3) or 'More than three times' (score 4).

Index of Deprivation

Given the relationships between deprivation and crime (Kawachi, Kennedy & Wilkonson, 1999) the first three or four characters of each participant's postcode for the area of habitation prior to incarceration was used to calculate an Index of Multiple

¹² (n=97 due to one missing score).

¹³ Six participants could not recall their age at first offence, n=92 for analyses

Deprivation Total score¹⁴ (full postcodes were unable to be used as they increased the risk of making participants identifiable). The Indices of Deprivation 2010 provide a relative measure of deprivation in small areas across England.

Parenting Practices

The Short Form of the Alabama Parenting Questionnaire (APQ-9; Elgar et al., 2007)¹⁵ is an abbreviated version of the full APQ. It assesses self report parenting practices in three areas: positive parenting, inconsistent discipline, and poor supervision (three items per subscale). Each item is scored as 1-Never, 2-Almost never, 3-Sometimes, 4-Often, 5-Always, minimum score per subscale is 3 and maximum score is 15. The measure was adapted to elicit the participant's perception of their parenting experiences. To acquire an overview of parenting received by participants they were asked "In your childhood and adolescence how would you describe the way in which you have been parented (whether by parents, guardians or other family members)?" The APQ-9 has been shown to have good convergent validity and internal consistency between $\alpha=0.59$ to 0.79 for mothers and $\alpha=0.63$ to 0.84 in fathers (Elgar et al., 2007).

Reactive and Proactive Aggression

The Reactive-Proactive Aggression Questionnaire (RPQ)¹⁶, Raine et al., 2006) is a brief 23-item self-report measure, assessing frequency of reactive aggression (11 items) and proactive aggression (12 items) in general behaviour. Participants can respond 0-Never,

¹⁴ IMD scores can be obtained from the following website
http://dclgexamples.mywebcommunity.org/imd_demo_v7.htm

¹⁵ See Appendix 3

¹⁶ See Appendix 4

1-Sometimes or 2-Often in response to “How often have you (item filler)...?” This measure has shown good internal reliability for reactive ($\alpha=.84$) and proactive aggression ($\alpha=.86$) and convergent and discriminant validity for behaviors measured by the Child Behaviour Checklist in adolescent males (Raine et al., 2006)¹⁷.

Procedure

Ethical approval was granted by the School of Psychology Ethics Committee¹⁸ at the University of Exeter and by the Director of the YOI. The proposal was sent to the Director and Lead Psychologist at the YOI and a meeting between the YOI Psychology Team¹⁹ and researchers was conducted prior to the YOI consenting to participate in the study. After agreeing to participate²⁰, the researchers returned to provide training in interview administration and data collection. A period of observation of data collection was arranged to ensure high quality data was being obtained. When potential participants were on a free period from their educational activities they were recruited to participate in the study. The structured interviews were administered in quiet rooms on the wings of the YOI, taking approximately 30 minutes per interview (to ensure comparability the measures were administered in the same order). After completion, two pounds phone credit was given to the participants to repay them for their participation.

¹⁷ One participant refused to answer one item on the proactive aggression subscale, $n=97$ for all analyses.

¹⁸ See Appendix 5

¹⁹ See Appendix 2 point 2

²⁰ See Appendix 2 point 3

Results

Head Injury Characteristics

Frequency.

Of the sample 73.5% (n=72) reported a history of one or more HI, of this group 25.5% (n=25) had experienced one HI, 15.3% (n=15) reported two HI, 11.2% (n=11) reported three HI, 4.1% (n=4) reported four HI and 17.3% (n=17) reported having suffered more than four HI. For further analysis this variable was dichotomized into non repeat HI vs. repeated HI: no HI or one HI category (n=51) and 2 or more HI category (n=47), to enable regression analysis to be run. This dichotomized variable was used in all analyses.

Severity.

Of those who had a history of HI the majority (n=28) reported their worst HI to have resulted in being dazed and confused (38.9%), 34.7% reported knock out for less than five minutes (n=25), 4.16% were unconscious for between 5 and 10 minutes (n=3), 12.5% for 10-30 minutes (n=9), 5.6% for 30 to 60 minutes (n=4) and 4.16% for more than 60 minutes (n=3), resulting in 61.1% reporting a knock out history from their worst HI. Frequency of HI and severity of HI were significantly positively correlated ($r=.61$, $p<0.01$). For further analysis this variable was dichotomized into no knock out history vs. knock out history: no HI or dazed and confused category (n=54) vs. loss of consciousness category (n=44) to enable regression analysis to be run. This dichotomized variable was used in all analyses.

Demographics.

The most common cause of participants' worst HI was a fight (50%, n=36), followed by a fall when sober (15.3%, n=11), road accident 12.5%, other non criminal activity 11.1%,

sports injury 8.3% and other criminal activity 2.8%. The mean age of first HI was 11.17 years (*SD* 3.68) and for worst HI was 13.44 years (*SD* 3.06)²¹.

Index of Multiple Deprivation

Approximately 50% of participants had an IMD overall score in the lower five deciles, the modal deciles were number two and number four (15.5% each). The least common decile was number 10 (9.5% in decile 1, 6% in decile 3, 10.7% in decile 5, 14.3% in decile 6, 11.9% in decile 7, 7.1% in decile 8, and 6% in decile 9).

Criminal Profile Characteristics

The mean number of convictions was 9.45 (*SD* 9.05), the most common conviction was for a violent offence (50%, n=49), followed by burglary/robbery (33.6%, n=33), drug offences (7.1%, n=7) and sexual offences (2%, n=2). The remaining offences were classed as 'other' and were accounted for by breach of conditions on release and possession of a firearm. Thirty one participants had no previous conviction for a violent offence (31.6%), 34 had one or two (34.7%) and 33 had three or more prior convictions for violent offences (33.7%). For further analysis this variable was dichotomized into non repeat offender vs. repeat offender: no or one previous conviction for violence category (n=50) and two or more previous convictions for violence category (n=48) to enable regression analysis to be run. This dichotomized variable was used in all analyses. The mean age of first offence was 12.98 years (*SD* 2.2). The indicators of offending were correlated (age of first offence and total convictions $r = -.43$, $p < 0.01$, age of first offence and past violence $r = -.40$, $p < 0.01$, total convictions and past violence $r = .38$, $p < 0.01$).

²¹ Missing data n=1.

Parenting Characteristics

The mean inconsistent discipline score was 9.29 (*SD* 3.63), for positive parenting it was 11.69 (*SD* 3.22) and for poor supervision it was 11.29 (*SD* 2.99). Poor supervision was significantly negatively correlated with positive parenting ($r = -.22$, $p < 0.05$).

Reactive and Proactive Aggression

Reactive aggression scores were endorsed more often than proactive aggression scores: mean scores of 13.63 (*SD* 4.4) and 7.59 (*SD* 4.49), respectively. The two subscales were significantly positively correlated ($r = .63$, $p < 0.01$).

Bivariate Simple Correlations

Data was assessed to establish outliers and influential cases and to explore assumptions enabling generalization of the findings to the population. All associations met assumptions for generalization and were not found to be unduly affected by influential cases²². Simple correlations are reported in Table 1²³.

It is evident that aspects of parenting were significantly associated with indicators of crime: increasing poor supervision was positively correlated with total convictions ($r = .30$, $p < 0.01$) and past violence ($r_b = .32$, $p < 0.01$) and negatively correlated with age of first offence ($r = -.27$, $p < 0.01$). Increasing positive parenting was associated with a

²² See Appendix 7 point 1

²³ To control for age and deprivation these variables were included in the bivariate correlation matrix, there were no significant correlations therefore these variables were excluded from further analysis.

younger age of first offence ($r = -.19, p < 0.05$). Unlike it was hypothesised, inconsistent discipline was not significantly correlated with indicators of crime.

Increasing poor supervision was significantly associated with more proactive and reactive aggression ($r = .26, p < 0.01, r = .24, p < 0.01$, respectively), whereas inconsistent discipline was only significantly positively associated with reactive aggression ($r = .17, p < 0.05$) and positive parenting was not significantly correlated with either subtype of aggression.

Poor supervision was significantly positively correlated to severity of HI ($r = .26, p < 0.05$) as predicted, but not to frequency of HI.

Both severity of HI and frequency of HI were significantly positively associated with reactive aggression ($r = .179, p < 0.05, r = .31, p < 0.01$, respectively) and not to proactive aggression, as hypothesised.

Increasing severity of HI was significantly associated with more convictions and past violence ($r = .23, p < 0.05$ for both associations) and a younger age of first offence ($r = -.26, p < 0.01$) as expected. However, not in line with predictions, frequency of HI was not significantly correlated with indicators of crime.

The only significant association between aggression and indicators of crime was between reactive aggression and age of first offence, with increasing reactive aggression significantly associated with a younger age of first offence ($r = -.24, p < 0.01$).

Table 1.

Bivariate Correlations (Pearson's) n=98

	Severity of Head Injury	Frequency of Head Injury ^{>}	Poor Supervision	Positive Parenting	Inconsistent Discipline	Reactive Aggression	Proactive Aggression	Total Convictions	Age of First offence	Past Violence ^{>}	Age	Index of Deprivation [^]
Severity of Head Injury	1	.61 **	.26 **	.04	.11	.18 *	.13	.18 *	-.26 **	.23 *	-.01	.08
Frequency of Head Injury		1	.05	-.02	.01	.31 **	.11	.07	-.17	-.001	-.03	.12
Poor Supervision			1	-.26 **	.15	.26 **	.24 **	.30 **	-.27 **	.32 **	-.02	.08
Positive Parenting				1	-.13	-.12	-.08	-.11	-.19 *	-.10	.07	.08
Inconsistent Discipline					1	.17 *	.03	0.16	-.11	-.08	-.09	.09
Reactive Aggression						1	.65 **	.16	-.24 **	.10	-.07	.13
Proactive Aggression							1	.16	-.07	.07	-.004	-.01
Total Convictions								1	-.43 **	.47 **	-.02	.001
Age of First Offence									1	-.51 **	.15	-.11
Past Violence										1	.06	-.18
Age											1	-.09
Index of Deprivation												1

* p<.05 ** p<.01 (1-tailed) [>]r corrected to r_b for these two categorical variables with underlying continuums. [^]Spearman's rho correlation coefficient

Path Analysis

Hierarchical multiple linear regressions and binomial logistic regressions were performed to investigate the predictive ability of independent variables on a number of outcome variables and to enable pathway diagrams depicting the direction and size of influence between the variables to be constructed. Age and deprivation scores were not significantly correlated with any variables, they were not part of the hypotheses and to avoid increasing the risk of Type II error rate given the sample size, they were excluded from regression analyses. Predictors were entered in blocks, using the enter method, according to past literature and prior power calculations²⁴. Confidence intervals are for 95% confidence.

