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The Relationship between Psychopathy Traits, Attention-Deficit/Hyperactivity Disorder and Autism Spectrum Disorder in Forensic Populations: A Systematic PRISMA Review

Running Head: Psychopathy and Neurodevelopmental Disorders in Forensic Populations

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Abstract Background: Numerous studies investigate the rate of neurodevelopmental disorders in forensic populations. Studies have also investigated the rate of psychopathy in such settings. However, there appears to be a paucity of studies looking at both of these (co-morbidity between these disorders) and the possible relationships between the two in forensic populations. Method: Presented here are the findings from a systematic review conducted, following PRISMA guidelines, of the peer-reviewed literature. The review identified studies that investigated the rate and/or relationship of neurodevelopmental disorders (Attention-Deficit/Hyperactivity Disorder and Autism Spectrum Disorders) and psychopathy in a forensic sample population without relying on previous childhood diagnosis of neurodevelopmental disorders. Results: Twenty-two studies were identified which investigated the rate and/or relationship of neurodevelopmental disorders and psychopathy in a forensic sample population without relying on previous childhood diagnosis of neurodevelopmental disorders such as attention-deficit/hyperactivity disorder and autism spectrum disorders. Conclusion: The findings highlight the need for the development of screening and diagnostic tools especially targeted at offenders and validated for this purpose.

Keywords Neurodevelopmental Disorders, Psychopathy, Criminality, ASD, Autism Spectrum Disorder, Attention-Deficit/Hyperactivity Disorders, ADHD, Offenders, Prison, Antisocial Personality Disorder

1. What This Paper Adds

This is the first systematic review to explore the rate and/or relationship of neurodevelopmental disorders (specifically Attention-Deficit/Hyperactivity Disorder and Autism Spectrum Disorder) and psychopathy in a forensic sample population. This review clearly highlights the possibility of an association between neurodevelopmental disorders and psychopathy (at least in the forensic population). This study draws attention to this association and the need for clinicians to reflect on the potential overlaps between neurodevelopmental disorders (such as ASD and ADHD) with other conditions like psychopathy and other personality disorders such as ASPD.

2. Introduction

2.1. Neurodevelopmental Disorders and Criminality

Neurodevelopmental disorders (NDDs) are defined as a genetic or acquired biological brain disorder/condition that produces a brain dysfunction which has its onset in childhood. Well known NDDs are autism spectrum disorders (ASDs), attention-deficit/hyperactivity disorder (ADHD), cerebral palsy, communication, speech, and language disorders, and genetic disorders (for example, fragile X syndrome and Down's syndrome) [1]. This review focuses primarily on two neurodevelopmental disorders (namely ASD and ADHD) in terms of their occurrence in forensic populations.

2.2. Autism Spectrum Disorders (ASD) and Criminality

Autism spectrum disorder (ASD) encompasses a wide variety of conditions defined as pervasive developmental disorders (PDDs) in the Diagnostic and Statistical Manual of Mental Disorders (DSM). PDDS include autism, Asperger's syndrome, pervasive developmental disorder not otherwise specified (PDD-NOS), Rett syndrome and childhood disintegrative disorder [2]. The onset of ASDs begins in early childhood and has an adverse impact on the individual's communicative and social interaction abilities and there are tendencies towards restricted interests and/or repetitive behaviours [3]. ASD affects 1 in 110 children in the United States and is said to be increasing at the rate of 12-14% per year [4].

A number of follow-up studies have indicated that individuals with ASDs are no more likely to engage in violent criminal behaviour compared to the general population [5] and, in fact, some studies have indicated that they may actually be less likely [6,7]. Unfortunately, media and academic reporting of violent crimes committed by individuals with ASDs has fueled an unsubstantiated association between offending and ASD [8-10]. Research, including that carried out with mentally abnormal offenders who are incarcerated in special hospitals, indicates that the prevalence of ASD in this population is higher compared to the general population [11]. Given the relative rarity of empirical research investigating the association between ASD and criminality [12,13], the question as to whether there is indeed an association remains to be answered. To date, the majority of the literature consists of surveys of criminal groups and case reports [14-21].

2.3. Attention-Deficit/Hyperactivity Disorder (ADHD) and Criminality

Attention-deficit/hyperactivity disorder (ADHD) has an onset in childhood and individuals with this disorder can exhibit a mixture of inattention, hyperactivity and impulsivity in various proportions [3]. The estimated prevalence of ADHD in childhood is around 5-7% [22] and the symptoms of ADHD frequently are continued into adulthood [23,24].

It is widely known that individuals with ADHD are more likely to engage in criminal behaviour, be arrested and when given a prison sentence, persist in engaging in anti-social behaviour whilst in prison. ADHD is also regarded as ‘‘one of the major factors affecting desistance from crime and the recidivism rate’’ [25] (p. 5). Despite this, there is relatively little investigation into the part that ADHD plays in offending behaviour [26]. Studies have indicated that individuals with ADHD are at greater risk of engaging in and being convicted of a variety of criminal behaviours [27] (however this association has been questioned, see [28]). An increased prevalence of ADHD in prison settings has been found in some studies to draw attention to the association between ADHD and both offending behaviour and critical incidents in adult [29,30] and juvenile prisons [31]. Another study carried out by Moore, Sunjic, Kaye, Archer and Indig (2013) [32] found that 35% of their sample of prisoners were screened positive for ADHD. After subsequent diagnostic assessment, 17% fulfilled the criteria for adult ADHD. In this prison sample, there was a higher prevalence of adult ADHD (17%) compared to estimated prevalence of the disorder found in the general population (2%-3%; [33]). These higher rates support findings of previous studies in prisoners and individuals with substance use disorders (10%-29%; [34,35]). However, consistent with Grieger and Hosser, [28], Gordon et al. (2014) [36] failed to find any statistically significant association between ADHD symptoms and convictions or breaches of prison discipline. However, the trends suggested an increased mean number of criminal convictions in the symptomatic and ‘at-risk’ groups compared to the non-symptomatic and ‘no-risk’ groups [36].

2.4. Psychopathy and Criminality

Much research supports the existence of a relationship between psychopathy and violent behaviour [37,38]. The consequences of psychopathic violence are significant. Despite psychopaths representing less than 1% of the general population and about 20% of prison populations [39], they commit double the amount of violent crimes compared to non-psychopathic offenders [40,41], and even as much as 30–50% of all violent crimes [42,37,43]. Despite over 70 years of research in the field of psychopathy (e.g., [44]), there is currently relatively little known about the appropriate and most effective way of intervening in psychopathic violence [45].

The Psychopathy Checklist—Revised (PCL–R; [46]) has attracted significant clinical attention to the construct of psychopathy. However, there has been conceptual confusion, specifically, regarding issues surrounding conflating measures with constructs. The PCL–R should not be considered to be a theoretical construct of psychopathy. One of the main areas under debate in this field is whether offending behaviour is an integral component, or just simply a downstream correlate of psychopathy. Skeem and Cooke (2010) [47] argue that there is support for the view that criminal behaviour is a correlate, as opposed to a component, of psychopathy [47]. Similarly, Langevin and Curnoe (2011) [48] found that key predictors of recidivism were criminal history variables and that including these criminal history variables on the PCL-R may actually be the primary reason psychopathy (as measured using the PCL-R), predicts recidivism. In an earlier study, Cooke, Michie and Skeem (2007) [49] drew attention to a psychopathy construct which is independent of criminality. Indeed, Widiger (2006) [50] has pointed out that the PCL-R items which directly refer to criminal behaviour actually make it more difficult to ascertain the degree to which psychopathy influences criminal behaviour. Others have also been doubtful about whether psychopathy, as measured by the PCL-R, is anything other than simply persistent criminality. Across studies, the most accepted position appears to be that which

suggest that the personality dimension of the PCL-R does not predict recidivism, rather it is the criminal history factor which predicts recidivism [48]. Lastly, findings by Camp and colleagues (2013) [51] also caution against the use of any generalised statements regarding the relationship between psychopathy and offending [51].

2.5. Relationship between Neurodevelopmental Disorders and Psychopathy in Offenders

Psychopathy and ADHD share much in common [52]. Frick, Bodin, and Barry (2000) [53] found that there were diagnoses of ADHD ranging from 80-100% of their samples of "psychopathic children". Eisenbarth and colleagues (2008a) [54] examined the possible correlation between ADHD and psychopathy in adult female and male ADHD patients (n = 28) in comparison to 41 healthy controls. Findings indicated that the emotional features of psychopathy are not impaired in ADHD whereas the behavioural features of psychopathy *are* present in ADHD. This is consistent with the model proposed by Colledge and Blair (2001) [52], which argues that psychopathy and ADHD share certain features (such as impulsivity and antisociality) but not an impaired emotional processing ability which is common in individuals with psychopathy [54]. It is important to point out here that few symptoms of mental disorders are specific to particular disorders. For example, depressed mood can be found in a range of conditions. It is the pattern of symptoms that is important. For example, individuals with ASD may show a lack of empathy but they rarely show the grandiosity and self-pathology that you would observe in psychopathy. Additionally, Christian, Frick, Hill, Tyler, and Frazer (1997) [55] identified a sample of children whom they considered to exhibit psychopathic features. Interestingly all the children in the psychopathic conduct cluster (n =11) had an ADHD diagnosis. McBride (1998) [56] investigated the relationship between ADHD (in some cases, attention deficit disorder, ADD) and psychopathy based on a sample of 233 adolescent offenders who were all mandated to a treatment programme for sex offenders. Offenders who were psychopathic were three times more likely to receive a diagnosis of ADHD or ADD (57%) compared to the non-psychopathic group (18%) [56].

Some researchers and clinicians consider that there is a correlation between ASD and psychopathy [57]. One study conducted by Rogers and colleagues (2006) [58] examined 28 ASD boys on autistic traits, psychopathic tendencies and a variety of cognitive measures (assessing for example, mentalising ability). Findings revealed that psychopathic tendencies were not associated with ASD symptom severity. Psychopathic tendencies were also not associated to any core autistic cognitive deficits, such as executive function and 'mind-reading'. Their findings also indicated that callous/psychopathic behaviours in a relatively small subgroup of individuals with ASD probably reflects a 'double hit' in that, aside from ASD symptoms, there is an added impairment of the empathic response to distressing stimuli [58].

The issue that measures of psychopathy and ADHD may be correlated because of the presence of overlapping items has been highlighted by some researchers (i.e., [59]). Indeed, behavioural items such as a need for stimulation and impulsivity on Factor 2 of the PCL-R corresponded with ADHD symptoms. It is crucial, therefore, to explore to what degree an individual who scores highly on measures of psychopathy also fulfils the diagnostic criteria for ADHD. It is also important to begin to understand if the construct of psychopathy has any predictive validity beyond what is considered to be attributable to symptoms of ADHD. Research which examines the relationship between psychopathy and ADHD is imperative in furthering our knowledge of the developmental processes mediating and moderating psychopathy and may help inform the types of interventions that are appropriate for juveniles exhibiting characteristics of psychopathy [60].

