

Review

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Attention-deficit hyperactivity disorder (ADHD), substance use disorders, and criminality: a difficult problem with complex solutions

Abstract: The association between attention-deficit hyperactivity disorder (ADHD) and criminality has been increasingly recognized as an important societal concern. Studies conducted in different settings have revealed high rates of ADHD among adolescent offenders. The risk for criminal behavior among individuals with ADHD is increased when there is psychiatric comorbidity, particularly conduct disorder and substance use disorder. In the present report, it is aimed to systematically review the literature on the epidemiological, neurobiological, and other risk factors contributing to this association, as well as the key aspects of the assessment, diagnosis, and treatment of ADHD among offenders. A systematic literature search of electronic databases (PubMed, EMBASE, and PsycINFO) was conducted to identify potentially relevant studies published in English, in peer-reviewed journals. Studies conducted in various settings within the judicial system and in many different countries suggest that the rate of adolescent and adult inmates with ADHD far exceeds that reported in the general population; however, underdiagnosis is common. Similarly, follow-up studies of children with ADHD have revealed high rates of criminal behaviors, arrests, convictions, and imprisonment in adolescence and adulthood. Assessment of ADHD and comorbid condition requires an ongoing and careful process. When treating offenders or inmates with ADHD, who commonly present other

comorbid psychiatric disorder complex, comprehensive and tailored interventions, combining pharmacological and psychosocial strategies are likely to be needed.

Keywords: ADHD; criminality; substance use disorders; systematic review.

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Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a complex and multifactorial neurodevelopmental disorder, with an estimated prevalence of approximately 5% in children and 2.5% in adults (1, 2). ADHD is characterized by a persistent pattern of age-inappropriate levels of inattention, hyperactivity, and/or impulsivity (1, 3). Along the lifespan, ADHD is associated with a wide range of personal, familial, medical, and social complications, with significant impairment in many areas of the individual functioning, as well as high levels of comorbid psychiatric disorders (1, 4–10). Conduct disorders (CDs), including oppositional defiant disorder (ODD), anxiety disorders, and mood disorders are among the most common comorbid psychiatric disorders in children with ADHD, while mood disorders, anxiety disorders, substance use disorders (SUDs), personality disorders, particularly borderline and antisocial personality disorders are the most common concurrent disorders in adult patients with ADHD.

SUDs are among the most common comorbid psychiatric disorders in adolescent or adult patients with ADHD and vice versa (6, 11–13). While several reports have evidenced that ADHD is an independent risk factor for developing a SUD (12, 14, 15), this severe comorbidity is most likely the result of a complex interaction of various factors, such as psychiatric comorbidity, particularly CD, antisocial personality disorders, and bipolar disorders (7, 16, 17). Furthermore,

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a history of CD during childhood is the strongest predictor for later developing a SUD among children and adolescents with ADHD (17, 18).

The association between ADHD and criminality has been also increasingly recognized over the last decade and identified as an important societal concern. Indeed, a growing number of studies conducted in different settings have revealed high rates of ADHD among arrested, convicted, and incarcerated adolescents and adults (19–21). The risk for delinquent or criminal behavior among individuals with ADHD is increased when there is a comorbid CD (22, 23). In addition, ADHD increases the risk for developing antisocial personality disorders and SUD in adolescence, which, in turn, increases the risk for criminal behavior in adolescence and adulthood (24). The risk for nonviolent and violent delinquency among adolescents or adults with ADHD is further increased by the coexistence of a SUD (25, 26). Conversely, children with ADHD who exhibit high rates of delinquency are at risk for later developing a SUD (22).

To sum up, there seems to be a complex and not fully understood relationship between ADHD, comorbid SUD, and the emergence of delinquency and other criminal behaviors, particularly focusing on adolescence, and the importance of comorbid SUDs. Hence, gaining further insight about this constellation of human ailments and major public health problems seems warranted from a medical and societal perspective. In the present report, it is aimed to systematically review the literature on the epidemiological, neurobiological, and other risk factors contributing to this association, with a particular focus on adolescence. Finally, we review the key aspects of the assessment and diagnosis of ADHD among offenders and convicted individuals, as well as the treatment options for ADHD and whether they may affect criminality rates.