Parenting as a Predictor of Proactive Aggression

As hypothesised poor supervision was a significant predictor of proactive aggression, accounting for 6% of variance, however, inconsistent discipline and positive parenting were not (see Table 2).

²⁴ See Appendix 7 point 2

Table 2

Significant Predictor of Proactive Aggression

	B	SE B	β	CI lower limit	CI upper limit
Block 1					
Constant	3.96	2.99			
Poor Supervision	0.36	0.16	.24*	0.048	0.672
Inconsistent Discipline	-0.01	0.13	-.004	-0.255	0.244
Positive Parenting	-0.03	0.15	-.02	-0.322	0.261

R^2 .06 Model $F(3, 93) = 1.98$

* $p < .05$

Parenting and Head Injury as Predictors of Reactive Aggression

Previous literature has shown an association between HI and reactive aggression in young people, therefore HI variables were entered in the first block. There is less support for a link between these parenting variables and reactive aggression in young offenders, therefore these variable were entered in block two to explore whether they could explain further variance reactive aggression. Head injury explained 6.7% of the variance in reactive aggression, frequency of HI was a significant predictor. Parenting explained an additional 7.8% of the variance with poor supervision the only significant predictor (see Table 3).

Table 3.

Significant Predictors of Reactive Aggression

	B	SE B	β	CI lower limit	CI upper limit
Block 1					
Constant	12.41	0.64			
Severity of head injury	0.74	0.98	.84	-1.19	2.68
Frequency of head injury	1.85	0.97	.21*	-0.08	3.78
$R^2 .067 F(2, 95) = 3.43^*$					
Block 2					
Constant	8.11	2.90			
Severity of head injury	0.02	1.00	.002	-1.97	2.01
Frequency of head injury	2.07	0.95	.24*	0.18	3.97
Poor Supervision	0.33	0.15	.22*	0.02	0.63
Inconsistent Discipline	0.16	0.12	.13	-0.08	0.4
Positive Parenting	-0.06	0.14	-.04	-0.33	0.22
$\Delta R^2 .078 \Delta F(3, 92) = 2.81^*$					
Model $F(5, 92) = 3.13^*$					

* $p < .05$ **Parenting and Head Injury as Predictors of Crime**

There is greater evidence supporting the link between parenting and indicators of offending compared to HI and indicators of offending, therefore HI variables were

entered in the second block of each regression to see if they could account for any further variance in offending outcomes. Poor supervision once again was the only significant predictor, accounting for 8.7% of the variance in total convictions (see Table 4). Severity of head injury was the only significant predictor of age of first offence, explaining and additional 5.0% of the variance (see Table 5, entering reactive aggression in the third block failed to significantly predict additional variance in age of first offence). Poor supervision was also predictive of past violent offending, such that as poor supervision increased so did the odds of repeat past violent offending (see Table 6).

Table 4.

Significant Predictors of Total Convictions

	B	SE B	β	CI lower limit	CI upper limit
Block 1					
Constant	-0.06	3.44			
Poor Supervision	0.98	0.30	.30*	0.31	1.48
$R^2 .087 F(1, 96) = 9.15^{**}$					
Block 2					
Constant	-0.53	3.44			
Poor Supervision	0.80	0.31	.27*	0.18	1.40
Severity of head injury	2.05	1.83	.11	-1.57	5.68
$\Delta R^2 .01 \Delta F(1, 95) = 1.26$					
Model $F(1, 96) = 9.15^{**}$					

* $p < .05$ ** $p < .01$

Table 5.

Significant Predictors of Age of First Offence

	B	SE B	β	CI lower limit	CI upper limit
Block 1					
Constant	13.82	1.35			
Poor Supervision	-0.17	0.08	-.23*	-0.32	-0.02
Positive Parenting	0.90	0.07	.13	-.05	0.23
R^2 .087 $F(1, 90) = 4.27^*$					
Block 2					
Constant	13.49	1.33			
Poor Supervision	-0.12	0.07	-.17	-0.27	0.03
Positive Parenting	0.11	0.07	.16	-0.03	0.25
Severity of head injury	-0.99	0.45	-.22*	-1.887	-0.083
ΔR^2 .05 $\Delta F(1, 89) = 4.71^*$					
Model $F(3, 89) = 4.53^*$					

*p<.05

Table 6

Significant Predictors of Past Violence

	B	SE B	Odds Ratio	CI lower limit	CI upper limit
Block 1					
Constant	-2.07	0.87			
Poor Supervision	0.18*	0.74	1.20	1.04	1.38
$\chi^2(1) = 6.41^*$					
$R^2 = .08$ (Nagelkerke)					
Block 2					
Constant	-2.09	0.88			
Poor Supervision	0.16*	0.76	1.20	1.01	1.36
Severity of head injury	0.53	0.43	1.70	0.73	3.90
$\chi^2(2) = 1.52$					
$R^2 = .10$ (Nagelkerke)					

*p<.05

Parenting as a predictor of Head Injury

Poor supervision significantly predicted a knock out history, as poor supervision increased the odds of a knock out history occurring increased, B=0.19, SE=0.08, p<.05, odds ratio 1.21 (95% CI 1.04 – 1.40), $R^2=.09$ (Nagelkerke).

The regression analyses showed poor supervision predicted worse offending profiles (increased convictions and risk of multiple violent offences), increased reactive and proactive aggression and risk of a knock out history for young offenders. Multiple head

injuries were predictive of increased reactive aggression and a knock out history predicted a younger age of first offence.

Discussion

In line with previous research YO reported a rate of HI above that found in the general population and over half reported a knock out history (Davies et al., 2012; Perron & Howard, 2008; Williams, Cordan, et al., 2010). The mean ages for first and worst HI experiences were around early adolescence. The results showed that significant predictors were as hypothesised based on prior literature, however, a number of anticipated predictors were not found to be significant. Poor supervision repeatedly predicted outcomes, although effect sizes varied: the more poor supervision reported the more convictions participants had and they were more likely to be repeat offenders of violent crimes (medium effect sizes). Poor supervision was also a significant predictor of increasing proactive and reactive aggression and a knock out history (small effect sizes). Head injury emerged as a predictor of outcomes alongside poor supervision. Repeated HI was a predictor of reactive aggression (medium effect size) and a knock out history predicted a younger age at first offence (small effect size).

Poor Supervision as a Predictor

Poor supervision surfaced as the key parenting practice predictive of indicators of offending, aggression subtypes and knock out history, with the models placing it at the cornerstone of the relationships. This is a particularly powerful finding given the measure was restricted to a three item subscale and the wealth of empirical support (Claes et al., 2005; Dahlberg, 1998; Farrington, 2005; Griffin, Botvin, Scheier, Diaz, & Miller, 2000)

for poor supervision being common place for offenders (the modal subscale score for the sample was the highest possible score for poor supervision): despite this poor supervision “stood out from the crowd” as a key influence. These results extend previous literature by linking poor supervision in particular with both reactive and proactive aggression, crime and knock out histories in YO, using adolescent reports of parenting practices.

A lack of parental supervision could be influencing outcomes in a number of ways. As Dodge (1991) stated, proactive aggression (in the literature associated with violent offending) could be endorsed by a lack of parental supervision, which could be viewed by the young person as encouraging the use of aggression for goal achievement, whereas harsh parenting could lead to vulnerability and hostility culminating in more reactive aggression. The results in this study indicate poor supervision is implicated in the development of both aggression subtypes, and incidentally YO reported high levels of positive parenting, which was not predictive of any outcomes²⁵. It is possible that a lack of poor supervision could be seen by children as neglectful or lacking in warmth, which might disrupt attachment in turn fostering hostility that results in reactive aggression.

Poor supervision could also be increasing the probability of young people associating with more deviant peer groups (Lord & Mahoney, 2007), such as gangs, and increasing the risks therefore of them engaging in criminal activity²⁶. Future studies should combine the measurement of parenting practices, adolescent attributions of parenting, and peer influence in YO explore potential explanatory relationships.

²⁵ See Appendix 8 point 1

²⁶ See Appendix 8 point 2

Poor supervision has been implicated as a risk factor for childhood injury (Morrongiello & Dawber, 1998; Morrongiello & House, 2004; Schwebel & Bounds, 2003), however, the literature was unclear whether this finding would hold for HI in particular and for YO reports of parenting received. Prior to the study it was not possible to predict the mean age participants would have experienced a HI, although literature suggests very young children are most at risk (Yates et al., 2006). The sample in this study reported sustaining their worst HI at a mean age of 13 years, suggesting poor supervision is a risk factor for injury not just in young children. A lack of supervision of young children is seen as increasing injury risk through parents not taking an active role in preventing hazardous engagement with the environment. This could possibly explain the findings here, but given the increased independence associated with adolescence there seems a need for alternative explanations. Once again a lack of supervision could encourage gang membership, which has been associated with HI (Cordan, 2010), but further research is needed to elucidate the mechanisms of influence between poor supervision and HI.

Inconsistent Discipline and Positive Parenting – Not Predictors

Poor supervision was the only parenting practice to significantly predict outcomes. Stanger et al. (2004) draw attention to research showing weaker associations between positive parenting practices and aggression and criminality compared with negative parenting practices such as poor supervision (Griffin et al., 2000; Patterson & Stouthamer-Loeber, 1984). Using the long form of the APQ they found positive parenting

did not predict aggression or rule breaking behaviour, similar to this study, however inconsistent discipline was a significant predictor. Potentially, the three item subscale for inconsistent discipline of the APQ-9 is not as sensitive to inconsistent discipline practices²⁷.