2.6. Other Variables That Impact the Development of Psychopathy or antisocial Personality Disorder, Such as Home Environment, Education, or Socioeconomic Status

While the present review is focused on ADHD and ASD as predictors of psychopathy, it is important to highlight here that there have been a number of other variables which have been found to impact, or contribute to, the development of psychopathy or ASPD, such as home environment, education, or socioeconomic status (SES). Studies have found that ASPD and psychopathy are associated with adverse early life experiences, such as childhood abuse (e.g., [61]). For instance, an association has previously been found between a diagnosis of ASPD and severe trauma history (most notably an association between ASPD and high rates of physical and sexual abuse) (e.g., [62,63]). A number of studies have found associations between abuse history and psychopathy. Poythress, Skeem and Lilienfeld (2006) [64] investigated the association between childhood abuse and psychopathy in a sample of 615 male offenders (incarcerated). All 615 male offenders were asked to complete a retrospective self-report measure of childhood abuse (Abuse: Child Abuse and Trauma Scale, CATS, [65]), the Dissociative Experiences Scale (DES; [66]) and Hare's (2003) Psychopathy Checklist-Revised [46]. Findings revealed that high rates of abuse were predictive of elevated levels of psychopathy. However, this relationship between high rates of abuse and higher levels of psychopathy was driven by the impulsive-lifestyle elements which are associated with ASPD and psychopathy [64]. Consistent with these findings by Poythress and colleagues (2006) [64], Weiler and Widom (1996) [67], examined the associations between early childhood victimisation, psychopathy and violence based on a sample of previously abused and neglected individuals (n = 652) and a matched control group (n = 489) and found that, compared to the group who had not experienced any abuse, those who had been abused,

neglected (or both) had significantly higher Psychopathy Checklist—Revised (PCL–R; [46]) scores. Importantly, even after controlling for any differences in criminal history and demographic characteristics, these higher scores on the PCL-R in the groups who had experienced abused remained.

Additionally, a number of studies have found negative childhood events such as parental rejection, neglect and abuse are associated with the later development of antisocial behaviour (e.g., [68-70]) and psychopathy [70,71]. Additionally, a recent meta-analysis identified 133 studies containing data suitable for effect size calculation (and analysed 139 independent effect sizes, total N = 339 868) and found that lower family socioeconomic status was associated with higher levels of antisocial behaviour [72]. Based on a sample of 411 non-clinical participants (99 males, 312 females), Krastins and colleagues (2014) [73] found that there was significant associations between levels of ASPD symptomatology and childhood maltreatment, parental bonding, teasing, depression, and anxiety. Dargis and colleagues (2015) [74] highlights that how early maltreatment potentially can exacerbate the development of disorders such as ASPD and psychopathy in adulthood requires further research [74]. Lastly, there have been some studies which have suggested factors which are found to be associated with the prevalence of ASD. For instance, Idring and colleagues (2015) [75] recently found that the prevalence of ASD decreased with increasing level of parental education [75].

2.7. Present Review

This systematic review will review the literature and identify studies which have looked at the rate and/or relationship of neurodevelopmental disorders (specifically ASD and ADHD) and psychopathy in their forensic sample population without relying on previous childhood diagnosis of neurodevelopmental disorders such as ADHD.

It is important to highlight here that, with respect to psychopathy, this review focuses on the dimensional construct of psychopathy.

3. Method

Two internet-based bibliographic databases (PsycINFO and PubMed) were searched to access studies which investigated the rate and/or relationship of neurodevelopmental disorders and psychopathy in their forensic sample population. The process of eliminating non-relevant papers can be seen in the flowchart following PRISMA guidelines [76] below. Duplicates were excluded prior to the retrieval of references. Searches on the two databases were conducted on the 31st March 2014. The following search criteria were entered into PsycINFO: [(((psychopathy OR psychopathic OR psychopath[AB/Abstract])) AND ("neurodevelopmental disorder*" OR autis* OR asperger* OR ADHD OR "attention-deficit/hyperactivity disorder"[AB/Abstract])) AND (prison OR criminal* OR crime OR offender*[AB/Abstract])] which returned a total of 37 references. The same search criteria were entered into PubMed [(((psychopathy OR psychopathic OR psychopath[Title/Abstract])) AND ("neurodevelopmental disorder*" OR autis* OR asperger* OR ADHD OR "attention-deficit/hyperactivity disorder"[Title/Abstract])) AND (prison OR criminal* OR crime OR offender*[Title/Abstract])] which returned a total of 132 references. No limits were placed on the date of publication in the searches conducted on the databases. A comprehensive separate search was also conducted on 'Google scholar' and other resources to see if there were any other relevant papers that were missed in the database searches. This search found no additional relevant papers which could be included as secondary data sources.

Abstracts for each reference were obtained and screened using the following criteria:

Inclusion Criteria

1. Human study population
2. Investigated the relationship between psychopathy and neurodevelopmental disorders in a forensic population (i.e., prison)

Exclusion Criteria

1. Papers not published in English
2. Dissertations
3. Book reviews
4. Studies which investigated a sample that comprised of individuals with a disorder other than neurodevelopmental disorders or psychopathy traits or not based on a forensic population
5. Systematic review articles (although relevant ones were included in the introduction and/or discussion)
6. Review papers
7. Book chapters

Screening

In the first stage, papers were rejected which:

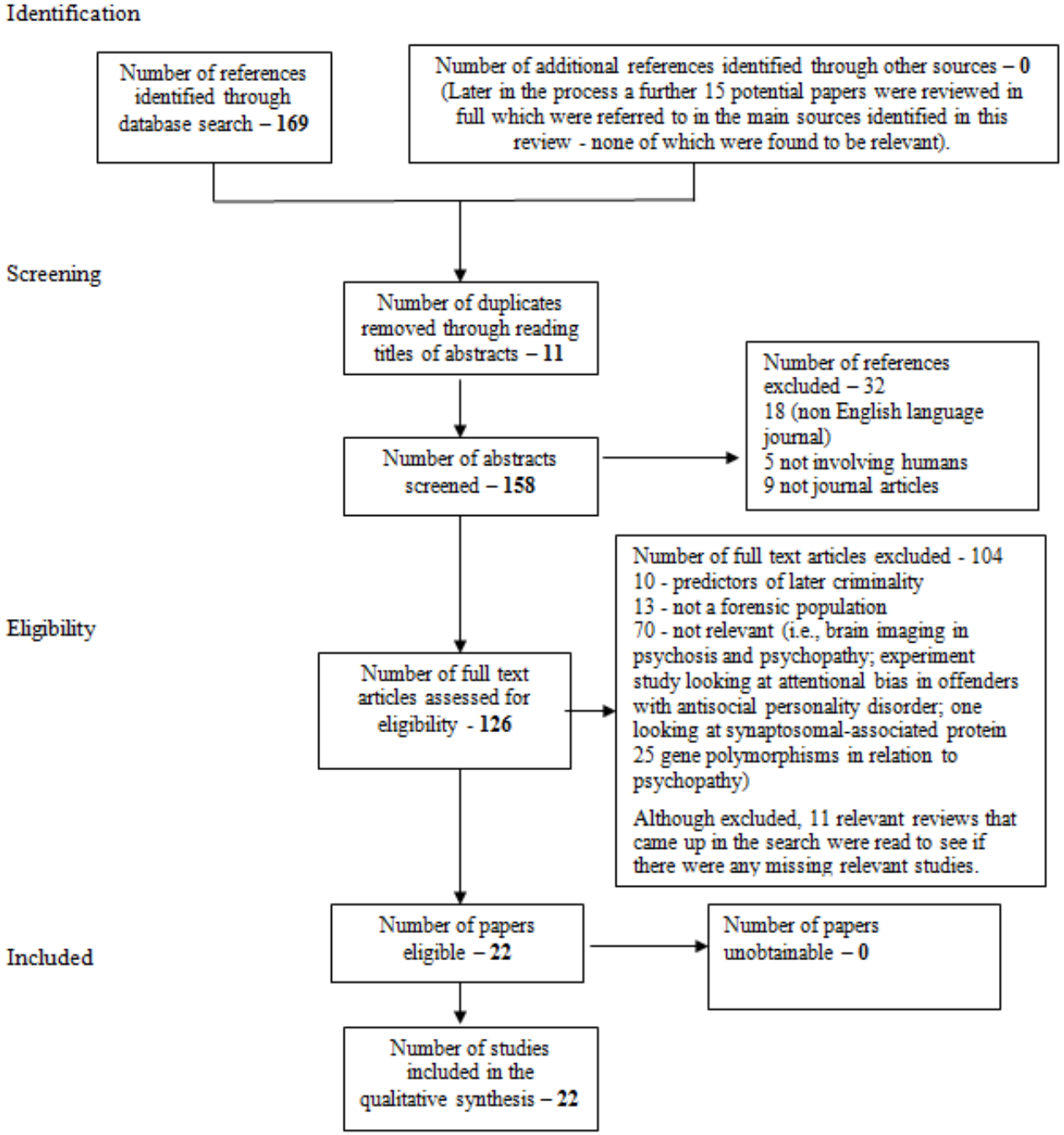
- did not explore the relationship between psychopathy and neurodevelopmental disorders in a forensic population (i.e., prison)
- were not published in English
- were not an empirical peer-reviewed journal publication
- did not involve humans

For the next stage papers were rejected which:

- looked at the childhood predictors of later criminality (predictors such as a diagnosis of ADHD in childhood)

Full documents were obtained for the remaining records. Given the little number of studies which have investigated both neurodevelopmental disorders and psychopathy, no exclusions were made based on method of investigating the relationship; the psychopathy and NDD measures used, gender of the sample or age of the sample.

Flow of Information through Systematic Review



4. Results

The focus of this systematic PRISMA review were studies investigating the rate and/or relationship between neurodevelopmental disorders and psychopathy in forensic samples. The studies included investigate this relationship in a forensic population rather than simply discussing aggression scores or levels of conduct disorder in relation to psychopathy and/or neurodevelopmental disorders.

4.1. Studies Investigating the Developmental Pathway from Childhood Neurodevelopmental Disorder to Adult Criminality: Predictors of Later Adult Criminality

Worthy of mention here, before discussing the primary studies of interest, are the ten studies which investigated the developmental pathway from childhood neurodevelopmental disorders to adult criminality [77-86]. We will briefly review some of the particularly interesting findings from these studies given that a proper review of these articles is outside the scope of this review. One of the studies examined the relationship between attention deficit disorder with hyperactivity in childhood and criminality in adolescence and adulthood in 89 hyperactive and 87 normal control subjects. Significantly greater juvenile (46% versus 11%) and adult (21% versus 1%) arrest rates were found in the participants who were hyperactive. Other variables that were found to be significantly greater were rates of juvenile and adult incarceration [80]. In another study, ADHD was found to increase the risk of developing antisocial and substance use disorders in adolescence (even in the absence of comorbid childhood conduct disorder), which subsequently leads to greater risk of later engagement in criminal activity [84]. However, Mordre and colleagues [86] found that, compared to other disorders, childhood ADHD was not any more likely to be related to later delinquency [86]. Lastly, based on retrospective reports of conduct problems before the age of 15 and hyperactivity–impulsivity–attention (HIA) problems before the age of 10, one study compared psychopathic and non-psychopathic violent criminal offenders (n = 186). Findings showed that it was typical (four times more likely than chance) for adult psychopathic offenders to have had a combination of childhood HIA and conduct problems [82].