Methods

A comprehensive literature search of electronic databases (PubMed, EMBASE, and PsycINFO) was conducted to identify potentially relevant studies published in English, in peer-reviewed journals until July 31, 2014, using the following keywords: “ADHD”, “ADD”, “attention deficit”, “hyperkinetic disorder”, “adolescence”, “juvenile”, “delinquency”, “offending”, “incarceration”, “criminal”, and “prison”. The literature search included clinical studies/reports as well as retrospective or prospective population-based studies with children, adolescents, or adults as participants. There were no restrictions on the identification or inclusion of studies in terms of publication status, type of publication, and design type. However, abstracts of presentations to meetings and conferences were not included. Titles and abstracts were screened for inclusion/exclusion and appropriateness, and full text versions were retrieved.

A total of 550 records were initially identified through database searches. After careful evaluation of the titles and abstracts, 358 hits were considered non-eligible. Moreover, 60 of the remaining 192 records were excluded due to the following reasons: papers in languages other than English ($n=8$), not located in full text ($n=9$), or not fulfilling the selection criteria ($n=43$). Therefore, 132 relevant papers were selected from electronic databases, and two more were identified in their reference lists. A hand search of the major journals of interest retrieved 14 relevant papers, thus, 148 documents were finally included in this systematic review.

Epidemiology of ADHD among offenders

ADHD is a psychiatric condition frequently observed among adolescents and adults within criminal justice settings. In a recent review, Young and Thome (21) reported that 45% of youth and 24% of adult male offenders had a childhood history of ADHD, and 14% continued to be symptomatic into adulthood. Similarly, in a large study, prevalence of ADHD was 18.3% of 11,603 adolescents committed to Texas juvenile correctional facilities between 2004 and 2008 (27). Furthermore, a systematic review on the epidemiology of psychiatric disorders among male detained adolescents reported a mean ADHD prevalence of 13.5% (19). While ADHD prevalence has been far more studied among male prisoners, several studies have suggested that female prisoners may have comparable high rates of ADHD (28–31). A systematic review and meta-regression analysis on the prevalence of mental disorders in adolescents in juvenile detention and correctional facilities revealed that 11.7% of boys and 18.5% of girls were diagnosed with ADHD (20).

As summarized in Table 1, studies conducted in adult offenders in diverse detention settings in France (32), Chile (33), USA (30, 31, 34–36), Finland (37), and Germany (38, 39) reported very heterogeneous rates of ADHD. Similarly, studies with adolescent offenders conducted in Iran (40), Brazil (41, 43), USA (42, 46), the Netherlands (44), Denmark (45), and Korea (47) also showed very differing prevalence rates of ADHD (Table 1). Variations in prevalence rates among study samples may be due to differences in instruments used for the assessment of ADHD, demographic characteristics of the samples in terms of gender and age, legal systems and facilities, and psychiatric comorbidities.

ADHD as a risk factor for criminality

Longitudinal, follow-up studies of children with ADHD have revealed high rates of criminal behaviors, arrests,

Table 1 ADHD among adolescent and adult offenders.