Head Injury as a Predictor

As hypothesised and in line with previous research (Dooley et al., 2008), HI predicted higher reactive aggression scores. Wall et al. (2006) found reliable decrements in response inhibition in jockeys with a history of multiple head injuries compared to those with a single head injury. Young adults showed the greatest vulnerability to impairment, even after three months post injury. Mobbs, Lau, Jones and Frith (2008) reviewed the neuroscience of anti-social behaviour literature and identified the frontal lobe systems as necessary for impulse control and modification of behaviour in line with its consequences. Young people experiencing repeated HI therefore, could be at further risk of criminal behaviour or maladjustment by increasing their propensity to engage in reactive aggression. It is worth noting that YO higher in reactive aggression may have been more likely to find themselves in situations where the risk of HI was elevated, such as getting into fights. This is supported by the finding that 50% of HI were sustained during a fight, which implies the young person was already engaging in behaviour reminiscent of offending. This highlights the difficulty in establishing causality between HI and offending and the need to see HI as a factor which may increase a young person's vulnerability for offending. As such the accumulation of HI incidents could further

²⁷ See Appendix 8 point 3

increase the young person's level of reactive aggression via neuropsychological impairments. Further exploration of reactive aggression as a factor interacting with HI and offending seems warranted, alongside investigation of the potential mechanisms of action, such as impaired cognitive functioning.

A knock out history was predictive of an earlier age of first offence, which is in line with Williams, Mewse, et al's. (2010) and Perron and Howard's (2008) research with adult offenders and Timonen et al's. (2002) study. In the latter study the authors note that unidentified factors such as ADHD and poor parental control may have explained the link. In this study participants with ADHD were excluded and a measure of parental supervision was included: when knock out history was entered in the regression analysis after the entry of parental supervision it was the only significant predictor of age of first offence. It is possible that neuropsychological deficits occur post knock out, which could increase the risk of offending. For example, impulsivity and socio-affective processing impairments post HI might make it harder for young people to operate in social situations, such as perceiving another's actions as threatening and not being able to de-escalate these threats (Williams, Cordan, et al., 2010; Turkstra, Williams, Tonks, & Frampton, 2008). Adolescence is a developmental period when negotiating social situations becomes increasingly necessary as children separate from parental figures and become more independent. Impairments in socio-emotional and cognitive functioning could therefore become more apparent when a young person reaches adolescence and more readily depends on these skills.

The findings are suggestive of a knock out history leading to earlier onset of criminal behaviour, placing these individuals at risk of life time offending (Moffit, 1993)²⁸.

Although the finding of knock out history as a predictor of earlier onset of criminal behaviour cannot be confirmed given the cross sectional nature of this study, the temporal order established by Timonen et al. (2002) suggests HI resulting in a knock out could be a risk factor for life long offending: longitudinal research controlling for covariates could provide more support for this notion.

Proactive and Reactive Aggression – Not Predictors

As Raine et al. (2006) found, reactive aggression was more endorsed than proactive aggression. However, unlike previous studies (Pulkinnen, 1996; Vitaro et al., 1998 and 2006, Raine et al., 2006) proactive aggression and reactive aggression were not predictive of indicators of offending. This is most surprising for the past violent offending outcome given the small amount of research that has been conducted has found a link between proactive aggression and violence. It is possible that reactive and proactive aggression are better able to distinguish offenders from non-offenders rather than within offender variation, unfortunately the lack of a community sample in this study prevents confirmation of this. It is also possible that the measure of past violent offences in this study lacked sensitivity and specificity to detect subtle variations in violent offending. Cornell et al. (1996) developed a coding system to categorise offences as instrumental (proactive) or reactive. Use of such a measure may reveal relationships between each aggression subtype and violent offending and would provide further support for the

²⁸ See Appendix 8 point 4

subtype distinction. Support for the distinction was still obtained from this study by finding repeated HI to be associated with reactive aggression and not proactive aggression²⁹.

Additional Limitations

Despite the use of regression analyses to establish pathway models, the cross sectional nature of this research limits the formation of conclusions about directions of causality, an issue which plagues much research on parenting practices and child outcomes (Geccas & Seff, 1990). However, as Mewse (1999) states there is “evidence to suggest that the relationships between adolescent adjustment and parenting style are due, at least in part, to the impact that parents have on their children rather than being entirely due to the effect that children have on their parents” (chapter 3, p.12). Consequently, there is empirical support as well as face validity to suggest a lack of parental supervision increases the risk of poor outcomes, rather than the reciprocal.

The use of retrospective and common rater self report data could reduce the reliability of the findings. However, Scholfield et al. (2011) found self reported HI rates by prisoners to be as accurate as hospital records, and the replication here of elevated HI rates as found in prior research (Williams, Cordan, et al., 2010, Davies et al., 2012, Hux et al., 1998) suggests self report may be a reliable data collection method. Furthermore, significant findings were in line with previous research which has used multiple methods

²⁹ See Appendix 8 point 5

for data collection suggesting YO may be accurate when reporting on numerous constructs³⁰.

Implications

This study found poor supervision to be a key parenting practice in the development of aggression, a knock out history and offending. This extends previous findings by identifying poor supervision as an influence *within* a young offender population. If longitudinal research was to replicate these findings interventions to improve levels of parental supervision would be well placed to reduce numerous negative outcomes. Multisystemic Therapy (MST) is a treatment model based on social ecology theory (Ashmore & Fox, 2011). It works with young people at risk of an ‘out of home’ placement as a result of antisocial or criminal behaviour. The onus is on the MST team to engage the young person, but treatment with family members can go ahead without approval from the young person. The effectiveness of this intervention has shown promise in the USA and is currently being tested in the UK. Given the key role poor supervision may play in the development and/or maintenance of troubled behaviour, an intervention like MST could be well placed to alter this trajectory³¹. The link between poor supervision and offending adds support to the recent ‘After the Riots’ official report which highlighted poor quality parenting as a contributing factor (The Riots Communities and Victims Panel, 2012). However, it is important to note alternative

³⁰ See Appendix 8 point 6

³¹ Carroll, Cassidy and Holm (2004) highlight the need to identify ‘modifiable’ risk factors for HI. The pathways of influence suggested here imply reducing poor supervision could be one such modifiable risk factor, reducing the risk of HI and indicators of offending.

explanations for the riots. For example, Reicher and Stott (2011) highlight the role of police-community relations: inadequate dialogue between the two groups is seen to exacerbate existing perceptions within marginalized communities of being aggrieved. Furthermore, the perceived lack of an acceptable outcome following legitimate means of peaceful protest can serve to ignite frustrations within groups. This multitude of explanations serves to highlight the complexity of relationships between factors leading to offending behaviour.

The findings from this study suggest interventions to reduce HI might contribute to reducing recidivism. Early recognition and rehabilitation during childhood and adolescence could reduce the risk of offending behaviour. As Williams, Cordan, et al. (2010) point out; access to support and treatment for these individuals might be particularly difficult, it will be necessary therefore for health, social and educational service systems to work together to increase recognition of HI and its possible sequelae. Specifically, these findings call for more refined screening processes on entry to the prison system. Individuals who have experienced HI and are in custody already could benefit from intervention targeting the link between HI and reactive aggression. Management programs that work on the young person's ability to tolerate frustration, inhibit inappropriate responses and plan alternative pro-social behaviours could reduce the levels of reactive aggression they display (Kempes et al., 2005)³².

³² See Appendix 8 point 7

Conclusion

This study extended previous research by exploring HI as a predictor of reactive and proactive aggression and indicators of offending, alongside parenting practices, in a sample of YO. Head injury therefore, could have a direct effect on behavior through possible cognitive and socio-emotional impairments or it could act as a “marker” for contextual risk factors such as poor supervision and reactive aggression. These findings point towards a number of areas for intervention before, during and after a young person has been imprisoned. A combination of working closely with parents to improve quality of supervision and promoting early recognition of HI and rehabilitation could together act as crime reduction measures³³.

³³ Dissemination statement is in Appendix 8

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Appendices

Word count: 5859

Appendix 1 – Extended Introduction

Point 1

Ferguson and Dyck (2012) highlight credible support for abandoning the General Aggression Model (GAM) for one that acknowledges the subtypes of the construct. Initially labeled as hostile and instrumental aggression, they have since been referred to by a number of different labels, but current research generally uses the terms reactive and proactive aggression. There is mounting analytical support for a two factor model of aggression (Poulin & Boivon, 2000; Raine et al., 2006; Baker, Raine, Liu & Jacobsen, 2008).

Point 2

There has been notable opposition to adopting the two factor model (Bushman & Anderson, 2001) on the basis that aggression is a learned, automatic response stemming from social cognitive scripts developed unconsciously. However, evidence such as that which shows aggressive actions may be implemented intentionally (proactive aggression) and result from biological and/ or genetic influences suggests the GAM is no longer the best model for understanding aggression (Ferguson & Dyck, 2012).

Point 3

Reactive aggression is commonly defined as accompanying the subjective experience of anger. However, Hubbard et al. (2002) measured physiological, observational and self reported anger in a sample of children and found reactive aggression only explained eight

percent of the variance in anger, suggesting other factors may more readily distinguish reactive from proactive aggression, such as the need to retaliate in response to provocation.

Point 4

Brendgen et al. (2001) proposed that proactive aggression may more readily link to violence as a function of the context it occurs in: they state past research (e.g. Pulkinnen, 1996; Vitaro et al., 1998) has looked at physical violence occurring in “more impersonal, delinquency-related contexts that involved relative strangers as victims” (p 294) and the “mostly instrumental nature” (p.294) of this violence may explain why proactive aggression was found to be a predictor. However, according to research on intimate partner violence by males, the abuse may be used as part of a strategy to control and intimidate their partner (proactive) or a defence in response to feeling vulnerable or provoked (reactive). In their sample of adolescent males (16 and 17 years old) they found childhood proactive aggression uniquely predicted delinquency related violence in midadolescence and reactive aggression uniquely predicted intimate partner violence. On the basis of these findings they concluded that reactive aggression should not be discounted as a risk factor for problem behaviour. However, on closer inspection of the four items used to assess delinquency-related violence it is not clear how they represent proactive aggression independent of more reactive style aggression, the results therefore should be interpreted with caution.