4.2. Studies Identified Which Investigated the Rate and/or Relationship between Neurodevelopmental Disorders (Specifically, ASD or ADHD) and Psychopathy in a Forensic Sample

Twenty-two studies were identified which investigated the rate and/or relationship of neurodevelopmental disorders and psychopathy in their forensic sample population without relying on previous childhood diagnosis of neurodevelopmental disorders such as ADHD and ASD. Numerous features of the studies were investigated such as: age of the sample; sample size; diagnostic features of the sample and nature of crime; aim of the study and findings (see Appendix A, Table 1 for detail on the studies identified by this review). In addition, we also looked at some other features of the studies such as: whether the paper included a statement of study funding; whether it included a conflict of interest statement; the country in which the study was conducted and whether there was blinding in the assessment of the sample (see Appendix B, Table 2).

4.2.1. Psychopathy or Personality Disorder

Eleven studies which came up in the search that did not specifically explore psychopathy and instead explored personality disorders (such as antisocial personality disorder) were still included given the literature which uses the terms psychopathy and antisocial personality interchangeably [44]. Antisocial personality disorder, or ‘‘psychopathy’’ appears to be considered a heterogenous concept [87]. In court proceedings, psychopathy (as measured using the PCL-R) is given the same credence as DSM personality disorders [100]. Psychopathy is a personality disorder (i.e., [111]).

4.2.2. Relationship between Neurodevelopmental Disorder (ASD or ADHD) and Psychopathy or Personality Disorder or Just Description of Rates

Table 3. details information on the studies' samples in terms of gender, whether they specifically investigated psychopathy or a personality disorder and what level of detail the study went into in terms of the relationship and rate between neurodevelopmental disorders (ASD and ADHD) and psychopathy. In Table 3, each of the 22 studies is assigned one of four criteria to specify the nature of the study in terms of how it explores the rate and/or relationship between neurodevelopmental disorders (ASD and ADHD) and psychopathy (or personality disorders). If it explores just the rate of these disorders as separate entities it is categorised as level 1 quality (n = 5). Level 2 quality are studies (n = 2) which not only look at the rate of the disorders but also at how many, who had psychopathy, also had a diagnosis of a neurodevelopmental disorder – either ASD or ADHD. Level 3 categorises studies (n = 8) which examined the impact of having both psychopathy (or personality disorder) and a neurodevelopmental disorder (ASD or ADHD). For instance, they were more impaired. Studies were also categorised as level 3 if they found that having psychopathy or a personality disorder increased the risk of having a neurodevelopmental disorder (or vice versa). Level 4 is the highest quality and categorised studies (n = 7) which explored the associations between distinct aspects of neurodevelopmental disorders (ASD or ADHD) with psychopathy traits.

Table 3. Details of gender of sample, use of psychopathy or personality disorder and level of analysis of the rate and/or relationship between psychopathy (or personality disorder) and neurodevelopmental disorders (either ASD or ADHD) of the twenty-two identified studies.

Author(s)	Gender of Sample	Psychopathy or Personality Disorder	Relationship between Neurodevelopmental Disorder and Psychopathy or Personality Disorder or just Description of Rates	Category
Anckarsäter 2005 [87]	Assume male due to nature of crime - not clearly stated	Psychopathy (as measured using PCL-R)	Explores associations between distinct aspect of ADHD and psychopathic traits and the correlation between Asperger symptoms/autistic traits with PCL-R scores	Level 4
Black *et al.* 2007 [88]	Male and Female	Borderline personality disorder	Individuals with BPD had higher rates of ADHD (as well as other disorders)	Level 2
Black *et al.* 2010 [89]	Male and Female	Antisocial personality disorder	Those with comorbid ADHD were more impaired than those without ADHD	Level 3
Boots & Wareham 2010 [90]	Male and Female	Antisocial personality	Affective/depressive, anxiety, ADHD, and oppositional defiant/antisocial personality problems independently predicted violence (but found no significant effect - independently predicted, no correlation).	Level 3
Dåderman & Jonson 2008 [92]	Male only	Psychopathic character	Note: Participants did not meet criteria for psychopathic character	Level 1
Einarsson *et al.* 2009 [93]	Male only	Antisocial personality disorder	The odds of an inmate meeting ADHD symptomatic criteria were four times greater if the inmate met the diagnostic criteria of ASPD	Level 3
Ginsberg *et al.* 2010 [94]	Male only	Psychopathy and antisocial personality disorder	ADHD and coexisting disorders, such as SUD, ASD, personality disorders, mood- and anxiety disorders, severely affected inmates with ADHD	Level 3
Gudjonsson *et al.* 2013 [95]	Male and Female	Antisocial personality disorder traits	Extent of offending predicted by a combination of being a young male with antisocial personality traits and ADHD symptoms	Level 3
Gunter *et al.* 2008 [96]	Male and Female	Antisocial personality disorder	Just frequencies	Level 1
Hofvander *et al.* 2011 [97]	Male and Female	Personality Disorders	Other definitions of PDs did not add to the prediction of adult life aggression in the presence of other behavioural predictors (i.e., hyperactivity)	Level 4
Kaplan & Cornell 2004 [60]	Male only	Psychopathy	Weak association between ADHD and psychopathy	Level 4
Langevin 2006 [98]	Male only	Psychopathy	Frequency. Also focused on the impact of the disorders on wanting, attending and completing treatment	Level 1
Langevin & Curnoe 2010 [100]	Male only	Psychopathy	Psychopathy significantly associated with ADHD	Level 3
Langevin & Curnoe 2011 [48]	Male only	Psychopathy	Focus on predictor of recidivism The personality dimension of psychopathy was not found to predict recidivism and violence as evidenced in the theory	Level 3
Pondé *et al.* 2011 [103]	Male only	Personality Disorders (i.e., APSD)	Just frequencies	Level 1
Semiz *et al.* 2008 [104]	Male only	Psychopathy and Antisocial Personality Disorder	ADHD symptoms correlated with PCL-R scores, suggesting a higher severity of psychopathy with increased symptom loading	Level 4
Soderstrom *et al.* 2004 [105]	Male and Female	Psychopathy	Behavioural and affective PCL-R factors were closely associated with childhood ADHD, CD & autistic traits	Level 4
Soderstrom *et al.* 2005 [106]	Male and Female	Psychopathy	Total PCL-R scores including Factor 2 (unemotionality) and Factor 3 (behavioural dyscontrol) scores were significantly correlated with ADHD, Asperger's syndrome/high-functioning autistic traits	Level 4
Torgersen *et al.* 2006 [107]	Male and Female	Antisocial personality disorder	High comorbidity between ADHD and ASPD as well as alcohol and drug abuse	Level 2
Vitacco & Rogers 2001 [108]	Male only	Psychopathy	Impulsivity appeared to be the strongest predictor of psychopathy and conduct problems No differences were found between level of psychopathy and sensation seeking or ADHD symptoms	Level 4
Wahlund & Kristiansson 2006 [109]	Male only	Antisocial personality disorder	Focus of study on the differences in psychosocial functioning and crime scene characteristics in relation to personality traits (i.e., ASD)	Level 1
Westmoreland *et al.* 2010 [110]	Male and Female	Borderline and antisocial personality disorders	ADHD is common in offenders and is associated with comorbid disorders, worse quality of life, and higher risk of suicidal behaviours	Level 3

A brief overview will be given of the level 4 studies that specifically looked at psychopathy (not personality disorders) and neurodevelopmental disorders (ASD or ADHD) (n = 5). Out of the 22 studies identified by this review, the key paper was that of Kaplan and Cornell (2004) [60] who investigated the relationship between psychopathy traits and ADHD in juvenile offenders. Interestingly, Kaplan and Cornell (2004) [60] found that the association between ADHD and psychopathy was poor. Specifically, indices of ADHD were associated with Factor 2 PCL:YV scores but were not found to be associated with total scores or Factor 1 scores, on the PCL:YV. Factor 1 is the interpersonal/affective dimension including items such as glibness/superficial charm, callousness, grandiosity, dishonesty and manipulativeness. Factor 2 measures the behavioural elements of psychopathy, including items such as impulsivity and need for stimulation, common symptoms of ADHD, so the association with this factor is unsurprising. However, this relationship is low in power given that the juvenile offenders with an ADHD diagnosis failed to also have a significantly increased total psychopathy score. No relationship between ADHD and other psychopathic features were evident. Interestingly, violent institutional behaviour was unable to be predicted by indicators of ADHD, while integrating psychopathy scores moderately increased the predictability of institutional violence [60]. Consistent with this study, Vitacco and Rogers (2001) [108] found no differences between level of psychopathy and sensation seeking or ADHD symptoms in their adolescent sample.

However, the findings appear to be different with adult samples. Based on adult samples, Semiz et al. (2008) [104] found that scores on the PCL-R were correlated with ADHDd symptoms (ADHD dimensional symptoms), indicating a higher severity of psychopathy with an increased number of symptoms. Additionally, Soderstrom et al. (2005) [106] found that total scores on the PCL-R and also Factor 2 (unemotionality) and Factor 3 (behavioural dyscontrol) scores were found to correlate significantly with ADHD, Asperger's syndrome/high-functioning autistic traits, substance abuse, conduct disorder and the DSM-IV Cluster B personality disorders. Anckarsäter's (2005) [87] study indicated that superficiality was the distinct factor common to ADHD and psychopathic traits, especially the PCL-R factor representing interpersonal callousness. PCL-R scores were found to be positively correlated with Asperger symptoms/autistic traits, highlighting the possibility that neurodevelopmental disorders and personality disorders such as psychopathy share common symptoms. Soderstrom, Sjodin, Carlstedt, and Forsman (2004) [105] found that the strongest correlate of violent recidivism were the PCL-R scores and conduct disorder. ADHD was found to be associated more with the behavioural and affective elements of the PCL-R components, elements which Cooke et al. (2007) [49] argue are more in parallel with "true psychopathy."