Reference	Sample and country	n	Instruments	ADHD prevalence
Adult samples				
Gaiffas et al. 2014 (32)	Imprisoned male adults (18–35) in France	93	CAADID	11% adult 17% childhood
Mundt et al. 2013 (33)	Imprisoned adults in Chilean penal institutions	1008	CIDI	2.2% adult
Cahill et al. 2012 (30)	Imprisoned adults (17–73) in USA	3962	Coolidge Correctional Inventory	10.5% current (overall) 9.8% current (male) 15.1% current (female)
Hennessey et al. 2010 (31)	Imprisoned female adults in USA	192	WURS	46% childhood
Einarsson et al. 2009 (37)	Imprisoned male adults in Finland	90	MINI, WURS	50% childhood
Westmoreland et al. 2009 (34)	Imprisoned adults in USA	319	MINI	21.3% current
Rösler et al. 2009 (38)	Imprisoned female adults in Germany	110	HASE	24% lifetime 10% current
Gunter et al. 2008 (35)	Imprisoned adults in USA	320	MINI-Plus	22% lifetime
Rösler et al. 2004 (39)	Imprisoned male adults in Germany	129	WURS	45% lifetime
Eyestone and Howell 1994 (36)	Imprisoned male adults in US	102	Interview	25.5% current
Adolescent samples				
Ghanizadeh et al. 2012 (40)	Imprisoned adolescents (12–19) in Iran	100	Face-to-face interview	33% current 72% lifetime
De Andrade et al. 2011 (41)	Imprisoned female adolescents (12–21) in Brazil	30	K-SADS-PL	33% current
Washburn et al. 2008 (42)	Adolescents (10–18) processed in juvenile and adult courts in USA	1829	DISC 2.3	8% current
Andrade et al. 2004 (43)	Adolescents (12–19) on parole in Brazil	116	KSADS-PL	54% current
Vreugdenhil et al. 2004 (44)	Imprisoned male adolescents (12–18) in the Netherlands	204	DISC	8% current
Gosden et al. 2003 (45)	Imprisoned adolescents (15–17) in Denmark	100	ICD-10 diagnosis	1% current (hyperkinetic disorder)
Teplin et al. 2002 (46)	Adolescents (10–18) in a temporary detention center in USA	1829	DISC 2.3	Males: 16.6% current Females: 21.4% current
Chae et al. 2001 (47)	Incarcerated adolescents in Korea	98	TOVA	42.4% current

convictions, and imprisonment in adolescence and adulthood (24, 48–52), as shown in Table 2.

A childhood history of ADHD and persistence during adolescence and adulthood has been suggested to be a risk factor for the appearance of a variety of offenses (53), including traffic offenses (54, 55), fire setting (56), sexual offenses (57, 58), and property offenses (58). Persistence of ADHD has been described as the most powerful predictor of violent delinquency, even above a comorbid SUD (21).

ADHD has also been associated with an earlier onset of antisocial behavior and delinquency (21, 59), multiple serious offences (60), higher number of imprisonments and criminal recidivism (21, 61–64), and more breaches of discipline among incarcerated individuals (21, 65). Delinquent behavior among ADHD adolescents is a strong predictor for a high level of caregiver strain (66). Despite fewer available studies, incarcerated females with ADHD share important similarities in criminal behavior with male counterparts. They have been reported to be younger at first conviction, have longer periods of incarceration,

and higher rates of psychiatric comorbidity (including SUD) than non-ADHD incarcerated females (38).

Impulsivity, emotional impulsiveness, mood instability, and low self-control have been proposed as core ADHD symptoms predisposing to social maladjustment and criminal offenses (21, 67–69). In some studies, hyperactivity during childhood has been shown to be a weak predictor of later criminality, whereas inattention has not been shown to be predictive of later criminality (70). Nevertheless, other authors have suggested positive correlations between both hyperactivity-impulsivity and inattention symptomatic dimensions and novelty seeking, which is seemingly associated with more delinquent behavior (67, 71, 72). In addition, childhood physical aggression and peer victimization among ADHD children have been reported to be strong predictors of delinquent behavior and offending during adolescence or adulthood (70, 73).

ADHD hyperactive/impulsive and combined subtypes have been associated with higher rates of violent behavior, delinquency, and criminal recidivism than

Table 2 Criminality among ADHD patients.

Reference	Sample	n	Main findings
Dalsgaard et al. 2013 (48)	Children with ADHD attended in a psychiatric clinic. Reassessed in adulthood	208	47% criminal convictions in adulthood RR for convictions=5.6 (12 for violent crimes) vs. general population
Lam and Ho 2010 (49)	Children with ADHD attended in a day hospital. Reassessed in adolescence	150	7% arrested at least once
Langley et al. 2010 (50)	Children with ADHD treated in outpatients clinics. Reassessed in adolescence	126	47% at least one serious criminal behavior 61% at least one police contact
Mannuzza et al. 2008 (24)	Children with ADHD without conduct disorder. Reassessed in adulthood	207	47% arrested at least once 42% convicted at least once 15% incarcerated at least once
Satterfield and Schell 1997 (51)	Adolescents with ADHD. Reassessed in later adolescence and adulthood	89	Juvenile: 46% arrested at least once Adults: 21% arrested at least once
Mannuzza et al. 1989 (52)	Children with ADHD. Reassessed between ages 16 and 23 years	103	39% arrested at least once 28% convicted at least once 9% incarcerated at least once

the predominantly inattentive subtype (30, 65, 74, 75). Although most studies only registered full syndrome ADHD, subthreshold ADHD may also be associated with higher risk of externalizing disorders, delinquent behaviors, younger age at first arrest, and a higher number of imprisonments (32, 76).