Point 5

In adolescent, HI is often associated with damage to the prefrontal cortex (Turkstra et al., 2008). Adrian Raine has completed much work in the field of psychopathy and brain functioning, with the consistent finding that a functional PFC is associated with appropriate social behaviour: reduced pre-frontal cortex activation was found in convicted murderers versus age and sex matched controls (Raine, Buchsbaum, & LaCasse, 1997); men with anti-social personality disorder showed reduced prefrontal gray matter volume (Raine, Lencz, Ehrle, LaCasse, & Colletti, 2002). Blake, Pincus and Buckner (1995), investigated 31 murder suspects and found evidence of dysfunctional frontal lobe functioning in just over half (64.5%). These findings provide support for the hypothesis that damage to or departure from the normal structure and activation patterns, of particular brain regions is associated with anti-social behaviour and potentially criminal behaviour. However, a lack of matched controls in these studies, consideration for other risk factors and low specificity of clinical measures requires these findings to be read with caution. Furthermore, a paucity of research in young offenders means they are a clinical group poorly understood.

Proactive aggression has been associated with callous unemotional traits, proposed to be a hallmark of fledgling psychopathy (Raine et al., 2006). It was beyond the scope of this study to explore participant temperament or personality, however there is emerging evidence to suggest that ineffective parenting, particular ineffective discipline, in children high in callous-unemotional traits, does not influence externalizing behaviour (Oxford, Cavell, & Hughes, 2003). The authors note that this provides preliminary evidence for

theories that suggest some children may be “immune” to the socialization process of parental discipline. Consequently, it may be that proactive aggression in children is a risk factor for being unresponsive to improvements in parental discipline. This evidences the notion that criminal behavior, particularly violent behaviour, is likely the result of a combination of influences: genetic factors, socialization, injury for example (Turkstra et al., 2008).

Point 6

In the UK prevalence estimates range between 185 and 294 per 100,000 children aged less than 15 years (Masson et al., 1996; Kraus & Chu, 2005). In the USA, just under half (40%) of patients attending for HI are younger than 14 years of age (Guerrero, Thurman, & Sniezek, 2000).

Point 7

Leon-Carrion and Ramos (2003) collected data on the pre-incarceration histories (pre 18 years of age) of adult prisoners in Spain. They discovered that difficulties at school were present across the sample, but offenders who had a HI requiring hospitalization differentiated violent offenders from non-violent offenders. It is worth noting that HI was only indicated by sports injuries, road traffic accidents and falls from a height, excluding therefore a potentially larger sample of HI offenders, reducing generalisability of the findings. Conversely, a study using an adult forensic sample in South Africa exploring factors that distinguished habitually violent offenders from never-violent offenders did not implicate HI (Kaliski, 2002). However, HI was defined only as a blow to the head

resulting in LOC for over one hour: judging by previous estimates of HI in prison populations this narrow definition is likely to have excluded a number of participants with mild HI.

Appendix 2 – Extended Method

Point 1

The data from this study was collected as part of a larger research programme using the same participants; further exclusion criteria therefore were applied. Neurocognitive and social cognitive data was obtained to further explore the link between HI and crime, with a particular focus on executive functioning and emotion recognition skills, thus requiring individuals with neurodevelopmental difficulties to be excluded from the study.

Point 2

All staff from the YOI involved in data collection agreed to abide by the ethical requirements of the project, for example: maintaining confidentiality by not sharing with other members of staff details of the participants' results; storing consent forms separately from response sheets, in locked facilities; and reassuring participants that specific information regarding their criminal pasts was not required and they could not therefore be further reprimanded for offences previously undeclared.

Point 3

A participant information sheet³⁴ was provided for participants who expressed an interest in the study. Written consent to participate was obtained via completion of a consent form. Owing to difficulties in obtaining consent from individuals aged below 16 years of age it was decided to limit the age of participants to 16 years and over. Participants were given the option to indicate if they wished to receive a précis of the findings by letter.

³⁴ See Appendix 6

Participants who completed the self report measures for this study were asked if they would be willing to complete part two of the research programme. A presentation of findings to the YOI staff involved in data collection was planned as part of the dissemination process.

Appendix 3 Alabama Parenting Questionnaire-Short Form (APQ-9)
(Elgar et al., 2007)

Instructions: The following are a number of statements about your parents. Please rate each item as to how often it typically occurs in your home. Possible answers are: Never (1), Almost Never (2), Sometimes (3), Often (4), Always (5). Please answer all items.

1. Your parent lets you know when you are doing a good job with something
2. Your parent threatens to punish you and then does not actually punish you
3. You fail to leave a note or to let your parent know where you are going
4. You talk your parent out of being punished after you have done something wrong
5. You stay out in the evening after the time you are supposed to be home
6. Your parent compliments you after you have done something well
7. Your parent praises you if you behave well
8. You go out with friends your parent doesn't know
9. Your parent lets you out of a punishment early (like lift restrictions earlier than they originally said)

Appendix 4 -Reactive Proactive Aggression Questionnaire (Raine et al., 2006)

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 response. Make sure you answer all the questions.

How often have you...

	Never	Sometimes	Often
1. Yelled at others when they have annoyed you	0	1	2
2. Had fights with others to show who was on top	0	1	2
3. Reacted angrily when provoked by others	0	1	2
4. Taken things from other people	0	1	2
5. Gotten angry when frustrated	0	1	2
6. Vandalised something for fun	0	1	2
7. Had temper tantrums	0	1	2
8. Damaged things because you felt mad	0	1	2
9. Had a gang fight to be cool	0	1	2
10. Hurt others to win a game	0	1	2
11. Become angry or mad when you don't get your way	0	1	2
12. Used physical force to get others to do what you want	0	1	2
13. Gotten angry or mad when you lost a game	0	1	2
14. Gotten angry when others threatened you	0	1	2
15. Used force to obtain money or things from people	0	1	2
16. Felt better after hitting or yelling at someone	0	1	2
17. Threatened and bullied someone	0	1	2
18. Made obscene phone calls for fun	0	1	2
19. Hit others to defend yourself	0	1	2
20. Gotten others to gang up on someone else	0	1	2
21. Carried a weapon to use in a fight	0	1	2
22. Gotten angry or mad or hit others when teased	0	1	2
23. Yelled at others so they would do things for you	0	1	2

Appendix 5 - Ethical Approval



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To: Emma Hodges & Hannah Meadham
From: Cris Burgess
CC: Huw Williams & Avril Mewse
Re: Application 2010/165 Ethics Committee
Date: May 3rd 2011

The School of Psychology Ethics Committee has now discussed your application, **2010/165 – *The association between TBI, social cognition and violent offending in young offenders.*** The project has been approved in principle for the duration of your study.

The agreement of the Committee is subject to your compliance with the British Psychological Society Code of Conduct and the University of Exeter procedures for data protection (<http://www.ex.ac.uk/admin/academic/datapro/>). In any correspondence with the Ethics Committee about this application, please quote the reference number above.

I wish you every success with your research.

A handwritten signature in black ink, appearing to read 'Cris Burgess', with a horizontal line underneath.

Cris Burgess
Chair of Psychology Research Ethics Committee

Appendix 6 – Participant Information Sheet**What is the relationship between head injury, social cognition and offending behaviour?**

You are being invited to take part in a research study, whether you have or have not experienced a head injury (HI) in the past. The research will investigate the impact that HI has on social processes, offending behaviour and general wellbeing. As part of this we will also look at the effect of HI on other brain functions, such as attention, and explore whether there is a link between these functions and the social processes we will measure. We will also explore the effect of HI on conviction rates and whether a HI affects the severity of violence of the convictions (for more detail read below).

This research is being conducted as part of our Clinical Psychology degree, which we are studying at the University of Exeter.

Taking part in this study is completely voluntary. Please could we ask you to take some time to read the following information to help you decide whether or not you would like to take part. You may want to talk to other people before making a decision. Please feel free to ask if you have any questions or would like to know more. You can also contact us by email at any time to ask more questions: [appropriate email to be inserted]. Our address is [appropriate address to be inserted].

Thank you for taking time to read this.

What is the research about?

Research suggests that a HI may make it difficult to understand what other people are thinking or feeling (this is what we mean by social processes). A HI may also affect other brain functions such as memory and attention. We are interested in whether problems in these areas are linked with committing crime and potentially more violent crimes. We will also be exploring whether HI is related to general wellbeing and family background.

Why have I been chosen?

You have been chosen because you are in custody for committing a crime. You may or may not have had HI. We are particularly interested in this topic in young males which is why you are a suitable candidate.

Do I have to take part?

No, you do not have to take part. This is entirely your choice.

If you do decide to take part, you will be given this information sheet to keep and will be asked to sign a consent form. You can contact us if you have further questions. You will still be able to stop taking part in the research at any time without having to give a reason. This will not affect the care you receive.

What will happen to me if I do take part?

One part of the study will involve filling in some questionnaires, which should take about 30 minutes. Another part of the study will involve some paper based tasks to explore the functions mentioned earlier in this information sheet. These will take about 40 minutes, but you will be able to take breaks if you need to. We will also need to access your Asset records for information about where you have lived before X, you can let us know if this is ok if you agree to take part in the study.

What are the possible disadvantages and risks of taking part?

There is a small risk that some people may become upset if they find it hard to complete some of the tasks or answer some of the questions. However, let us assure you that you will not be judged on how well you perform, and all results will be kept anonymous and confidential. You can withdraw from the study at any time and if you would like to talk things through either during or after the study, we would be happy to arrange this. We have conducted many studies like this before and have found that few people become upset in the process. Rather, the main disadvantage of taking part is the time involved.