4.2.3. Exploring ADHD Subtypes

Some researchers have emphasised that the relationship between hyperactivity and violent criminality is not straightforward. The relationship requires the existence of hyperactivity and also childhood conduct disorder [112]. Studies have also highlighted that the type of ADHD symptoms are also clinically important when making predictions about the development of later antisocial behaviours. For instance, compared to inattention symptoms, hyperactivity and impulsivity are more important when making predictions about the development of antisocial behaviours [113]. Therefore, it is possible that ADHD-Hyperactive or Combined types would be much more related and overlap with psychopathy compared to the ADHD-inattentive type. Out of the total 22 studies identified in this review only four studies explored sub-types of ADHD in relation to psychopathy, levels of aggression, criminality, etc. ([97]). (One study did not look at ADHD ([109])). First, Hofvander et al. 2011 [97] found that hyperactivity, not attention deficits, was the marker for greater risk of aggression associated with ADHD. This indicates that hyperactivity (even independently from Conduct Disorder) actually carries an increased risk for aggression. Second, in the study carried out by Semiz et al. 2008 [104] sixty-eight participants (65%) met the DSM-IV diagnostic criteria for ADHDc (ADHDc diagnostic comorbidity; combined, inattentive, or hyperactive-impulsive subtypes). They found the most frequent subgroup was the combined type (n = 33, 49%), followed by inattentive (n =22, 32%) and then the hyperactive-impulsive (n = 13, 19%) types. Interestingly, they found that scores on the Conners Adult ADHD Rating Scale (CAARS; [114]) were significantly different across the ADHDc subtypes (combined, inattention and hyperactive-impulsive subtypes). The highest scores on the CAARS were found in the combined type. However, there was no significant difference between the ADHDc subtypes on the PCL-R Total, Factor 1 and Factor 2 scores. Third, Soderstrom et al. 2004 [105] statistically analysed ADHD separately for attention deficit (AD) and hyperactivity/impulsivity (HD). They found that both AD and HD were significantly associated with violent recidivism. Conduct disorder and HD were found to remain independent, significant covariates to violent recidivism following additional analysis - .multivariate stepwise regression models using Axis 1 disorders as independent variables. Lastly, Soderstrom et al. 2005 [106] investigated what the strongest childhood precursors to psychopathy were by entering all significant associations between childhood neuropsychiatric disorders and PCL-R scores into multivariate models. Findings revealed that hyperactivity disorder criteria in childhood was the only significant covariate to the total PCL-R scores and to the behavioural Factor 3. Affective PCL-R Factor 2 was found to be a significant covariate with attention-deficit criteria in childhood.

One study did look at impulsivity as a separate category to ADHD ([108]). They found that Impulsivity was the best predictor of both psychopathy and conduct problems [108]. Moreover, two studies (in addition to the four studies

explored sub-types of ADHD in relation to psychopathy, levels of aggression, criminality, etc.) did report rates of the different types of ADHD in their sample ([107]; [94]). Torgersen et al. 2006 [107] found that 44 patients fulfilled the diagnostic criteria for attention-deficit, 43 patients for hyperactivity and 43 patients for impulsivity. Thus, forty-four patients (97.8%) also fulfilled the diagnostic criteria for DSM-IV, 314.01 AD/HD combined type. Ginsberg et al. 2010 [94] found that almost all their participants in the inmate group had confirmed ADHD of the combined type. Specifically, in their inmate group, 28 (93%) met the diagnostic criteria for ADHD combined type and two (7%) met the diagnostic criteria for ADHD, inattentive type.

Lastly, this systematic PRISMA review excluded studies which were not in English. However, one particularly relevant German paper was discussed by another author and is worthy of mention here (although not included in the PRISMA flow chart). In order to elucidate the relation between ADHD and psychopathy, Retz and Rösler (2009) [115] carried out a study using a sample of 230 incarcerated male participants (all serving two years for felony crimes). No association was evident between diagnostic items of psychopathy with those of ADHD indicating that there may be separate routes to antisocial behaviour in individuals with psychopathy and ADHD [115].

5. Discussion

Only twenty-two studies were identified which investigated the rate and/or relationship between neurodevelopmental disorders (specifically, ASD and ADHD) and psychopathy. Interestingly, eight of the 22 studies were conducted in Scandinavia which highlights the long tradition of public health data linkage analysis that exists in this part of the world. On the other hand, none of the studies were conducted in the United Kingdom, which does not have the same tradition of public health data linkage. In the key study identified by this review, based on their findings, the authors highlighted that mental health specialists involved with the juvenile justice system need to exert caution when making any statements regarding the association between ADHD and psychopathy as only a small overlap in symptoms was found, not the strong association that you might expect to see if psychopathy was a developmental consequence of ADHD symptoms such as hyperactivity and impulsivity [60]. Vitacco and Rogers 2001 [108] found no differences between level of psychopathy and sensation seeking or ADHD symptoms. Langevin and Curnoe 2011[48] also found that the personality dimension of psychopathy was not found to predict recidivism and violence as evidenced in the theory. It is important to note that, while a few of the studies in this article show a relationship between those with psychopathy having a history of ADHD or currently meeting criteria for ADHD, the majority of people in the United States with ADHD do not go on to be diagnosed with a severe personality disorder such as antisocial personality disorder.

5.1. Limitations

One of the most significant limitations is that the PCL-R scores were generally low across all the studies (with the exception of Semiz et al. 2008 [104]). For instance, in one study PCL-R scores were relatively low (ranging from 0 to 27) which did not allow for the identification of a specific subgroup of ‘‘psychopaths’’ [87]. Another limitation of the literature to date is that less than half the identified studies included females (10 out of 22). In studies which do include females, the numbers are relatively small. This is important to address, particularly given that little is currently understood about female psychopathy and the specific treatment needs of this group [45;116]. Additionally, in studies which relied on self-report (i.e., [89]) there is the possibility that some degree of underreporting of antisocial behaviours and over-reporting of symptoms of mental illness can occur. Lastly, differences between offenders (compared to individuals in the general population) may be confounded by numerous factors independent of personality traits or levels of aggression. Across studies there are a number of variations including differences in phenotypical characterisation, methodologies and interpretation [117]. Finally, there is the potential for psychopathic individuals to be more likely to be apprehended during or subsequently detected of criminal activity than non-psychopathic individuals committing the same criminal acts simply because of their personality differences. This may be a contributory factor to the high proportion of psychopathic prison inmates.

5.2. Clinical Implications

The findings in this review have important implications for clinical practice. It highlights the need to obtain, not just a history of childhood ADHD symptoms, but the need to investigate the possible existence of neurodevelopmental disorders (such as ASD and ADHD symptoms) in adult offenders. Such understanding as to the comorbidity of neurodevelopmental with antisocial behaviours is useful for timely diagnosis and is crucial for informing appropriate treatment in offender populations [103].

The study by Kaplan and Cornell (2004) [60] also highlighted another important clinical issue. They found that juvenile offenders with a history of psychostimulant medication had higher scores on Factor 2 of the PCL:YV. They suggest one of the reasons for this is that young people with psychopathy may actually display such a high extent of impulsive and disruptive behaviour that mental health specialists misdiagnose these individuals with ADHD and subsequently treat this behaviour with medication [60] which is obviously not entirely appropriate for this group. Despite the shared symptoms between psychopathy and ADHD, the use of the PCL:YV significantly increased the ability to identify violent behaviour in male juvenile offenders compared with the predictive ability of the ADHD indicators [60].

Given that some studies identified in this review suggest

some association between neurodevelopmental disorders and psychopathy, offenders should undergo routine screening for neurodevelopmental disorders such as ASD and ADHD to identify those who would benefit from a more thorough comprehensive assessment [93] in order to examine the factors which mediate offending behaviour [118]. Psychopathy is notoriously regarded as an untreatable condition. However, the possible association between psychopathy and neurodevelopmental disorders, such as ADHD and ASD, suggests that the implementation of specific treatment paths needs be explored in this group to reduce recidivism [48,81,100]. A recent review draws attention to the possibility that interventions which are specific and tailored to the individuals and take into account the unique patterns of behavioural conditioning and predispositions in the individual with psychopathy, may have an impact on recidivism [45].

The importance of more research conducted into the field identified in this review is becoming increasingly recognised. For instance, the acronym ESSENCE (Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations) has been used to describe the early symptoms of the frequently over-lapping disorders which include ADHD, Oppositional Defiant Disorder (ODD), tic disorder, Developmental Coordination Disorder (DCD), and ASD [119]. Longitudinal studies of children with a range of ESSENCE disorders indicates that these conditions tend to persist into adulthood [120-122]. ESSENCE, as a concept, emphasises that is crucial that there is a shift away from 'compartmentalising syndromes' in child through to adult psychiatry into different "boxes" ("ADHD-box") or separate entities which are completed independent of each other. It advocates the need for health care professionals to be attentive to all neurodevelopmental symptoms, as well as psychopathy traits, which may impact on the individual in different ways. Treatments do not address patient heterogeneity with a one-method-fits-all approach taken. Patients' needs are much more complex and varied than current treatment suggests. There is a need to accommodate the individuality of the patient and more studies, like the ones discussed in this review, need to be carried out to further explore the impact, interactions and relationships between the disorders that exist in forensic populations.

5.3. Clinical Importance of the Present Review

This review clearly highlights the importance and need to routinely screen prisoners for ASD and ADHD to identify those individuals who would require further more comprehensive assessment in order to investigate which individuals fulfil the diagnostic criteria for ADHD and associated problems. The findings from one of the studies identified in this review found that psychiatric morbidity was very common among prisoners [93] which is consistent with the findings across all the studies identified in this review overall. Indeed, the study by Einarsson and colleagues [93] found that the ADHD symptomatic group was significantly more likely compared to the other prisoners who were not ADHD symptomatic to fulfil the diagnostic criteria for at least one of the disorders on Mini International Neuropsychiatric Interview (MINI; [121]). Ninety-six percent of the ADHD symptomatic group were found to fulfil the diagnostic criteria for at least one mental disorder compared to 79% of those who did not have a diagnosis of ADHD. Moreover, Einarsson and colleagues [93] also found that the single most powerful predictor of fulfilling the diagnostic criteria of full or partial symptoms of adult ADHD was ASPD ([93]). Lastly, Black et al. 2010 [89] found that antisocial offenders with ADHD are at increased risk for suicidal behaviour. Despite relatively little study into the association of ADHD in adults with ASPD, there has been some follow-up studies of ADHD which have found that the co-occurrence of ADHD and ASPD is a significant predictor of earlier onset of both addictive behaviours and criminality (e.g., [122,123]).

Overall conclusions from many of the studies identified in this review, is the clinical importance that ADHD is recognise early and that individuals are offered appropriate and effective treatment as soon as possible (e.g., [94]). As the study by Westmoreland et al. 2010 [110] also emphasised that ADHD is common in offenders and is associated with comorbid disorders, a poorer quality of life and an increased risk for suicidal behaviours. Given these findings, a prisoner presenting with ADHD is therefore more likely to 'require more intensive mental health services' [110].