However, direct relationship between ADHD and offending can be difficult to estimate, as ADHD is often associated with comorbid disorders and other problems that have been independently associated with criminal behavior in adolescence and adulthood. Various sociodemographic factors such as male gender, living in an urban environment, low socioeconomic status, low school involvement, peer rejection, or high peer delinquency have been linked to higher rates of violence and criminality in several studies (23, 61, 77–79), while low peer delinquency in childhood and adolescence has been described as a protective factor (78). Childhood maltreatment has also been described as an important risk factor for delinquency outcomes in individuals with ADHD, regardless of the presence of psychiatric comorbidities (80). The importance of demographic and social risk factors in ADHD patients has been underlined in a longitudinal study of adolescent offenders in which mental health problems (including ADHD and SUDs) did not account for criminal outcomes on their own (81).

Among psychiatric disorders, CD is frequently comorbid to ADHD. Impulsivity appears to be the best predictor for the presence of CD among ADHD adolescents, with minor contributions from sensation seeking

and other ADHD symptoms (67). ADHD and CD constitute a relevant association as it has been related with poor social functioning and the highest risk for delinquency outcomes (26, 58, 79, 82–84). In service sectors (which include the juvenile justice system), the public costs for adolescents with the ADHD-CD phenotype have been estimated to double the costs of those with ADHD alone (85). It has also been proposed that ADHD, in the absence of a comorbid CD, is not associated with higher rates of either criminal behavior (22, 23, 86–89) or recidivism (90, 91). However, several studies have reported that ADHD, when controlling for early aggressive behavior, ODD, CD, antisocial personality disorder, or other psychiatric comorbidities, is still a potential risk factor for delinquency and criminal offences (24, 48, 71, 84, 92–94). Gudjonsson et al. (25) recently estimated that ADHD contribution to the variance in nonviolent and violent delinquency among 11,388 young (16–24 years old) students was 8.2% and 8.8%, respectively, but these effects were almost completely mediated by the presence of peer delinquency and comorbidities, particularly CD and SUD.

ODD is another psychiatric disorder often comorbid to ADHD during childhood, which has also been associated with an earlier age of initiation into delinquent behavior, a greater variety of offending and higher prevalence of severe delinquency, though less severe than that found with CD (83, 84, 95, 96).

Psychopathic traits and interpersonal callousness are also significantly more common among adolescents

and adults with ADHD, and associated with serious criminal behavior and recidivism (83, 91, 97, 98). Adult psychopathy is heavily linked to childhood and adolescent history of ADHD with CD comorbidity (99, 100). Sevecke et al. (101) studied risk factors for psychopathy among incarcerated adolescents and concluded that the influence of ADHD was largely due to an overlap with CD in male offenders, whereas among female offenders, ADHD could contribute independently to higher psychopathy scores.

Not only externalizing but also internalizing (mainly anxiety and depression) disorders have been frequently reported among adolescent and adult ADHD offenders (36, 37, 39, 99, 102). Incarcerated ADHD adults score higher in neuroticism and lower in agreeableness and conscientiousness personality dimensions than non-ADHD inmates (103).

It is well established that ADHD patients are at high risk during adolescence and adulthood for SUD. The prevalence of SUD among imprisoned adolescents and adults with ADHD has been revealed to be even higher than in ADHD individuals from community samples (39, 104). Moreover, among adult offenders, those with SUD are more likely to have a childhood history of ADHD than non-substance abusers (105, 106). The ADHD-SUD comorbidity has been reported to predispose more frequently to criminal offences and imprisonment than each of these two disorders alone (102). Aggressiveness, delinquency, and social impairment during childhood and adolescence, as well as externalizing disorders (mainly CD, but also ODD), all significantly increase the risk for drug or alcohol use disorders in ADHD patients (107–111). On the other hand, parental support and knowledge about friendships and activities of their offsprings have been described to have a protective role for criminal and SUD outcomes among children and adolescents with ADHD (110, 112).