Will I have to travel a long way to take part?

If you want to take part the staff from X will help you to get involved.

What are the potential benefits in taking part?

We hope that the information gathered in this research may be used in the future to inform the rehabilitation of people who have had a HI and may be at risk of committing a crime for the first time or re-offending. It will also inform us about young people's general wellbeing after a HI and having been convicted of a crime, which could help provide better care for people in your situation.

Will my taking part in the study be confidential?

We will follow ethical and legal practice and all information about you will be handled in confidence. Your name will be removed from any information collected from you during the sessions and all records will be given a code to maintain confidentiality. Any documents that do contain identifying information (e.g. names) will be securely stored separately from your responses. Your name will not be used in the writing up of the results. When your responses are entered onto a laptop at X they will be anonymous. When this laptop is taken away from X back to University of Exeter your responses will

still be anonymous.

What will happen to the results of the research study?

The results will be written up by us as part of our degree research. It may be published in academic journals or presented at conferences for psychology professionals. Your identity will not be revealed in any report, publication or presentation.

If you would like to know the outcome of the research we would be happy to send you this in written form when the study is complete.

What if something goes wrong?

If you have a concern about any aspect of this study, you can talk to the staff from the psychology department who will do their best to answer your questions (see email address above). If you are still unhappy and wish to complain formally, you can do this through the Serco Complaints Procedure. Details can be obtained from Sian Murphy, Forensic Psychologist in Training.

Who is organising or funding the research?

The research is being sponsored by the University of Exeter.

Who has reviewed the study?

This research project has been reviewed and approved by the University of Exeter. All research conducted by Clinical Psychology students is looked at by an independent group of people, called a Research Ethics Committee, to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given favorable opinion by the University of Exeter Research Ethics Committee and cleared by X's Research Ethics Committee (pending).

We will be leading the research under the supervision of Dr Williams and Dr. Mewse at the University of Exeter.

Thank you for taking the time to read this information sheet.

Emma Hodges and Hannah Meadham

Contact details: W.H.Williams@exeter.ac.uk. or A.J.Mewse@exeter.ac.uk

All of the above can be contacted by post at:

School of Psychology, Washington Singer Laboratories, Streatham Campus, University of Exeter, Exeter, EX4 4QG

Appendix 7 – Extended Results

Point 1: Influential Cases and Generalization Assumptions

For each regression analysis the effect of influential cases was assessed, as was the ability of the model to be generalized to the population from which the sample came, using the parameters suggested by Field (2009). The result of each assessment statistic is presented in Table 7. As can be seen in Table 7 two regression analyses did not meet the assumption of normally distributed residuals. This can reduce the ability to generalize the model to the population the sample came from. Transformation of scores can rectify this, however, Field (2007) points out that transformation does not necessarily affect the residuals and can produce additional difficulties with the data. The slightly positive skew of the errors therefore is acknowledged, but considering the remaining assessment statistics for generalization of the models were met this violation was not considered influential to a point of not being able to generalize the models to the population. For the multiple regression where total convictions was the outcome, the assessment statistic for standardised residuals was not met, one case exceeded the value of 3, but Stevens (2002) suggests there is no need to delete the case when the Cook's distance value is less than one as the effect of the outlier on the regression analysis will not be large, the case therefore remained in the analysis.

Table 7. Assessment statistics for accuracy and generalisability of the regression models

Assessment Statistics	Outcome Variable			
	Proactive Aggression	Reactive Aggression	Total Convictions	Age of First Offence
Influential Cases and Outliers				
Standardised residuals (99% cases between -2.58 and 2.58)	✓	✓	X	✓
Standardized DFBETA (no cases >1)	✓	✓	✓	✓
Cook's distance (no cases >1)	✓	✓	✓	✓
Leverage (no values >3 times the average)	✓	✓	✓	✓
Mahalanobis distances (no cases >15)	✓	✓	✓	✓
Assumptions for Generalization				
Predictors are quantitative and unbounded	✓	✓	✓	✓
No non-zero variances	✓	✓	✓	✓
No perfect multicollinearity (VIF close to 1, Tolerance value not <0.1)	✓	✓	✓	✓
Homoscedasticity	✓	✓	✓	✓
Independent errors (Durbin Watson value between 1 and 3)	✓	✓	✓	✓
Normally distributed residuals	X	✓	X	✓
Each value from separate entity	✓	✓	✓	✓
Linearity	✓	✓	✓	✓

For logistic regression some of the same assumptions apply. Each case must come from a separate entity (this was met in all three regressions), there was no multicollinearity of

predictors (VIF values close to one and tolerance values not below 0.1) and the continuous predictors were linearly related to the log of the outcome.

Point 2: Entry Method and Power Calculations

Sample size was calculated based on the recommendations for multiple regressions as this formed the main focus of the analysis strategy. Tabachnick and Fidell (2001) recommend a sample size of 104 plus k , where k is the number of predictors entered into the regression analyses. The sample size for each regression analysis was calculated using this guidance. Most often predictors not significantly correlated with the outcome will not be significant predictors, however, each predictor can influence the variance explained by another predictor when entered simultaneously into regression and can produce significant results. Yet, the addition of predictors when a sample size is not adequately powered will increase the Type II error rate. There is no known guidance for determining a threshold at which to decide whether to enter all hypothesised predictors or to limit entry to predictors significantly correlated with the outcome variable. The discrepancy between the adequately powered sample size and the actual sample size for each regression was calculated; Table 8 shows that all sample sizes for each regression were not equal to the adequately powered sample size and four out of seven regressions had an actual sample size less than 90% of the adequately powered sample size. It was decided therefore, to only enter variables that were significantly correlated with the outcome variable when the discrepancy in sample sizes was over 10% to reduce the probability of making a Type II error.

Table 8.		Discrepancy between	
<i>Power calculations</i>		size	sample sizes
Outcome (O)			N (%)
<i>k</i> Poor supervision*	107	97	10(9)
Inconsistent Discipline			
Positive Parenting			
O Proactive Aggression			
<i>k</i> Severity of HI*	109	98	11(10)
Frequency of HI*			
Poor supervision*			
Inconsistent Discipline*			
Positive Parenting			
O Reactive Aggression			
<i>k</i> Poor supervision*	111	97	14(13)**
Inconsistent Discipline			
Positive Parenting			
Severity of HI*			
Frequency of HI			
Reactive Aggression			
Proactive Aggression			
O Total Convictions			

<i>k</i> Poor supervision*	111	92	19(17)**
Inconsistent Discipline			
Positive Parenting*			
Severity of HI*			
Frequency of HI			
Reactive Aggression*			
Proactive Aggression			
O Age of first offence			
<i>k</i> Poor supervision*	111	98	13(12)**
Inconsistent Discipline			
Positive Parenting			
Severity of HI*			
Frequency of HI			
Reactive Aggression			
Proactive Aggression			
O Past violence			
<i>k</i> Poor supervision*	105	98	7(7)
O Severity of head injury/ Frequency of head injury			

* Predictor variables significantly correlated with outcome variable in bivariate correlations.

** Discrepancy greater than 10% therefore only predictors significantly correlated with outcome in bivariate correlations entered into regression analysis

Appendix 8 – Extended Discussion

Point 1

Even though participants reported high levels of positive parenting there was no measure of whether they attributed the positive parenting they received, such as high praise and compliments for good behaviour, as genuine warmth from their parents; it would be informative to access the attributions YO make of the parenting they experience, as evidence suggests it is these perceptions which influence behaviour, Lamborn et al., (1991).

Point 2

Gang membership is often highly influential in the development of criminal behaviour (Battin-Pearson, Thornberry, Hawkins, & Krohn, 1998; Medina-Ariza, Aldridge, & Sharp, 2005) and more recently has also been associated with an increased risk of HI (Cordan, 2010).

Point 3

Another explanation could relate to Oxford, Cavell and Hughes' (2004) work showing children scoring high in callous unemotional traits were “immune” to the socialization process of parental discipline practices. This introduces the notion of child temperament being a moderating influence between parenting and developmental outcomes; data to corroborate this tentative explanation was not collected in this study, research incorporating child temperament or personality (in the adolescent participant) therefore, could deepen understanding of the interplay between these concepts.

Point 4

Moffitt's (1993) dual pathway theory of criminal behaviour defines two criminal trajectories young people may take: one consists of early onset offenders who become lifetime offenders and the other consists of late onset offenders who limit offending to the adolescent life stage. Late onset is theorized to result from the frustrations prompted by the adolescent-adulthood maturity gap and deviant peer influence. Early onset offending is proposed as a consequence of temperamental and neurological antecedents present early in life, which give rise to deviant behaviour especially when combined with environmental factors like poor parenting. The addition of HI into this mix of risk factors and its association with earlier age of first offence gives cause for concern.

Point 5

Kempes et al. (2005) have questioned the validity of categorising individuals as either proactive, reactive, both or neither given the majority of individuals are often classified as both. The strong correlation between reactive and proactive aggression replicated in this study adds support to the notion of seeing reactive and proactive aggression as occurring on a dimension. This is not to negate the importance of the distinction, however, as Cronbach (1951, as cited in Brendgen, 2001) pointed out, even when two constructs are highly correlated they can be seen as distinct if they correlate to other measures in different ways.

Point 6

Drug and alcohol use was not accounted for in this sample: A longitudinal study by Bogner, Corrigan, Mysiw, Clinchot and Fugate (2001) found that in 80% of participants who had a HI as a result of violence also had a history of substance misuse. Perron and Howard (2008) found earlier onset substance misuse was associated with HI and in the cross-sectional study by Williams, Cordan, et al. (2010) YO with HI displayed more frequent cannabis use. Consequently, it is possible the effects of excessive substance misuse could account for variance in the outcomes. However, findings from a recent study with YO found repeated HI was associated with symptoms on the Rivermead Post-Concussion Questionnaire (King, 1995) independently of substance misuse; which suggests there may be neurological sequelae post HI that remain for some time and could effect behavioural adjustment.