5.3.1. Comorbidity between the Inattention And Impulsivity Components of ADHD and Psychopathy

Another important clinical consideration is the comorbidity between the inattention and impulsivity components of ADHD and psychopathy. The overall findings from the four studies (of the 22 studies) identified in this review which explored sub-types of ADHD in relation to psychopathy, levels of aggression, criminality, etc, indicates that the ADHD-hyperactive type or ADHD combined type are much more related and overlap with psychopathy compared to the ADHD-inattentive type. In a sample of children, Colledge & Blair (2001) [124] carried out partial correlational analyses on the components of ADHD and psychopathy and findings highlighted that the relationship between ADHD and psychopathy is a potentially complex one. The association which was found between ADHD and psychopathic tendencies was mainly the result of the intercorrelation of the impulsivity component of ADHD and the Impulsivity and Conduct (I/CP) problems component of psychopathy (i.e., the anti-social behaviour component). This intercorrelation cannot be explained by an overlap of items for the two components. There was no association found between the Impulsivity and Conduct (I/CP) problems component of the Psychopathy Screening Device (PSD, [125]) and the inattentive component of ADHD (independent of its association with the impulsivity component of ADHD). In sum the study indicated that the level of a young child's impulsivity difficulties is a significant predictor of the conduct problem component of psychopathy which highlights the importance of identifying ADHD and it

subtypes as early as possible and implementing appropriate intervention when required. Consistent with the theory that there exists multiple developmental routes to conduct problems (e.g., [126]), the conduct problem component of psychopathy was found to be associated, independently, to the impulsivity component of ADHD and also the callous/empathic component of psychopathy [124]. Consistent with the findings of Colledge and Blair (2001) [124], Babinski et al. (1999) [127] study showed that early conduct problems and hyperactivity-impulsivity were significant predictors of later criminal involvement. Conduct problems and hyperactivity-impulsivity were significant predictors of later criminal involvement both independently and when they were combined. The symptoms of inattention, on the other hand, were not found to be involved in the risk for criminal involvement.

Colledge and Blair (2001) [124] findings of the partial correlations provide support to theories positing the existence of multiple developmental routes to the display of antisocial behaviour (e.g.,126). The findings of Colledge and Blair (2001) [124] do not support the theory that there exists a common pathological basis to both ADHD and psychopathy or even a common pathological basis to the impulsivity component of ADHD and the Impulsivity and Conduct (I/CP) problems components of psychopathy [124]. Moreover, Kaplan and Cornell (2004) [60], one of the studies identified in this review, did not find evidence to support a strong link between PCL:YV scores and ADHD indicators. This finding is not consistent with the theory that there is a developmental pathway which leads from inattention and impulsivity to psychopathy and they urge clinicians involved with the juvenile justice system to exert caution when hypothesising a causal link between psychopathy and ADHD. Kaplan and Cornell (2004) [60] identified a modest overlap in symptoms in their study. If psychopathy was a developmental consequence of hyperactivity and impulsivity this overlap/relationship would be much stronger than the modest one found by Kaplan and Cornell (2004) [60].

In sum, studies investigating the potential association between psychopathy and ADHD are clinically important in furthering our knowledge and understanding of the developmental processes underlying psychopathy. Such study may also aid clinicians in identifying timely and appropriate interventions for young children who are displaying features of psychopathy. There is a need for further studies exploring the association between psychopathy and ASD

5.4. Future Directions

Establishing whether ADHD actually is a prerequisite to psychopathy, a view supported by Lykken (1995) [128] and Newman et al. (2005) [129], requires further investigative studies. Additionally, there is a paucity of studies which have investigated the psychopathic individual's response to treatment, particularly in regard to treatment in offender groups where violent behaviour/recidivism is an outcome [45]. Given that the majority of studies identified in this review involved psychopaths who leaned more towards the lower end of the psychopathy scale, further research is needed which includes a greater number of very high scoring psychopaths. It is possible that stronger associations may be found between neurodevelopmental disorders and psychopathy in this higher scoring group. The study could also look at three groups of psychopaths (low scoring, medium scoring and high scoring) to see if there are any interesting differences.

This review, as has previously been pointed out by others [117], highlights the need for further research into the means of assessing the relationship between psychopathy, neurodevelopmental disorders and aggressive, criminal behaviours - with the aim of identifying individual causes of criminal behaviour and developing appropriate remedial and avoiding treatments. The social, community and financial benefits from the evaluation and treatment methods that such research could yield is potentially immense [117].

Other useful directions for future research would be to include psychophysiological markers of psychopathy to provide some information on the individual's reactivity in response to distress cues (for a very good summary see [129]) or impaired aversive conditioning [130]. There is also the need for further study using much larger samples (for power) and also to enable a 'comprehensive subtype analysis' which could also be complemented with additional data on the psychometric details of disorder(s) in the individual [116]. This would also provide the basis for developing further research to deepen our understanding of what subgroups of offenders may be more amenable to interventions and treatments, Lastly, another area which requires additional research is identifying the influence that cultural factors may have, as well as investigating whether certain rare comorbidities, such as ASD and psychopathy, increase the likelihood of offending

5.5. Conclusion

Understanding the comorbidity and relationship between all these disorders has important clinical and forensic implications for sentencing, placement, diversionary initiatives and the most appropriate and effective treatment programmes as well as for risk assessment for future violence.

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Conflicts of Interest Statement

CA has no conflicts of interest to declare. DC was involved in developing the new assessment of psychopathic personality disorder - the Comprehensive Assessment of Psychopathic Personality (CAPP).

Authors' Contributions

CA conducted the systematic review and wrote the paper. DC was the project supervisor.

Appendix A

Table 1. Table 1 contains details on the age of the sample used, the size of the sample, diagnostic features of the sample and the nature of the crime, the aim of the study and the main findings of each of the 22 studies identified in this review.

Table 1. Details of the twenty-two studies identified in this review which investigated the rate and/or relationship of neurodevelopmental disorders and psychopathy in their forensic sample population without relying on previous childhood diagnosis of neurodevelopmental disorders such as ADHD and ASD.

Author(s)	Age of the Sample	Sample Size	Diagnostic Features of the Sample and Nature of Crime	Aim of the Study	Findings
Anckarsäter 2005 [87]	Not included	89	Perpetrators of severe violent and sexual crimes 18 of the 89 offenders subjects had a history of an ASD (5 cases had autism; 3 had Asperger syndrome & 10 had atypical autism). A global IQB/85 was registered in 37, 17 of whom had IQB/70 18 had a tic disorder (Tourette syndrome in five) 39 had ADHD (in remission in 13) 24 had developmental coordination disorder 48 had met the criteria for conduct disorder in childhood. The PCL-R scores were relatively low, ranging from 0 to 27, and do not allow the identification of a specific subgroup of 'psychopaths'	To investigate, in a cohort of violent offenders, the possibility of common signs and symptoms of childhood-onset neuropsychiatric disorders and personality disorders, in particular psychopathy	Factor analysis identified four higher-order problem constellations: Executive Dysfunction, Compulsivity, Social Interaction Problems and Superficiality. The constellation of Executive Dysfunction problems resembled established criteria for ADHD. The constellations representing Compulsivity and Social Interaction Problems reflected autistic features. Superficiality was a distinct aspect of ADHD (although not part of the diagnostic ADHD criteria) and psychopathic traits, particularly the PCL-R factor reflecting interpersonal callousness. The numerous aspects of psychopathy were associated with executive dysfunction and empathy deficits were associated with superficial understanding of self, others and the rules of communication. Although Asperger symptoms/autistic traits showed a positive correlation with PCL-R scores, the superficiality that is characteristic for psychopathy could be disentangled from the social disability in ASD by 'means of operational criteria'
Black *et al.* 2007 [88]	BDP Present (n = 65) - 29.5 (7.3). BDP Absent (n = 155) - 31.7 (10.1)	220 offenders entering Iowa's prison system (198 men, 22 women)	Borderline personality disorder (BPD) was present in 65 (29.5%) participants Of the 9 individual items, the most prevalent was impulsivity with 191 offenders exhibiting this (86.8%), followed by inappropriate anger (62.7%), unstable mood (47.7%), suicidal thoughts/behaviour (31.8%), paranoid ideation (28.7%), interpersonal problems (24.6%), feeling empty (22.3%), efforts to avoid abandonment (19.1%), and identity disturbance (10.0%). 15 offenders (6.8%) reported no symptoms.	To estimate the rate of BPD in male and female offenders newly committed to the Iowa Department of Corrections Additionally, to compare clinical and demographic characteristics of offenders with and without BPD	Compared to offenders without BPD, offenders with BPD had worse quality of life as assessed using the Medical Outcome Survey Short Form 36 Health Survey. They exhibited higher rates of ADHD, mood, anxiety, psychotic, and eating disorders and antisocial personality disorder (ASPD). Almost 30% of offenders (male and female) assessed met the criteria for BPD. More than 90% exhibited at least one self-reported BPD symptom, the most frequent being impulsivity, followed by displays of inappropriate anger, transient paranoid ideation, unstable mood and suicidal thoughts/behaviours. Almost 57% of offenders with BPD also met the criteria for ASPD Psychiatric comorbidity in sample with and without BPD: BDP Present (n = 65) - ADHD 41.5% BDP Absent (n = 155) - ADHD 16.1%

Black *et al.* 2010 [89]	Mean age (SD) ASPD status Present (n = 113) : 29.3 (8.3) ASPD status Absent (n = 207) : 32.1 (10.0)	320 (264 men, 56 women)	*ADHD sub-analysis* Authors carried out sub-analysis comparing 37 antisocial offenders with ADHD to 75 individuals without ADHD. Therefore, 33% of antisocial offenders had comorbid ADHD	To investigate the frequency of ASPD in offenders. Demographic characteristics, psychiatric comorbidity, and quality of life in those with and without ASPD was also investigated.	ASPD was found in 113 participants (35.3%) No gender-based prevalence difference Those with ASPD were younger, had a higher suicide risk and also higher rates of ADHD. mood, anxiety, substance use, psychotic, somatoform disorders and BPD. Quality of life was worse, and their LSI-R scores were higher, indicating that they are a higher risk of recidivism. Sub-analysis found that offenders with ASPD with comorbid ADHD had a greater risk of suicide, increased rates of comorbid disorders, and more impaired mental health functioning. Sub-analysis on antisocial offenders with and without ADHD showed that those with ADHD were more severe. ASPD status Present (n = 113) : ADHD 33.6% ASPD status Absent (n = 207) : ADHD 15.0%
Boots & Wareham 2010 [90]	Boys & Girls Sample divided into four age periods that reflect different stages of human development during childhood and adolescence. Middle childhood for ages 7–9 (chunk 1; M = 8.64 yrs), late childhood for ages 10–12 (chunk 2; M = 11.65 yrs), early adolescence for ages 13–16 (chunk 3; M = 14.68 yrs), & late adolescence for ages 17–19 (chunk 4; M = 17.68 yrs).	No details given	Self-reported violence using a community-based sample of Chicago youths from the Project on Human Development in Chicago Neighborhoods	To expand on work by Boots (2008) [91] who used Pittsburgh Youth Study (PYS) data to investigate the relationship between mental health and offending in the youngest cohort of PYS boys from middle childhood through to late adolescence	Results suggested that affective/depressive, anxiety, ADHD, and oppositional defiant/antisocial personality problems independently predicted violence Unexpectedly, the presence of comorbid mental health problems was not a critical component in predicting violence in the sample. At any stage of development, when exploring comorbidity, only oppositional defiant and antisocial personality problems significantly predicted violence
Dåderman & Jonson 2008 [92]	Mean age of 38.7 years (standard deviation, s = 5.9 years, range 30-51 years)	10 violent male forensic psychiatric rapists	6 of the 10 participants were extremely violent rapists (i.e. the rapes were extremely drawn out and sadistic) All but one had a DSM diagnosis of	To describe the 10 violent male offenders on a set of Rorschach variables, which are considered to represent psychopathic character, to further our understanding of rapists	Participants did not meet criteria for psychopathic character. At least 7/10 participants met 11/31 criteria. Participant no. 10 was a dangerous violent psychopath who demonstrated high scores on the PCL-R (unpublished data) and