It has been proposed that in the absence of CD or childhood and adolescent delinquency, ADHD may not be associated with SUD outcomes (22, 113–115). Furthermore, De Sanctis et al. (116) recently reported in a 10-year follow-up study that in the absence of maltreatment history, no differences were found between ADHD patients and controls in rates of criminal behaviors and SUD. However, Thompson et al. (117) reported that boys with the CD-ADHD comorbidity had more substance dependence diagnoses than boys with CD alone.

Comorbidity between ADHD, CD, and SUDs is highly relevant as it has been associated with worse functional impairment (118), increased rates of suicidal behavior (119), as well as higher risk for other psychiatric disorders,

such as depression (117), anxiety (117), posttraumatic stress disorder (120, 121), eating disorders (38), borderline personality disorder (38), or abnormal sleep architecture (122).

Neurobiological substrates of ADHD and criminality

The precise underlying etio-physiology of ADHD remains unknown, but molecular genetic studies have revealed that genes play a key role, with heritability about 75–80% (123, 124). ADHD is, however, a polygenic disorder with at least 50 genes involved (125), which may explain the clinical heterogeneity of ADHD presentations and comorbidity with other psychiatric disorders, including CD and antisocial personality (126, 127).

Three specific genes have been implicated in ADHD with concurrent antisocial behavior and delinquency, three genes have shown to be most related: the gene coding the dopamine receptor D4 (*DRD4*), the dopamine transporter (*DAT1*), and the serotonin transporter (*5-HTT*) (124, 128). However, penetrance for studied polymorphisms of all three genes is low, which means many carriers will not develop the disorder (126). A gene \times gene interaction between *DRD2* and *DRD4* has been linked to the appearance of CD and antisocial behavior in males (129). Similarly, an association between various *DRD4* polymorphisms and ADHD susceptibility has been reported, while both *DRD4-7* repeat allele and *DAT1-10* repeat allele have been related with hazardous sensation seeking, antisocial behavior, and offenses (126, 130–133). Conversely, a protective effect against risky behaviors has been reported with the 9R/9R genotype in the VNTR of the dopamine transporter gene (*DAT1*), in comparison to the 10R/9R and 10R/10R genotypes. However, this protective effect seems to vary over age (134). The long variant (especially the homozygous L/L genotype) of the serotonin transporter promoter region (*5-HTTLPR*), has been related with a higher risk for ADHD and a decreased behavior-inhibiting capability (135).

Despite the importance of genetic factors, 20% of the variance of ADHD symptoms is due to environmental factors (126). Among these, prenatal exposure to marijuana or lead has been related to ADHD symptoms and increased criminal behaviors (136, 137).

Neuroimaging studies have evidenced that ADHD patients present low prefrontal cortex activation while trying to modulate attention and behavior (138). Prefrontal cortex seems to have an integrative function and

plays an essential role in social cognition, so its malfunction could hypothetically favor antisocial behavior (139). Additionally, some authors have reported hyporeactivity of the autonomic nervous system (ANS) among ADHD individuals, especially when comorbidity with CD or ODD is present (140, 141). An unresponsive ANS involves a low level of fear and has been associated to delinquent behavior (142).

Evaluation of ADHD and comorbid conditions

In spite of the high prevalence and comorbidity of ADHD, CD, and SUD among adolescent and adult offenders, underdiagnosis is still common across different settings of the justice system (143). Furthermore, in a recent study conducted in an outpatient clinic for forensic mental health care, ADHD diagnosis was missed previously in life more than half (56%) of adults patients who have problems with delinquency (144). Older men, individuals with hyperactive/impulsive and combined subtypes of ADHD, patients who reported fewer symptoms of ADHD in childhood or adolescence, those with a comorbid mood disorder in adulthood, and in those who had never received mental health care before, were more likely not to have been previously diagnosed with ADHD. Considering that ADHD may be missed very often in individuals with a criminal history, the importance of routine screening of ADHD and psychiatric comorbidities within offender and forensic management services is clearly warranted (143).