Point 7

Examples of necessary further research have been suggested throughout this discussion, but to summarise: longitudinal studies collecting data on the related factors discussed here will help establish directions of influence and mechanisms of action. Along with this a particular focus on adolescent attributions of parenting received will provide potential reasons for links between parenting and aggression and crime outcomes. More sensitive measures of offences, particularly violent offences could help refine understanding of the variable links between reactive and proactive aggression and offending. Finally, research exploring the role of cognitive and socio-emotional impairment post HI is required if the effect of HI on crime on YO is to be better understood.

Appendix 9 - Dissemination Statement

Participants who selected to receive a summary of the results from this study will be provided with this after completion of the project. The results of this study will be presented to the staff team from the Young Offenders Institute who assisted with data collection. This will be in the form of a presentation conducted by the researcher, with the opportunity for questions and feedback. An article will be submitted to *Neuropsychological Rehabilitation*³⁵ for publication. Preliminary findings have already been presented at the International Brain Injury Association Meeting (Edinburgh 2012) by Prof. Huw Williams (research supervisor), as the primary researcher could not make the conference due to course commitments. The results have also been used to inform the Policy Review for Barrow Cadbury Trust on Brain Injury and the Criminal Justice System, which will be influential in altering current processes in the Youth Justice System.

³⁵ See Appendix 10 for Notes for authors

Appendix 10 - Notes for Authors – Neuropsychological Rehabilitation³⁶

Aims & Scope

Neuropsychological Rehabilitation publishes human experimental and clinical research related to rehabilitation, recovery of function, and brain plasticity. The journal is aimed at clinicians who wish to inform their practice in the light of the latest scientific research; at researchers in neurorehabilitation; and finally at researchers in cognitive neuroscience and related fields interested in the mechanisms of recovery and rehabilitation. Papers on neuropsychological assessment will be considered, and special topic reviews (2500-5000 words) addressing specific key questions in rehabilitation, recovery and brain plasticity will also be welcomed. The latter will enter a fast-track refereeing process.

Peer Review Integrity

All published research articles in this journal have undergone rigorous peer review, based on initial editor screening and anonymous refereeing by independent expert referees.

Format

Typescripts. The style and format of the typescripts should conform to the specifications given in the *Publication Manual of the American Psychological Association* (6th ed.).

Typescripts should be **double spaced** with adequate margins, and numbered throughout.

The title page of an article should contain only:

(1) the title of the paper, the name(s) and address(es) of the author(s);

³⁶ Accessed from <http://www.tandf.co.uk/journals/journal.asp?issn=0960-2011&linktype=44> on 20.02.12

(2) a short title not exceeding 40 letters and spaces, which will be used for page headlines;

(3) name and address of the author to whom correspondence and proofs should be sent;

(4) your telephone, fax and e-mail numbers, as this helps speed of processing considerably.

(5) 3-5 keywords

Abstract. An abstract of 50-200 words should follow the title page on a separate page.

Search engine optimization (SEO) is a means of making your article more visible to anyone who might be looking for it.

Headings. Indicate headings and subheadings for different sections of the paper clearly.

Do not number headings.

Acknowledgements. These should be as brief as possible and typed on a separate page at the beginning of the text.

Permission to quote. Any direct quotation, regardless of length, must be accompanied by a reference citation that includes a page number. Any quote over six manuscript lines should have formal written permission to quote from the copyright owner. It is the author's responsibility to determine whether permission is required from the copyright owner and, if so, to obtain it. (See "[Seeking permission to use other sources](#)" for a template letter to use when seeking copyright permission.)

Footnotes. These should be avoided unless absolutely necessary. Essential footnotes should be indicated by superscript figures in the text and collected on a separate page at the end of the manuscript.

References:

Reference citations within the text. Use authors' last names, with the year of publication, e.g., “(Brown, 1982; Jones & Smith, 1987; White, Johnson, & Thomas, 1990)”. On first citation of references with **three to five** authors, give all names in full, thereafter use [first author] “et al.”. In the references, the first **six** authors should be listed in full.

If more than one article by the same author(s) in the same year is cited, the letters a, b, c, etc., should follow the year. If a paper is in preparation, submitted, or under review, the reference should include the authors, the title, and the year of the draft (the paper should also be cited throughout the paper using the year of the draft). Manuscripts that are “in press” should also include the publisher or journal, and should substitute “in press” for the date.

Reference list. A full list of references quoted in the text should be given at the end of the paper in alphabetical order of authors' surnames (or chronologically for a group of references by the same authors), commencing as a new page, typed double spaced. Titles of journals and books should be given in full, e.g.:

Books:

Rayner, E., Joyce, A., Rose, J., Twyman, M., & Clulow, C. (2008). *Human development: An introduction to the psychodynamics of growth, maturity and ageing*(4th ed.). Hove, UK: Routledge.

Chapter in edited book:

Craik, F. I. M., Naveh-Benjamin, M., & Anderson, N. D. (1998). Encoding processes: Similarities and differences. In M. A. Conway, S. E. Gathercole, & C. Cornoldi (Eds.), *Theories of memory* (Vol. 2, pp. 61–86). Hove, UK: Psychology Press.

Journal article:

Adlington, R. L., Laws, K. R., & Gale, T. M. (2009). The Hatfield Image Test (HIT): A new picture test and norms for experimental and clinical use. *Journal of Clinical and Experimental Neuropsychology*, *31*, 731-753. doi:10.1080/13803390802488103

Tables. These should be kept to the minimum. Each table should be typed double spaced on a separate page, giving the heading, e.g., "Table 2", in Arabic numerals, followed by the legend, followed by the table. Make sure that appropriate units are given. Instructions for placing the table should be given in parentheses in the text, e.g., "(Table 2 about here)".

Figures.

Figures should only be used when essential and the same data should not be presented both as a figure and in a table. Where possible, related diagrams should be grouped together to form a single figure. Each figure should be on a separate page, not integrated with the text. The figure captions should be typed in a separate section, headed, e.g., "Figure 2", in Arabic numerals. Instructions for placing the figure should be given in

parentheses in the text, e.g., "(Figure 2 about here)".

For more detailed guidelines see Preparation of Figure Artwork.

Statistics. Results of statistical tests should be given in the following form:

"... results showed an effect of group, $F(2, 21) = 13.74$, $MSE = 451.98$, $p < .001$, but there was no effect of repeated trials, $F(5, 105) = 1.44$, $MSE = 17.70$, and no interaction, $F(10, 105) = 1.34$, $MSE = 17.70$."

Other tests should be reported in a similar manner to the above example of an F -ratio. For a fuller explanation of statistical presentation, see the *APA Publication Manual* (6th ed.).

Abbreviations. Abbreviations that are specific to a particular manuscript or to a very specific area of research should be avoided, and authors will be asked to spell out in full any such abbreviations throughout the text. Standard abbreviations such as RT for reaction time, SOA for stimulus onset asynchrony or other standard abbreviations that will be readily understood by readers of the journal are acceptable. Experimental conditions should be named in full, except in tables and figures.

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Literature Review:

Exploring the link between parenting, head injury, aggression and crime in
young offenders.

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Exploring the link between parenting, head injury, aggression and crime in young offenders.

Outline of Review

Head injury (HI) is the leading cause of death and disability in children and young adults (Tagliaferri, Compagnone, Korsic, Servadei, & Kraus, 2006). Prevalence rates vary, but it is estimated that 5-25% of individuals in the general population have suffered a HI (Farrer & Hedges, 2011; Silver, Kramer, Greenwald, & Weissman, 2001). Childhood and adolescence appear particularly risky periods. Yates, Williams, Harris, Round, and Jenkins (2006) found UK brain injury rates higher in childhood (up to 20 years of age) than in adulthood³⁷. In adult prison populations HI prevalence rates are significantly higher than in the majority of other populations studied, such as community samples (McMillan, 2010). Research is beginning to show a similar increase in young offenders (YO): Williams, Cordan, Mewse, Tonks, and Burgess (2010) found a self reported prevalence rate of 65% in group of male YO. This elevated prevalence of HI in offenders suggests a possible association between HI and crime.

Factors contributing to the development of criminality are upper most in Government thinking and policy reform (Ministry of Justice, 2012), particularly with YO. However, HI has been relatively neglected in this discussion. Despite the high prevalence rates of HI in offenders, screening for HI on entry to the custodial system remains poor and is largely left out of policy documents (see, for example, Home Office, 2008, and Lord

³⁷ These rates remain relatively high up to 20 years of age, but severe HI in urban males and females less than 5 years old was highly represented.

Bradley, 2009) and further still, as Fazal, Langstrom, Grann, and Fazel (2007) highlight, the needs of YO will differ to the needs of adult offenders.

There is still much to be understood in the field of HI and crime. Mechanisms by which HI may influence criminality in YO are beginning to be explored: impairments in executive functioning and the impact on aspects of social cognition are emerging as contenders. The need to further clarify the role of HI in youth offending extends to improving understanding of how HI interacts with other factors implicated in the development of criminality: parenting, childhood aggression and substance misuse have received attention for the part they play, but less is known about their relationship with HI. The failure to identify HI, its “partners in crime” and underlying mechanisms of influence in YO is all the more crucial given adolescence is a pivotal time for acquiring functional skills; possibly determining a young person’s future life as one of further crime or not (Williams, Cordan et al., 2010).

This review begins with an overview of the review strategy and key definitions. Following will be further epidemiology of HI in the general population and prison population, and a look at HI and its effect on criminal behaviour with consideration for potential mechanisms of action (in particular through executive function and social cognition deficits). The review will then move on to consider the variables of parenting, substance misuse and aggression and their relationships with HI and crime. A summary and statement of directions for future research will bring the review to a close.

Search Strategy and Definitions

Given the breadth of this topic search terms were kept as specific as possible, without limiting the acquisition of information. EBSCO, Science Direct, PsychInfo and Google Scholar were searched, alongside reviewing the references of key papers, research grant applications and citation searches. The exclusion criteria were: papers not written in English, papers for which the full article could not be accessed, book chapters which could not be accessed and duplicate publications.