			personality disorder (3 had ASPD & 2 had BPD) 7 of the 10 participants had dyslexia and 6 had ADHD		who also had a diagnosis of ASPD; he failed to meet the criteria for a psychopathic character Overrepresentation of dyslexia and ADHD was found in the participants. 7 of the 10 participants had dyslexia and 6 of them had ADHD
Einarsson *et al.* 2009 [93]	31 years (standard deviation, s = 9.8), ranging between 19 and 56 years	90 male prisoners	On clinical screening, 50% of the prisoners met the criteria for ADHD in childhood and of those over half (60%) were either fully symptomatic or in partial remission All Icelandic (Caucasian) and were predominantly serving sentences for property offences (52%), traffic violations (42%), drug offences (28%), violent offences (17%) & sex offences (7%)	To investigate the relationship between ADHD symptoms and associated psychiatric conditions among prisoners.	Model showed that the odds of an inmate meeting ADHD symptomatic criteria was four times higher if the inmate also met the diagnostic criteria of ASPD based on the MINI [Wald 4.49 ($p<0.05$), Odds Ratio = 4.08, 95% CI 1.11-14.95]. Overall correct classification was 71.9%. Study findings also showed that it is ASPD which drives offending behaviour in individuals with ADHD
Ginsberg *et al.* 2010 [94]	Mean age of ADHD prison group: 34.4 (10.67) Mean age of ADHD psychiatry group: 33.4 (8.65) Mean age of control group: 35.2 (9.85)	30 inmates for ADHD and coexisting disorders 20 adult males with ADHD, and 18 healthy controls	The sample is taken from a prison which predominantly holds longer-term inmates, who are typically convicted of crimes as a result of drugs or violence The psychiatric outpatient study group includes 20 adult males with ADHD, 18 of which diagnosed with ADHD of the combined type, & 2 with the predominantly inattentive subtype. SCID I, SCID II PQ, or PCL-R was not conducted on the ADHD psychiatric outpatients Of the prison group: 3 (10%) scored equal or greater than 30 on the PCL-R Of the prison group: 7 (23%) had an ASD diagnosis	1). To estimate the prevalence of ADHD among longer-term inmates of a high-security Swedish prison 2). To describe ADHD, coexisting disorders, and executive functions among prison inmates 3). To compare the findings from the above with ADHD psychiatric outpatients and healthy controls	Estimated prevalence of adult ADHD among longer-term inmates was 40%. Only 2 of the 30 inmates confirmed with ADHD had obtained a diagnosis of ADHD during childhood Psychopathy was present among only one tenth (fewer than expected), as all but one participant displayed ASPD. ASD (mainly PDD-NOS) was found in nearly one fourth of ADHD inmates Diagnostic evaluations for ADHD among 30 inmates found them to be severely disabled as a result of ADHD and comorbid disorders (such as SUD, ASD, personality disorders, mood and anxiety disorders). The inmates with ADHD exhibited more impaired executive functions (which existed even when controlling for IQ) when compared to both the psychiatric outpatients with ADHD and the healthy control group
Gudjonsson *et al.* 2013 [95]	Most of the participants (80.1%) were 16 to 18 years.	295 Icelandic students 136 (46.4%) males and 157 (53.6%) females (2 did not reveal their sex)	295 students from four educational establishments in Iceland.	To examined the relative importance of ADHD symptoms, mood instability, and ASPD traits in predicting self-reported offending	Self-reported offending (with the Mak Total Offending Score and RATE Antisocial Behavior Scale) was significantly correlated with ADHD symptoms (BCS), mood instability (the RATE Emotional Control Scale), and antisocial personality traits (the Gough Socialization Scale). The effect sizes were mainly medium to large. Antisocial personality traits were the single best predictor ($\beta = -.408$), and they partly mediated the effects of ADHD symptoms. Antisocial personality traits was the most powerful single predictor of "general" offending, followed by ADHD symptoms. Entering mood instability into the regression had no significant

					incremental effect. Entering antisocial personality traits mediated nearly half of the effect of ADHD symptoms on offending.
Gunter *et al.* 2008 [96]	Female (n = 56) - Mean age : 31.1 (8.5) Male (n = 264) - Mean age : 31.1 (9.7)	20 randomly selected individuals newly committed to the general population of the Iowa prison system	Substance use disorders (90%), mood disorders (54%), psychotic disorders (35%), ASPD (35%), and ADHD (22%) Did not include violent offenders, those needing special programming (e.g., close supervision, segregation), or those requiring maximum security	To investigate the prevalence of current and lifetime mental and addictive disorders in offenders recently committed to the Iowa Department of Corrections (IDOC), by using the Mini International Neuropsychiatric Interview-Plus (MINI-Plus)	Although rates of ASPD and ADHD were greater in the males, the difference was not statistically significant. ADHD in female sample (14.3%). ADHD in male sample (23.1%) ASPD in female sample (26.8%) ASPD in male sample (37.1%)
Hofvander *et al.* 2011 [97]	Outpatients group - 178 subjects (98 men, 80 women, median age 31.5, range 19-59) Perpetrator group : 92 subjects (85 men, 7 women, median age 30.0, range 17-76)	Outpatients referred for psychiatric evaluations of childhood-onset neuropsychiatric disorders (n=178) and perpetrators of violent crimes referred to pre-trial forensic psychiatric investigations (n=92)	In perpetrator group, 46 (50 %) had childhood-onset neurodevelopmental disorder (ADHD and/or ASD), 17 met criteria for an ASD (4 autism, 3 Asperger syndrome, and 10 atypical autism), 38 with ADHD (6 predominately AD, 6 predominately HD, and 26 in combined form), 42 had a mood disorder, 16 met criteria for a psychotic disorder, 49 had an alcohol abuse disorder, 29 had a substance abuse disorder, and 38 had a PD	To test the following hypotheses: 1). That outpatients with ADHD and/or ASDs would have high scores on the Life History of Aggression (LHA) scales, similar to the violent offenders 2). That high LHA scores would be specifically associated with hyperactivity symptoms, CD, and substance abuse in both groups 3). That high LHA scores is associated with disordered personality profiles (with explosive temperaments and low character scores) in the two groups	Findings showed that hyperactivity, not attention deficits, was the marker for greater risk of aggression associated with ADHD. This indicates that hyperactivity (even independently from CD) actually carries an increased risk for aggression LHA scores and attention deficits (except the Self-directed aggression subscale), hyperactivity, and CD before 15 years of age were all found to be significantly correlated ASD symptoms were found to have a non-linear relation to LHA in both groups. Lower ASD symptom rates were correlated with higher LHA scores in the outpatient group (with the exception of Self-directed aggression in the outpatient group) - in the forensic group the opposite was found No clinical disorder variables (depression, bipolar disorder or psychotic disorder) exhibited a significant relation to any of the LHA scores. Other definitions of PDs did not increase the predictive ability of adult life aggression in the presence of the behavioural predictors reported in this study
Kaplan & Cornell 2004 [60]	Ages 13 to 18 years,with an average age of 16.0 years (SD = 1.13)	122 incarcerated male juvenile offenders	64% had a recorded violent offence & 15% had a history of sexual offending 25% of participants had a recorded clinical diagnosis of ADHD, 32% had oppositional defiant disorder, 61% had conduct disorders, and 33% had a mood disorder. 24% had a comorbidty of ADHD and conduct disorder, and another 6% had a comorbidity of ADHD and oppositional defiant disorder	To investigate: 1). What is the relation between ADHD and ratings of youth psychopathy? 2). How does the presence of ADHD influence the relationship between psychopathy and violent behaviour?	Weak association between ADHD and psychopathy found which indirectly supports the discriminant validity of the Psychopathy Checklist: Youth Version (PCL:YV). Despite overlap in symptomatology between psychopathy and ADHD, inclusion of PCL:YV scores increased the identification of violent behaviour in male juvenile offenders over and above the prediction made by ADHD indicators which, by themselves, were not able to show any significant predictive ability The construct of juvenile psychopathy as assessed by the PCL:YV contains important information which was not included in the ADHD measures
Langevin 2006 [98]	Average age of 35.6 years (SD = 12.4, range = 13-82)	778 male sex offenders from a forensic database	70 exclusive genital exhibitionists, 323 extrafamilial child sexual abusers (138 homosexual, 137 heterosexual, and 48 bisexual paedophilic	To investigate the desire for, acceptance of, and completion of treatment in sexual offenders. Demographic and clinical features found to be significant in the literature were	The Hare (1991) [99] 20-item PCL-R was delivered or a version was reconstructed based on the offender's file. A minimum of 15 items was accepted as criterion for inclusion. The offenders that were more likely to enter treatment were the