Adequate evaluation of symptoms of ADHD must be conducted under a biopsychosocial clinical perspective and necessarily must include assessment of family functioning style. In addition, the assessment process should comprise general personality characteristics and specifically antisocial traits, comorbid SUD, as well as externalizing disorders (CD, ODD) and internalizing disorders (depression, anxiety, eating disorders) (145).

Self-report questionnaires may be useful for ADHD screening, due to their rapid implementation and high cost effectiveness (146). The Wender Utah Rating Scale (WURS) has shown to be useful for evaluation of childhood ADHD symptoms in several epidemiologic studies (31, 37, 39). The Coolidge Correctional Inventory (CCI) is a 250-item, self-report, DSM-IV criteria-based inventory, specifically designed for incarcerated population over 15 years old, with good psychometric properties (147). Several authors have warned about low reliability of self-report instruments, as offenders with mental health

disorders tend to minimize symptoms (148, 149). Moreover, ADHD offenders have shown to be less reliable than controls in self-reporting delinquent acts (150). Thus, parental information about lifetime ADHD, symptoms of CD, and criminal behavior should always be obtained, whenever possible.

Some structured diagnostic interviews, which can be administered by nonclinical interviewers after a short training period, have also shown to be useful in the assessment of ADHD. The National Institute of Mental Health Diagnostic Interview Schedule for Children (NIMH DISC) for children and adolescents (151) and the MINI International Neuropsychiatric Interview (MINI) for adults (152) have been frequently used in epidemiologic studies among criminal offenders (34, 35, 37, 42, 44, 46).

Treatment of ADHD and criminal behaviors

Treatment programs, including medication and psychosocial interventions, can be very effective in improving the functioning of children, adolescents, and adults with ADHD in a broad range of functional outcomes (8, 153). Treatment guidelines recommend pharmacological treatments as the first line for children, adolescents, and adults with severe ADHD, but always within a comprehensive treatment program that addresses psychological, behavioral, and educational or occupational needs (8, 154). Nonetheless, there are few studies on effective interventions for children and adolescents with delinquent or violent behaviors.

Overall, treatment guidelines recommend treatment with medication as the first line for children, adolescent, and adults with severe ADHD and psychological treatment as the first line for those with less severe symptoms (8, 153, 155). Furthermore, in a comprehensive systematic review, it was concluded that there was consistent evidence that pharmacotherapies are cost effective compared with no treatment or behavioral therapy for children and adolescents with ADHD (156). In addition, as shown in recent study using a large sample of 25,656 patients with a diagnosis of ADHD in Sweden, criminality rates were significantly lower for both men and women during periods when they were receiving ADHD medication (157).

A large number of randomized, controlled studies conducted in children, adolescents, and adults with ADHD and with or without other comorbid conditions have shown the efficacy and effectiveness of stimulant and nonstimulant medication on a variety of outcome

variables (6, 153, 154, 158–162). However, medication alone is unlikely to achieve these aims fully. Furthermore, the net effect of medications on criminality remains to be established. While pharmacological treatment may have a protective effect on concurrent rates of all types of criminality, there appears to be no significant long-term reduction in crime rate after termination of medication (157, 163). Another aspect that should be considered in the treatment of ADHD offenders is the potential of abuse and risk of misuse of pharmacotherapies used in the treatment of ADHD, particularly in individuals with comorbid SUD. Short-acting stimulants should be avoided, and long-acting stimulant formulation should be prescribed with caution to patients at risk of stimulant misuse or diversion and in those with particular concern for medication abuse, and atomoxetine or other non-stimulant medications, whenever available, may be considered as first-line pharmacotherapies for ADHD (8).

Antipsychotics have also been considered as a treatment for children and adolescent ADHD and comorbid conduct disorder. Indeed, risperidone may be useful for adolescents with refractory and persistent symptoms of ADHD and ODD (109), as well as in children and adolescents with ADHD, ODD, and severe conduct disorder (164). In a further open-label study, another atypical antipsychotic, aripiprazole, was well-tolerated and associated with significant improvements in symptoms of inattention, hyperactivity/impulsivity, as well as of ODD and conduct disorder (165). In addition, aripiprazole was also associated with significant improvements in delinquent and aggressive behavior. The potential beneficial effects of these medications, used off license, need to be assessed in randomized-controlled trials.