Defining HI is not without difficulty: in publication it can be referred to as traumatic brain injury, acquired brain injury and head trauma, for example, each revealing a different meaning. For the purpose of this review HI was defined as “nondegenerative, noncongenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairments of cognitive, physical and psychosocial functions with an associated diminished or altered state of consciousness” (Dawodu, 2007, p.1). Common causes include fights, falls, road traffic accidents and sports related injuries. Criminal activity is defined as any act deemed worthy of criminal conviction by the Law, regardless of whether a conviction was granted or not (in American research this is often termed delinquency). In England the age of criminal responsibility is 10 years old. The applicable age range and judicial process for YO can vary depending on the nature of the crime. Government guidelines define YO as individuals below the age of 21 years, but individuals aged 18-21 years are detained separately from YO below the age of 18. The term YO is used in this review to refer to anyone under the age of 21 years involved in criminal activity.

Epidemiology of Head Injury

General population.

In the UK prevalence estimates range between 185 and 294 per 100,000 children aged less than 15 years (Masson et al., 1996; Kraus & Chu, 2005). In the USA, just under half (40%) of patients attending for HI are younger than 14 years of age (Guerrero, Thurman, & Sniezek, 2000). However, McKinley et al. (2008) suggest these figures may be an underestimate due to a lack of official documentation. Further difficulties in establishing an accurate epidemiology of HI arise from the varying definitions of HI across professional groupings and inconsistencies in reporting of HI. Consequently, figures are likely to be an underestimate, indicating child and adolescent HI could be a “silent epidemic” (Perna, 2002).

Prison population.

With regards to YO, as previously mentioned, Williams, Cordan, et al. (2010) recorded a self report rate of 65% (n=197) across HI severities (46% reported a loss of consciousness [LOC]). A recently published study found a slightly higher rate of 70% of which 41% reported a knock out (Davies, Williams, Hinder, Burgess, & Mounce, 2012). Slightly lower rates of HI were found in a comparison of a group of non-offending young people compared with a sample of YO: 40% and 50% respectively (Huxx, Bong, Skinner, Belau, & Sanger, 1998). It is acknowledged reliance on somewhat more subjective reports of HI may lead to an inflation of prevalence rates. However, work by Schofield, Butler, Hollis, and D'Este (2011) found self report of HI was similar in accuracy to

hospital records in a group of prisoners. Coupled with the difficulties tracing medical records, self-report remains a popular data collection method in offender based research.

Head Injury and Crime

These elevated rates reveal HI is more common in offenders than non offenders, suggestive of a link between HI and crime. Further to this, research has found HI can discriminate *within* offender groups, indicating worse criminal profiles compared to offenders without HI. Leon-Carrion and Ramos (2003) collected data on the pre-incarceration histories (pre18 years of age) of adult prisoners in Spain. They discovered that difficulties at school were present across the sample, but offenders who had a HI requiring hospitalization differentiated violent offenders from non-violent offenders. It is worth noting that HI was only indicated by sports injuries, road traffic accidents and falls from a height, excluding therefore a potentially larger sample of HI offenders, reducing generalisability of the findings. Conversely, a study using an adult forensic sample in South Africa exploring factors that distinguished habitually violent offenders from never-violent offenders did not implicate HI (Kaliski, 2002). However, HI was defined only as a blow to the head resulting in LOC for over one hour: judging by previous estimates of HI in prison populations this narrow definition is likely to have excluded a number of participants with mild HI, inclusion of which could have altered findings.

Kenny and Lennings (2007) gathered data pertaining to a number of areas with a sample of YO (mean age 17 years 2 months), including HI and violent offending. They found a

history of HI was significantly associated with severe violent offending and not moderate, mild or non-violent offending. They explain this link as owing to severe violent offences displaying more disinhibited aggression and HI being a marker of disinhibition, thereby increasing the risk of severe violence. Whilst the authors should be praised for raising the distinction between different types of aggression, there is evidence to suggest severe violent acts may be more closely associated with planned aggression (Raine et al., 2006).

Perron and Howard (2008) explored the correlates of HI (LOC greater than 20 minutes) in 720 YO. Those YO with a history of HI reported earlier onset of criminal behaviour and more criminal acts in the previous year. Similarly, Williams, Cordan, et al. (2010) found YO with HI reported more convictions and greater violence in convictions if they had suffered three or more HI compared to YO who suffered less than three HI or no HI. Williams, Cordan, et al. suggest neuropsychological dysfunction, in areas such as executive functioning, may be one of the mechanisms by which HI influences crime: however, they acknowledge they did not collect such data to corroborate this.

Methodological limitations notwithstanding research findings are suggestive of HI being associated with worse criminal profiles; however with regards to YO research is still relatively sparse.

Literature exploring outcomes and rates of offending in HI populations provides further support for the association between HI and offending behaviour. A study investigating outcomes in veterans from the Vietnam war found injury to frontal systems could put

survivors at risk of crime. Veterans with such injuries repeatedly reported greater aggression and violence compared to non-injured controls and to patients with lesions in other brain areas (Grafman et al., 1996). In a data linkage study conducted in Sweden, 8.8% of participants with a HI committed violent crime, compared with 3% in the population controls, resulting in an increased risk of violent crime in the HI population (adjusted odds ratio [aOR] = 3.3). Furthermore, individuals with HI, when compared to unaffected sibling controls, were still at an increased risk of violent crime (aOR = 2.0). People with HI therefore committed more violent crimes compared to other people, including their own siblings (Fazel, Lichtenstein, Grann, & Langstrom, 2011).

Mechanisms of Action between Head Injury and Crime

A number of brain regions and functions are developing during adolescence. The prefrontal cortex (PFC) appears to have one of the longest developmental trajectories. As a result of this continued development, Casey, Giedd, and Thomas (2000) propose this region may be particularly vulnerable to environmental influences, such as HI.

Incidentally, there is a high probability of damage to the PFC in adolescents with HI (Turkstra, Williams, Tonks, & Frampton, 2008). Mounting evidence suggests that “sleeper effects” may exist, whereby early HI may only result in observable or detectable consequences years later (Jacobs, Harvey, & Anderson, 2007; Kolb, Gibb, & Gorny, 2000), thereby challenging the once widely accepted “Kennard principle”, which stated an earlier HI would result in a better outcome (Kennard, 1940). The “sleeper effects” might be a result of functional brain regions compensating for damaged areas. As

individuals mature these compensatory brain regions cannot fulfill their original function, consequently impairments may surface (a process termed ‘crowding out’)³⁸.

The PFC is associated with executive function and social cognition processes. Executive function³⁹ is a necessary component of appropriate social behaviour. For example, engaging in a conversation requires attending to the context, interpreting the semantic content, planning a response, generating a suitable verbal and non-verbal output and potentially inhibiting the urge to respond with an inappropriate behaviour (Turkstra et al, 2008). Social cognition is an umbrella term to cover cognitive processes involved in social behaviour, such as Theory of Mind (ToM), commonly referred to as the ability to hold a mental representation of another’s mental state (Baron-Cohen, O’Riordan, Stone, Jones, & Plaisted, 1999), and empathy: cognitive empathy refers to the ability to understand another’s emotions; affective empathy is the ability to experience the same emotion as another (Cohen & Strayer, 1996)⁴⁰.

Ward, Keenan and Hudson (2000) proposed sexual offenders committed offences as a result of a reduced ability to infer the mental states of their victims. Jolliffe and Farrington (2007) found male YO scored lower on a validated measure of empathy

³⁸ However, much of this evidence is a result of imaging studies, which have its limitations: sample sizes are often small making it difficult to generalize findings; certain participant groups may be excluded from testing, such as those from lower socioeconomic groups, leading to participant bias; and the validity and reliability of some neuro-imaging measures have been questioned (Hein Ciccio, Meulenbroek, & Turkstra, 2009).

³⁹ Executive functioning is a theoretical system to describe processes involved in attention; planning, implementing and modifying behaviour; impulse control and problem solving (Miller & Cohen, 2001; Posner & Peterson, 1990)

⁴⁰ “Cold” social cognitive skills such as ToM perspective taking are thought to rely on the PFC, the inferior parietal cortex and occipitotemporal junction, areas still developing in puberty (Blakemore & Choudhury, 2006; Brothers, 1990). “Hot” social cognition skills, such as empathy are thought to involve the ventromedial PFC and limbic system: whether this neuroanatomical mapping holds for cognitive and affective empathy remains to be seen.

compared to non-offenders. Even in light of these preliminary findings comprehension of the effects of HI on social cognition in developing brains is still relatively unknown (Hein Ciccio et al., 2009).

Blake, Pincus, and Buckner (1995) investigated 31 murder suspects and found evidence of dysfunctional frontal lobe functioning in just over half (64.5%). Mobbs, Lau, Jones, and Frith (2008) provide further support for this: following a review of the neuroscience of anti-social behaviour literature they identified the frontal systems as necessary for impulse control and modification of behaviour in line with its consequence⁴¹. However, a paucity of research in this area with YO means they are a clinical group poorly understood.

Head Injury and Crime: An epiphenomenon?

Cross-sectional research poses difficulty in establishing the direction of causality between HI and crime. It is possible that criminal activity may increase the risk of young people having a HI. A correlate of HI in YO in the Perron and Howard (2008) study was earlier entry into the custodial system compared with YO without HI, however, they do not state whether the HI preceded conviction. Timonen et al. (2002)⁴² found a temporal order between HI and crime: children who had sustained a HI before 12 years of age committed

⁴¹ Tonks et al. (2008) reviewed research evidence and concluded HI can result in selective impairments, either purely cognitive, purely social cognitive or both. They state a proportion of social cognition deficits post HI may be attributed to EF impairments, but that some may occur independently. They highlight more research with young people, in particular offenders, is required to clarify the nature of deficits from HI if appropriate interventions are to be provided.