			offenders) who committed sexual crimes involving boys and girls under the age of 16, 145 courtship disorders (128 charged with sexual assault or rape and 17 cases charged with a combination of prowl by night or trespassing reflecting voyeurism, exhibitionism, and/or sexual assault), 219 incest offenders (32 homosexual, 174 heterosexual, & 13 bisexual, all involved victims under the age of 16), & 21 mixed offenders who victimised both adults & children Of the total of 778 offenders, 11.6% were considered to be psychotic and 13.4% with ASPD Only 313 cases had sufficient information to examine the issue of ADHD. 11.8% were diagnosed of ADHD Only 9.2% of the PCL-R scores were 30 or more, which is Hare's (1991) [84] categorical definition of psychopathy	investigated in reference to treatment variables	offenders who were exhibitionists or substance abusers or who scored higher on psychopathy, ADHD, or learning difficulties or had head injuries. However, there were no differences in the treatment completion between offenders who scored low or high on the psychopathy measure
Langevin & Curnoe 2010 [100]	Average age: 35.30 years of age (range, 12–84; standard deviation [SD] = 12.91)	1,695 adult male sexual, violent, and nonviolent offenders	1,520 sex offenders and paraphilics (SOP group) and two comparison groups: 133 violent non-sex offenders (VNS), and 42 non-violent non-sex offenders (NVNS) from the same clinics	To investigate the relationship of PCL-R, ADHD, and a numerous brain dysfunction measures in a forensic sample of sexual offenders and a control group	In psychopaths, compared to non-psychopaths, ADHD and brain dysfunction were significantly more common. An ADHD diagnosis was correlated 0.33 with total PCL-R score and 0.13 with factor 1 and 0.44 with Factor 2. ADHD correlated with facets 1 to 4, respectively, .13, .11, .36, and .41. Given that Factor 2 and Facets 3 and 4 include items on impulsiveness, need for stimulation, and early behavioural problems, characteristic features of ADHD cases, in addition to shared persistent criminal activity this correlation is unsurprising 12.86% of cases were given a diagnosis of ADHD in childhood, which is nearly twice that expected for the general male population Diagnosis of childhood ADHD were more common in the psychopathic group proper (PP) - they were more than five times the percentage of ADHD cases than that in the non-psychopathic group (NP), whose prevalence was similar to the general population (7.48% versus 7.00%) NP = Nonpsychopathic Group BP = Borderline Psychopathic PP = Psychopathic Group Proper 71.26% of the offenders scored 20 or less (NP group), 19.70%

					scored between 21 and 29 (BP group), and 9.03% scored 30 or more (PP group)
Langevin & Curnoe 2011 [48]	Mean age 35.30 years of age (range 12 to 84; SD = 12.91)	1,695 adult male sexual, violent, and nonviolent offenders	1,520 sex offenders and paraphilics (SOP group), 133 violent non-sex offenders & 42 nonviolent non-sex offenders all from the same clinics Details on subgroup classification of cases is described elsewhere (Langevin & Curnoe, 2008) [86]. This detail was not included in this paper	To investigate which is the best predictor of recidivism among sex offenders: psychopathy, ADHD, brain dysfunction, or a combination of these variables	The PCL-R was the strongest predictor of overall recidivism. Specifically, it was the PCL-R items on criminal history that were associated with recidivism. General recidivism was mainly associated with past criminal history and secondarily with learning disorders and ADHD Using Hart, Forth, and Hare's (1990) [87] criteria, scores of 0 to 20 were assigned to a non-psychopathic group (NP), 21 to 29 to a borderline psychopathic group (BP), and 30 to 40 to a psychopathic group proper (PP). ADHD diagnoses were based on childhood ADHD obtained either from offender report, hospital records or report from family The findings raise the question about whether the adult psychopath is actually an ADHD, brain-dysfunctional, or LD child raised in a dysfunctional family environment who also has a significant adult criminal history. The personality dimension of psychopathy was not found to predict recidivism and violence as evidenced in the theory
Pondé *et al.* 2011 [103]	Age of the prisoners in a closed system ranged from 20 to 63 years with a mean of 33 (SD = 8.5) years. In the semi-open system, age ranged from 19 to 65 years with a mean of 29.5 (SD = 7.8) years. All males	290 prisoners, were interviewed in the closed prison system; and 207, representing 58.5% of the total population, in the semi-open system.	See last column for findings relating to this.	To get information on the psychiatric profile of prisoners in the state of Bahia, Brazil using a semi-structured survey based on the DSM-IV diagnostic criteria	Prevalence rates of psychiatric disorders obtained in the closed and semi-open prison systems, respectively, were: depression 17.6% and 18.8%; bipolar mood disorder 5.2% and 10.1%; anxiety disorders 6.9% and 14.4%; borderline personality disorder 19.7% and 34.8%; antisocial personality disorder 26.9% and 24.2%; alcohol addiction 26.6% and 35.3%; drug addiction 27.9% and 32.4%; psychosis 1.4% and 12.6%; ADHD in childhood 10.3% and 22.2%; and ADHD in adulthood 4.1% and 5.3%
Semiz *et al.* 2008 [104]	Age 20-36 years Mean age : 22.7 (SD = 2.9) years	105 adult male offenders	92% of the participants (n=97) reported self-injurious behaviour (SIB) Of the 105 ASPD participants, 42 (40%) met DSM-III-R criteria for at least one other axis II disorder, including borderline (n=18), narcissistic (n=17), paranoid (n=11), histrionic (n=9), & passive aggressive (n=3) personality disorders. 68 participants (65%) met DSM-IV	1). To define the relationship between DSM-III-R ASPD and psychopathy scores (based on the PCL-R) with comorbid diagnosis of ADHD (ADHDc) and dimensional ADHD symptoms (ADHDd) in a group of male offenders 2). To investigate the relationship between ADHD and SUD, SIB, & recorded suicide attempts and criminal behaviours 3). To examine the relationship of ADHD measures with history of social and familial	ADHDd symptoms were found to be correlated with PCL-R scores, suggesting a greater severity of psychopathy with increased symptom loading. 65% of the individuals with ASPD fulfilled the criteria for ADHDc diagnostic comorbidity with significantly higher rates of childhood neglect, parental divorce and suicide attempt, but not higher rates of psychopathy ASPD participants with ADHDd symptoms were found to have earlier onset and higher rate of self-injurious behaviour (SIB), suicide attempt, and psychopathy. The psychopathy scores were predictive of earlier onset of SIB and behavioural problems

			ADHDc diagnostic criteria; the most common subgroup was combined type (n=33, 49%), followed by inattentive (n=22, 32%) and hyperactive-impulsive (n=13, 19%) types, respectively. Mean PCL-R score was 29.0 (SD = 4.2, range=19-38, median =29). 37 patients (35%) had a PCL-R total score equal to/or greater than 30, indicating severe cut-off for psychopathy	adversity (such as parental divorce, childhood physical and emotional abuse and neglect, sexual abuse)	ADHDc diagnostic comorbidity (combined, inattentive, or hyperactive-impulsive Subtypes) ADHDd dimensional symptoms PCL-R Total, Factor 1 and Factor 2 scores were not found to differ significantly across the three ADHDc subtypes (p=0.35, p=0.28, p=0.37, respectively)
Soderstrom *et al.* 2004 [105]	92 males & 8 females, aged 17–76 (median 30) years, had been included.	100 participants	Participants - perpetrators of severe violent or sexual index crimes (murder/manslaughter in 21 cases, attempted murder/manslaughter in 17, aggravated assault in 17, aggravated unlawful Threat/robbery in 6, rape in 3, sexual child abuse in 22 and arson in 14). 5 participants met DSM-IV criteria for autistic disorder, 3 for Asperger syndrome, and 10 for ASD NOS. 39 participants had ADHD (13 in remission) and 18 had a current tic disorder (Tourette syndrome) 4 reported childhood tics. 23 had DCD.	1). To investigate the comorbidity between childhood and adulthood disorders among 100 perpetrators of violent crimes based on file reviews, structured interviews, clinical assessments and neuropsychological assessments 2). To identify the lifetime psychiatric profiles which are more strongly associated with higher levels of both aggression and criminal recidivism	PCL-R ratings were conducted in all 100 participants. The cluster of hyperactivity, CD, and PCL-R total and behavioural scores was identified as the psychiatric problem constellation most closely associated with crime and aggression Childhood-onset neuropsychiatric disorders - ADHD, learning disability, tics and ASDs - were found in 55% of the participants and formed complex comorbidity patterns with adult personality disorders [including psychopathic traits according to the PCL-R], mood disorders and substance abuse. The strongest psychiatric covariates to both high Lifetime History of Aggression (LHA) scores and violent recidivism were the PCL-R scores and childhood conduct disorder (CD) Behavioural and affective PCL-R factors were associated with childhood ADHD, CD and autistic traits Compared to the general population, childhood-onset neuropsychiatric disorders were significantly greater in this studies sample: ADHD 39/100 (39%) versus 15/409 (3.7%) $p<0.001$, ASDs 18/100 (18%) versus 10/826 (1.2%) $p<0.001$, tic disorders 18/100 (18%) versus 17/435 (3.9%) $p<0.001$. PCL-R scores were typically low (range: 0 to 27 points on the 40-point scale). The median score was 8.
Soderstrom *et al.* 2005 [106]	92 men and 8 women, aged between 17-76; median, 30 years.	100 - All were under prosecution for severe violent and/or sexual crimes and underwent forensic psychiatric investigation by court order.	Major mental disorders (n = 100), childhood-onset disorders (n = 100), and personality disorders (PD) (n = 74) 55% met the diagnostic criteria for one or several childhood-onset neuropsychiatric disorders: autism in 5%, Asperger's syndrome in 3%, atypical autism in 10%, Tourette's syndrome in 5%, chronic tics in 13%, ADHD in 39%, and mental retardation in 17%. 3 participants had	To investigate the degree to which the features and problems assessed by the PCL-R correlate with DSM-IV diagnostic definitions of mental and personality disorders with the aim of identifying possible unique features for psychopathy	Total PCL-R scores and also Factor 2 (unemotionality) and Factor 3 (behavioural dyscontrol) scores were found to be correlated significantly with ADHD, Asperger's syndrome/high-functioning autistic traits, CD, substance abuse, and the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Cluster B personality disorders. No such correlations were found with interpersonal Factor 1. It may capture features that are specific to psychopathy, enabling the distinction of core psychopathy from other diagnostic definitions The strongest positive associations to the PCL-R were substance abuse, ADHD, CD, autistic features, and Cluster B personality disorders. The only PCL-R factor not association with any of these