When treating offenders or inmates with ADHD, who commonly present other comorbid psychiatric disorder complexes, comprehensive and tailored interventions are likely to be needed. Multiple psychological and psychosocial interventions have been used to manage the symptoms and problems experienced by patients diagnosed with ADHD. However, few studies have systematically evaluated the efficacy of psychosocial treatments in adolescents and adults with ADHD and severe disruptive behavioral problems. In a recent systematic review, behavioral interventions for children and adolescents diagnosed with ADHD were found to have significant positive effects on a range of other outcomes, including conduct problems, social skills, and academic performance (166). Indeed, the Stop Now and Plan (SNAP) Program, an intervention for boys aged 6–11 years with severe aggressive, rule-breaking, or antisocial behavior, was assessed in a randomized controlled treatment effectiveness study vs.

standard behavioral treatment (167). Participants in the SNAP intervention showed significantly greater reduction in aggression, conduct problems, and overall externalizing behavior, as well as on symptoms of depression, anxiety, ODD, and ADHD. Furthermore, the beneficial effects of the SNAP program on aggression, ODD, and ADHD persisted at 1-year follow-up. Another home-based cognitive behavioral prevention program, targeting first-time delinquent children aged 8–13 years with ADHD and concurrent conduct disorder, was reported to be effective in reducing problem behavior (168). Likewise, the effectiveness of the Reasoning and Rehabilitation for ADHD Youths and Adults (R&R2ADHD) cognitive behavioral group treatment was assessed in another randomized controlled study (169). After treatment and at 3-month follow-up, this CBT program increased the effect of psychopharmacological treatment in reducing ADHD symptoms and comorbid problems, including antisocial behavior and social functioning.

Finally, another aspect that needs to be addressed by clinicians and treatment planners and researchers is the adequate health care transition for adolescents and young adults with ADHD, considering that discontinuity in the transition from pediatric to adult health care for ADHD patients has also been linked to higher rates of criminality (170). Moreover, one prominent feature of ADHD treatment is that the discontinuation of medication is common especially in adolescence and early adulthood (171, 172). This is of particular importance in adolescents and younger adults with severely disruptive or criminal behaviors, who are likely to have more severe and pervasive symptoms of ADHD, and less likely to adhere or comply to treatment (173). Furthermore, although importance of treatment discontinuation for criminality and other longer-term outcomes is largely unknown (157), it may increase the risk to fall into a “revolving door” between prison and probation, and the community (8).

Conclusions

As evidenced by epidemiological and neurobiological studies, ADHD, mainly in combination with other psychiatric disorders, particularly ODD, conduct disorders, SUD, and antisocial personality disorders, has been identified as an important risk factor for criminal and delinquent behaviors and offending, with an early onset of criminal behavior and high rates of recidivism among young individuals (21, 26, 39, 174). Furthermore, the combination of ADHD with other comorbid disorders during

childhood and adolescence is significantly related to a range of environmental factors, including an earlier initiation to substance use and a more severe SUD, which may further increase the risk for criminal offending (17, 19). It is, therefore, very important to carefully and systematically assess for the presence of ADHD in adolescents and adults within juvenile and adult correctional and forensic services, as well as among offenders and prison inmates. Pharmacological and psychosocial treatment programs for adolescents and adult offenders with ADHD are very limited in many countries, particularly within prisons and other detention facilities (143). Although there is no conclusive evidence that such treatments lower the risk for developing delinquency in adulthood, several comprehensive and integral treatment programs have been shown to be effective in reducing aggressive, violent, or other severely disruptive behaviors (8, 109, 167, 169). It is, therefore, important to provide adequate treatment to adolescent or adult offenders, particularly to those previously not diagnosed or treated, considering that ADHD among incarcerated individuals is likely to be associated with high recidivism rates and with substantial higher economic and societal costs than their non-ADD counterparts (8, 143). Therefore, any strategy toward reducing future offending and detention, addressing known vulnerability factors such as ADHD and other comorbid disorders, should be a priority for clinicians, researchers, and policymakers.

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