⁴² They conducted a population-cohort based study in Finland (n > 12 000). HI during childhood significantly increased the risk of offending 1.6 fold.

crimes significantly earlier than those children receiving a HI after 12 years of age. Yet, the authors note that there may have been unidentified factors increasing the risk of HI and offending, such as ADHD⁴³ and poor parental control. This highlights that HI may also act as a marker for other contextual variables or risk factors common to both HI and crime. Such risk factors include; increased rates of substance abuse, dysfunctional family background and increased levels of aggression, potentially resulting in the relationship between HI and crime being an epiphenomenon⁴⁴ (Turkstra, Jones, & Toler, 2003).

It is clear that research needs to consider the complex system within which HI and crime appear to operate, to not do so is to risk forming conclusions not applicable to the realities of criminal life. As such, this review goes on to explore a number of shared risk factors, reflecting the complexities of the relationship between HI and crime.

Aggression, Head Injury and Crime

Research is beginning to reflect the theoretical notion that aggression may not be a homogenous construct, but consist of distinct sub-types which could have different etiological pathways: proactive and reactive aggression is one such perspective (Dodge, 1991). Proactive aggression is characterized as instrumental, planned and goal oriented,

⁴³ It is interesting to note that ADHD has been implicated pre and post HI in young people (Keenan, Hall, & Marshall, 2008 and Max et al., 2004, respectively) and is elevated in YO compared to non-offenders (Fazel, Doll, & Langstrom, 2008).

⁴⁴ Yates et al. (2006) provided evidence that those from lower SES will report longer lasting difficulties from HI and also higher frequency of HI. Thoughts around this increased risk have suggested that those within lower SES families may lack the means to seek appropriate rehabilitation support post HI (Yates et al., 2006). Crime of varying types has also been repeatedly recorded as more prevalent in areas of increased deprivation (Kawachi, Kennedy, & Wilkinson, 1999; Howarth, Kenway, Parker, & Street, 1998; Mirlees-Black & Allen, 1998).

without need for provocation or anger and with perpetrators displaying psychopathic traits, such as low affect arousal⁴⁵ (Frick, Cornell, Barry, Bodin, & Dane, 2003). Reactive aggression is characterized as a response to provocation following perceived hostility, involving a lack of inhibition, increased impulsivity and affect arousal⁴⁶ (Raine et al., 2006).

Head injury, in particular resulting in damage to the frontal and temporal regions of the brain has been linked with increased aggression in children (Andrews, Rose, & Johnson 1998). Brower and Price (2001), having reviewed the link between frontal lobe damage and violent behaviour, note that frontal lobe dysfunction may lead to impairments in impulse control. It is proposed that structural and/or neurochemical damage in these regions may result in individuals being more impulsive and less able to inhibit inappropriate responses, characteristics of reactive aggression

There are disparities in the literature concerning which form of aggression is most likely to result in criminal behaviour. Raine et al. (2006) point out reduced inhibition and self control characteristic of reactive aggression might lead to greater problem behaviors; however, prospective research indicates a positive relationship between proactive aggression and later violence. In one of the few prospective studies in adolescents, Pulkinnen (1996) investigated the links between reactive and proactive aggression in adolescence and crime in adulthood (measured by imprisonment and/or misdemeanors) in a sample of Finish individuals. Results supported a link only between proactive

⁴⁵ It has its routes in Social Learning Theory (Bandura, 1973, as cited in, Hubbard et al., 2002)

⁴⁶ It is derived from the frustration – aggression hypothesis (Berkowitz, 1993, as cited in Hubbard et al., 2002)

aggression and criminality. However, the definition of reactive aggression arguably more closely resembled behaviour of self defence. As the subtypes of aggression literature has developed reactive aggression has been defined more by the over attribution of hostility to another and reacting after perceived provocation. This later definition of reactive aggression may lead to it being linked with problem behaviour. However, in support of Pulkinnen's findings, Vitaro, Gendreau, Tremblay, and Oigny (1998) also found proactive aggression at age 12 predicted delinquency in adolescence. Raine et al. (2006) in developing a brief measure of reactive and proactive aggression in adolescents, once again found only proactive aggression to be linked to greater violence, yet reactive aggression was more widely endorsed. It is evident that research in this field is still in its infancy, but perhaps as Karnik and Steiner (2007) put it: reactive may be most common amongst YO, but proactive is most feared.

Parenting Practices, Aggression, Head Injury and Crime

Research supports the contribution of family background, in particular parenting practices, to the development of childhood aggression and the likelihood of young people offending (Gardner, Ward, Burton, & Wilson, 2003; Hodgins, Kratzer, & McNeil, 2001; Patterson & Stouthamer-Loeber, 1984; Rothbaum & Weiz, 1994; Schroeder, Bulanda, Giordano, & Cernkovich, 2006; Schroeder, Giordano, & Cernkovich, 2010; Webster Stratton, 1999). In Farrington's (2005) review of childhood risk factors for aggression and later offending, he highlights the role of poor parenting, in particular low parental supervision, which has been further supported by other studies (Griffin, Botvin, Scheier,

Diaz, & Miller, 2000). Juvenile crime has been shown to peak in after school hours (Newman, Fox, Flynn, & Christenson, 2000, as cited in Lord & Mahoney, 2007), potentially a consequence of low parental supervision. Lord and Mahoney (2007) explored the link between poor supervision in the after school hours and aggressive behaviour. They found the higher the level of self care (low parental supervision) the more externalising behaviors (aggressive in nature) teachers reported, but this was only for children from more deprived neighborhoods. The authors explained this finding as possibly resulting from unsupervised exposure to more dangerous higher risk environments. The participants in this study were school aged (6-10) it is difficult to know whether the finding would hold for adolescent boys. Stanger, Dumenci, Kamon and Burstein (2004) investigated the link between parenting practices and child rule breaking and aggressive behaviour. They found medium effect sizes for the effects of poor parental supervision and inconsistent discipline on rule breaking, both were significant predictors, and inconsistent discipline also had a medium effect size of aggressive behaviour.

With regards to specific parenting practices and subtypes of aggression, research is less abundant. Dodge (1991) suggested proactive aggression could be encouraged by parental endorsement, through a lack of discipline or supervision which could be seen to encourage aggression for goal achievement. Conversely, reactive aggression could be promoted by parenting behaviour which disrupts attachment, such as a lack of warmth, thereby fostering vulnerability, hostility and aggression in later social relationships. Consequently, Brendgen (2001) predicted poor supervision would moderate the link between proactive aggression and delinquency-related violence, whilst low parental

warmth would moderate reactive aggression and intimate partner violence, which was supported in their sample of 525 Caucasian males aged 16-17 years. With these studies it is important to note that childhood aggression and offending behaviour could make it more difficult to parent and a lack of parental supervision may be the result of child defiance (Stanger et al., 2004). Despite the potential reciprocal nature of the relationship, the findings still offer a potential avenue for interventions aiming to reduce youth offending and aggression.

The role of parenting practices as a risk factor for HI is less clear. Much research has focused on parenting and general childhood injury and not HI specifically. Barry and Clark (1991) studied the correlates of children entering an inpatient rehabilitation facility following severe HI. More children came from non-intact families and had an earlier age at admission. Whilst the authors do not report on it, it would have been interesting to explore whether single parents found it more difficult to provide appropriate supervision, thereby increasing risk of HI. As Dahlberg (1998) highlights parents need skills and resources to address external demands to allow them to effectively supervise their children, being a single parent may make this more difficult. Research has linked a lack of parental supervision with increased risk of childhood injury (Morrongiello and Dawber, 1998; Morrongiello & House, 2004; Schwebel & Bounds, 2003). Supervision is seen as taking an active role in preventing hazardous engagement with the environment. Schwebel and Barton (2004) found parents with temporal resources protected hyperactive children from injury; they suggested the extra time could have been spent with child, supervising them. These studies have employed very young children and parent reports of

parental care. It is yet to be seen how the risk of HI may be implicated in late adolescence and whether adolescent reports of the parenting they receive would mirror these findings. However, it is important to remember adverse parenting experiences and potential neuropsychological sequelae post HI are likely to increase risk for aggression and offending than either predictor alone (Raine, Brennan, & Mednick, 1994; and Raine, Brennan, & Farrington, 1997).

It is clear there exists an intricate web of links between HI and offending. It is very hard to determine degree of causality of associations between variables given the complex set of factors which may or may not determine outcomes post HI. In addition to the factors discussed in this review there are a number of other influences likely to impact on the association between HI and offending, for example: support from schools; the nature and location of the HI; pre-injury vulnerabilities, such as ADHD; and mental health status. The presence or absence of this multitude of risk factors will determine the trajectory of adjustment for young people following a HI.

Summary

It is evident that HI is over represented in offender populations including YO, and appears to be associated with worse criminal profiles. Potential mechanisms of action between HI and crime could be the effect of HI on executive function and social cognition, resulting in impairments that may make it harder for individuals to interact with the environment and coordinate their behaviour. A key message from this review is

the importance of viewing the relationship between HI and crime within the context of other risk factors. Parenting practices, substance misuse and aggression have been linked to offending behaviour, however, the interplay between these variables within an adolescent YO sample have has not been explored. Given the pivotal nature of this developmental period it is imperative to gain a better understanding of how the factors are related.

Future Research

To the author's knowledge these variables and the relationships between them have not been explored simultaneously in a cohort of YO. There is growing concern that if HI is not addressed within forensic rehabilitation opportunities to reduce recidivism and improve integration with society on discharge may be missed. Research needs to focus on the potential interactions between offending and influential factors. Longitudinal studies will provide evidence to better understand directions of causality and the interplay between risk factors. There is a need to better understand how HI may associate with crime and the influence of other factors in this narrative. There is also much need to explore the potential mechanisms of action between HI and offending. Neurocognitive factors, such as executive dysfunction and socioemotional factors, such as empathy and emotion recognition could be integral to understanding the association. Studies comparing young offenders without HI to those with varying severities of HI on neurocognitive and socioemotional processing could form a major part of future research. However, it will be important to recognise and account for the often low intellectual

functioning of young offenders. Tasks will need to be carefully selected to avoid floor effects in this population. If these relationships can be explored it will provide an avenue for intervention specialists to target, ultimately offering the possibility to reduce the risk of young people becoming lifetime offenders.

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