			DCD (overall present in 23%), and 14 had CD as main childhood-onset diagnosis (overall present in 48%) PCL-R scores were generally low (ranging from 0 to 27 points, median, 8) All participants were under prosecution for severe violent and/or sexual crimes		conditions was interpersonal Factor 1, which comprises of the superficial, vicious, and manipulative traits which correspond to the commonly known concept of a 'true psychopath' Hyperactivity disorder criteria in childhood was the only significant covariate to the total PCL-R scores ($p < 0.001$) and to the behavioural Factor 3 $p < .001$) Affective Factor 2 was covaried with attention-deficit criteria in childhood ($p < .001$) The problem constellation found to be most associated with violent crimes (ADHD, CD/ASPD, and the behavioural and emotional facets of psychopathy) includes problems in attention, behaviour inhibition and emotional processing across the life span
Torgersen *et al.* 2006 [107]	34 men and 11 women. Mean (9/standard deviation) age was 28.3 (SD = 6.4), range 17-46 years.	45 adult patients with ADHD	21 (46.7%) patients had one or more criminal sentences. 12 (26.7%) had a sentence for violence, 10 (22.2%) for theft, 8 (17.8%) for drug related crimes, and 7 (15.6%) had a sentence for drunk driving. 11 had at least 2 different types of criminal sentences. 30 (66.7%) had received psychiatric treatment as adults before being diagnosed with ADHD All met criteria for an ICD-10 diagnosis of F90.0 Hyperkinetic disorder. 44 patients fulfilled criteria for attention-deficit, 43 patients for hyperactivity and 43 for impulsivity. No clear subgroups could be identified	To examine psychiatric morbidity, comorbidity and impairment in patients with a diagnoses of ADHD and treated with stimulants during the first 5-year period after stimulant treatment was legalised for adults	A high comorbidity between ADHD and ASPD as well as alcohol and drug abuse was found. 39 patients (86.7%) had lifetime comorbid disorders as scored from the medical records by the time of receiving the ADHD diagnosis, 4 had one comorbid disorder and 35 (77.8%) had at least two. Lifetime major depression (53.3%), ASPD (44.4%), alcohol abuse (46.7%), cannabis abuse (51.1%) & amphetamine abuse (48.9%) were the most common comorbid diagnoses
Vitacco & Rogers 2001 [108]	Aged 14-18 years (All male)	79 male adolescents, who, as a result of adjudication, were placed in a maximum-security facility.	The majority of the offenders had multiple index offences (such as violent, drug related and property crimes) See final column for diagnosis as this was part of the studies outcome	1). To investigate numerous clinical constructs (sensation seeking; impulsivity; and attentional problems) as predictors of psychopathy in adolescents whose cases were adjudicated. In addition, the authors also examined whether these predictors would vary between psychopathy and conduct problems given that psychopathy is conceptualised as distinct from conduct problems 2). Study also tested components of Lynam's HIA-CP model (Lynam, 1998). This model evaluates the relative importance to adolescent psychopathy of ADHD, impulsivity, and conduct problems	Impulsivity was found to be the strongest predictor of both psychopathy and conduct problems Participants were categorised into three groups based on psychopathy scores: 40 (51.3%) low psychopathy 19 (24.4%) moderate psychopathy 19 (24.4%) high psychopathy No differences were found between level of psychopathy and sensation seeking or ADHD symptoms

Wahlund & Kristiansson 2006 [109]	Aged 15 to 71 years (All male)	35	Participants found guilty of homicide or manslaughter All given a diagnosis of either ASPD or ASD Participants were categorised into 3 groups: impulsive antisocial personality disorder (ASPDi), controlled antisocial personality disorder (ASPDc) & ASD Structured assessment of degree of psychopathy according to PCL-R was not conducted. The authors decided not to carry out psychopathy scoring retrospectively with just the file information. In the ASPD group, type of violence was defined as either impulsive or controlled. Information for this was derived from forensic psychiatric reports	To investigate the relationships between personality traits, lifetime psychosocial functioning and crime scene behaviour	Findings indicate that there may be subgroups among those with ASPD (impulsive and controlled) which are associated with specific psychosocial patterns, background histories and particular crime scene behaviour Participants with ASD more often used methods other than guns and knives compared to the participants with ASPD, 80% versus 28% ($p < .01$). Knives were more common in the ASPDi group compared to the ASPDc group, 71% versus 11% ($p < .001$). In the ASPDc participants, use of guns was more frequent compared to those in the ASPDi group, 50% versus 14% ($p < .05$). At the time of the offence, it was more common for ASPD participants to be intoxicated with alcohol and drugs than for those participants with ASD, 90% versus 56% ($p < .01$).
Westmoreland *et al.* 2010 110]	Offenders with ADHD had a mean age of 29.2 (SD = 7.9) years. Of those with adult persistent ADHD, 60 of 68 were male	319 offenders	68 participants (21.3%) had ADHD Sample did not include offenders on any kind of special supervision (i.e., violent offenders, acutely unstable offenders, probation violators, maximum security designees)	To examine the rate of ADHD as well as the demographic and clinical characteristics of male and female offenders with and without ADHD	Offenders with ADHD were more likely to report difficulties with emotional and social functioning and to have increased suicide risk scores ($p < .001$). Increased rates of mood, anxiety, psychotic, and somatoform disorders were also found in this group. There was a significant overlap between ADHD and both antisocial and borderline personality disorders; 54.4% of offenders with ADHD (versus 29.9% of offenders without ADHD) met criteria for ASPD, while almost 52% of offenders with ADHD met criteria for borderline personality disorders compared to 22.6% of offenders without ADHD In offenders with ADHD, comorbid borderline and antisocial personality disorders were significantly more common (52% & 55%, respectively)

Appendix B

Table 2. Table 2 reports the details on whether there was a statement of study funding, a conflict of interest statement, the country the study was conducted in and whether the assessors were blind during the assessment.

Table 2. Reports the features of the studies such as: whether the paper included a statement of study funding; whether it included a conflict of interest statement; the country in which the study was conducted and whether there was blinding in the assessment of the sample.

Author(s)	Statement of Study Funding	Conflict of Interest Statement	Country Study was Conducted	Blinding
Anckarsäter 2005 [87]	Supported by grants from the National Board of Forensic Medicine and the Göteborg Medical Society, Sweden. Anna-Kari Sjodin is gratefully acknowledged for expert PCL-R ratings.	Not included	Sweden	Final PCL-R ratings were made by a psychiatric social worker with special training. The rater was blind to the research diagnostic work-up and other research data.
Black *et al.* 2007 [88]	Not included	Not included	America	Not mentioned
Black *et al.* 2010 [89]	Not clear what grants funded the present study.	Dr. Black receives research/grant support from AstraZeneca and Forest Laboratories and is a consultant to Jazz Pharmaceuticals. Drs. Gunter, Loveless, Allen, and Sieleni report no financial relationship with any company whose products are mentioned in this article or with manufacturers of competing products.	America	Not mentioned
Boots & Wareham 2010 [90]	Not included	Not included	America	Not mentioned
Dåderman & Jonson 2008 [92]	Preparation of this article was supported by a scholarship awarded to Anna M. Dåderman for research into violent criminals from the Swedish Carnegie Institute. Grants from the Swedish National Board of Forensic Medicine (Rättsmedicinalverket), and in part (allowance for the authors' travelling expenses) by the St Sigfrids Hospital.	Not clear	Sweden	Not mentioned
Einarsson *et al.* 2009 [93]	Funding by the Nordic Council of Criminology.	Not included	Icelandic Sample	Not mentioned
Ginsberg *et al.* 2010 [94]	The Swedish Ministry of Health and Social Affairs, and Stockholm County Council, Sweden financially supported this study. The funding sources were not involved in the authors' work.	YG has been on the speaker's bureau and consultant for Janssen-Cilag, Novartis and Lundbeck A/S. YG has been the principal investigator of two clinical trials sponsored by Janssen-Cilag. NL has been the investigator of a clinical trial sponsored by Janssen-Cilag. TH declares no conflicts of interest.	Sweden	Not mentioned
Gudjonsson *et al.* 2013 [95]	The author(s) received no financial support for the research, authorship, and/or publication of this article.	The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.	Icelandic Sample	Not mentioned

Gunter *et al.* 2008 [96]	Study was funded in part by the Iowa State Bank through the Nellie Ball Trust.	Not specified but it does state the following: Dr. Arndt is Director, The Iowa Consortium for Substance Abuse Research and Evaluation, Iowa City, IA. Dr. Sieleni is also Director of Mental Health Services, Department of Corrections, Iowa Medical and Classification Center, Oakdale, IA.	America	Not mentioned
Hofvander *et al.* 2011 [97]	Study was supported by grants from the Region Skåne, the Swedish Research Council (VR), the National Board of Forensic Medicine, Stiftelsen Lindhaga, and Stiftelsen Professor Bror Gadelius Minnesfond.	None of the authors has interests pertaining to the results of this study.	Sweden	Not mentioned
Kaplan & Cornell 2004 [60]	Not included	Not included It does say that: Dewey G. Cornell, Ph.D directs the Virginia Youth Violence Project http://youthviolence.edschool.virginia.edu, which is concerned with research and practice in violence prevention and school safety.	America	Researchers were blind to the PCL:YV scores of the participants whose files they reviewed. A researcher who carried out the PCL:YV interview for a particular participant did not review that individual's file during the second round of file reviews.
Langevin 2006 [98]	Not included	Not included	Canada	Not mentioned
Langevin & Curnoe 2010 [100]	Not included	Not included	Canada	Not mentioned
Langevin & Curnoe 2011 [48]	The authors received no financial support for the research and/or authorship of this article.	The authors declared no conflicts of interests with respect to the authorship and/or publication of this article.	Canada	Not mentioned
Pondé *et al.* 2011 [103]	Supported by a grant from FAPESB (FAPESB／SECTI／SSP), Reference ET-06／2005.	Not included	Brazil	Not mentioned
Semiz *et al.* 2008 [104]	Not included	Not included	Current study was conducted in the psychiatry department of a military, tertiary-care health centre located in Istanbul, Turkey.	Raters who were blinded to the ADHD information of the participants conducted assessments on childhood history of abuse & neglect
Soderstrom *et al.* 2004 [105]	Study was supported by grants from the National Board of Forensic Medicine and the Göteborg Medical Society, Sweden.	Not included	Sweden	Not mentioned
Soderstrom *et al.* 2005 [106]	The study was supported by grants from the National Board of Forensic Medicine and the Göteborg Medical Society, Sweden.	Not included	Sweden	Structured Clinical Interview for DSM-IV Axis II Personality Disorders (n = 74) were made by clinical psychologists (TN, AC and their colleagues) with training for the instrument, who were blind to the Axis I diagnostic work-up, in all but 5 cases where the interview was made by HS.
Torgersen *et al.* 2006 [107]	Not included	Not included	Norway	Not mentioned

Vitacco & Rogers 2001 [108]	Not included	Not included	America	Not mentioned
Wahlund & Kristiansson 2006 [109]	Not included	Not included	Sweden	The forensic psychiatric teams were not aware of the forthcoming study, so their ratings can be regarded as independent of the authors' aim with the current study.
Westmoreland *et al.* 2010 [110]	Not included	Not included	America	Not mentioned

Key

AD: Attention Deficit

ADHD: Attention-Deficit/Hyperactivity Disorder

ASPD: Antisocial Personality Disorder

ASD: Autism spectrum disorder

CD: Conduct Disorder

DSM-IV: Diagnostic Statistical Manual fourth version.

HD: Hyperactivity Disorder

HIA: Hyperactivity–impulsivity–attention

LHA: Life History Aggression (LHA) scales

LSI-R: Level of Service Inventory–Revised (LSI-R; Andrews & Bonta, 1995).

PDD-NOS: Pervasive Developmental Disorder - Not otherwise specified (PDD-NOS).

PCL-R: Psychopathy Checklist Revised (PCL-R). [84]

PCL:YV: Psychopathy Checklist: Youth Version (PCL:YV, Forth, Hart, & Hare, 1990).

PD: Personality Disorder

PPI-R: Psychopathic personality inventory revised (PPI-R; Eisenbarth & Alpers, 2007) German version.

SIB: Self-injurious behaviour (SIB)

SUD: Substance Use Disorder

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