Attention Deficit Hyperactivity Disorder (AD/HD)

in longer among longer-term prison inmates is a prevalent, persistent and disabling disorder

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Abstract

Background

ADHD is a common and disabling disorder, with an increased risk for coexisting disorders, substance abuse, and delinquency. In the present study, we aimed at exploring the relationship between ADHD and criminality. We estimated the prevalence of ADHD among longer-term prison inmates, described coexisting disorders, characterized symptoms and cognitive functioning, and compared findings with ADHD among psychiatric outpatients with ADHD and healthy controls.

Methods

At Norrtälje Prison, we approached 315 male inmates for screening of childhood ADHD by the Wender Utah Rating Scale (WURS-25) and for present ADHD by the Adult ADHD Self-Report Screener (ASRS-Screener). The response rate was 62%. Further, we assessed 34 inmates for ADHD and coexisting disorders. Observations were compared with profiles from 20 adult males with ADHD assessed at a psychiatric outpatient clinic and 18 healthy controls.

Results

The estimated prevalence of adult ADHD among longer-term inmates was estimated to 40%. Only two out of 30 prison inmates confirmed evaluated with ADHD had received a diagnosis of ADHD. Only 2 were diagnosed during childhood, despite most needed health services and educational support. All subjects reported a lifetime substance use disorder (SUD), where amphetamine was the most common drug, and conduct disorder prior to...
antisocial personality disorder (APD). Amphetamine was the most common drug. Mood and anxiety disorders were present among half of subjects; autism spectrum disorder (ASD) among one fourth, and psychopathy among one tenth, of subjects. Personality disorders were common; almost all inmates presented conduct disorder (CD) before antisocial personality disorder (APD). Prison inmates in this cohort reported more AD/HD symptoms during both childhood and adulthood, as compared to the AD/HD psychiatric outpatient group. However, no differences between AD/HD groups were evident in the retrospective parental ratings of childhood symptoms. Furthermore, analysis of executive functions after controlling for differences in IQ showed that both AD/HD groups performed poorer than controls on tests of working memory tests. Besides, on a continuous performance test, the AD/HD prison group displayed poorer results compared with both other groups than the AD/HD psychiatry group and control group. The AD/HD group showed lower full scale IQ as compared to the AD/HD psychiatry group and controls. Moreover, there were no differences in working memory between AD/HD groups when controlling for IQ, while controls performed better. In addition, the AD/HD prison group demonstrated poorer results on a continuous performance test, also when controlling for IQ.

Conclusions
This study suggested AD/HD to be present in 40% of adult male longer-term prison inmates. The evaluated prison cohort group was severely symptomatic and disabled from AD/HD and co-existing disorders, such as SUD, ASD, personality disorders, mood- and anxiety disorders, severely affected prison inmates with ADHD. Besides, inmates showed they demonstrated poorer executive functions also when controlling for estimated
IQ cognitive abilities, as compared with ADHD in psychiatric outpatients, and controls. Our findings imply the need for considering these severities when designing treatment programmes for prison inmates with ADHD.
Background

ADHD is a common, inherited, chronic and impairing, disabling neurodevelopmental disorder with early onset, highly heritable, with an early onset, and most often ADHD persists across the lifespan, with a chronic life course, affecting 2-4% of adults. Beyond the core symptoms of ADHD are including inattention, hyperactivity and impulsivity. Further, deficits in executive functioning are commonplace, such as planning, organizing, exerting self-control, working memory, and affect regulation. Therefore, ADHD affects educational and occupational performances, psychological functioning, and social skills. Adults with ADHD are at increased risk for unemployment, sick-leave, coexisting disorders, abuse, and anti-social behaviour leading to conviction. Nearly 80% of adults with ADHD present with at least one coexisting psychiatric disorder. Further, studies demonstrate ADHD to be common prevalent among prison inmates. However, little attention has been paid to the ADHD symptoms profiles of prison inmates, especially when compared with other groups affected by ADHD, and to controls. Besides, effects of pharmacological treatment for ADHD among prison inmates remain unexplored. The clinical presentation has shown been demonstrated to change with age, as hyperactivity declines, whereas inattention and executive dysfunction persist, thus representing the core features of adult ADHD. However, most previous studies have been conducted in settings excluding prison inmates, questioning how relevant these findings are to prison inmates. Therefore, these findings could not necessarily be generalized to a prison population, which might represent a specific endophenotype of ADHD.
To gain some more information, we evaluated the relationship between ADHD and criminality, which is the focus of the present paper. The first aim of this study was to estimate the prevalence of ADHD among longer-term inmates of a high-security Swedish prison. The second aim was to describe characterise ADHD, co-existing disorders, and executive aspects of cognitive functioning in among a prison inmates cohort. The final aim was to compare these findings observations with ADHD psychiatric outpatients diagnosed with ADHD, and to healthy controls.

We hypothesized that ADHD would be more common among this group prevalent in this population comprising predominantly longer-term prison inmates, typically convicted of crimes because of related to violence and drugs. Also, moreover, we hypothesized that they would present demonstrate more severe ADHD symptoms across the lifespan, more co-existing psychiatric disorders, and poorer cognitive abilities (executive functions) as compared to with the other groups.
Methods
The present study included an estimation of the prevalence of ADHD among longer-term prison inmates. Further, it included a description of and characterisation of ADHD and executive functions cognitive abilities in among prison inmates cohort as compared with ADHD among psychiatric outpatients, and to healthy controls. The Regional Ethical Board in Stockholm approved the studies by the Regional Ethical Board in Stockholm. Participants provided written informed consents before were obtained prior to study procedures.

Participants
Norrtälje Prison is a high-security prison placed outside Stockholm, Sweden, serving the entire country, hosting 200 adult male inmates. This prison holds mainly predominantly longer-term inmates, typically convicted of crimes because related to drugs, or violence.

Figure 1 shows the study flowchart. Norrtälje Prison hosted 589 inmates between December 2006 and April 2009. Of those inmates, we did not invite 200 for screening as we could not include them in the following trial because of deportation out of the country after served conviction. Further, we did not approach 74 inmates...
because of practical reasons, or if we considered them as too mentally affected to take part. Thus, a specially trained correction officer approached a total of 315 prison inmates for screening during the study period by a specially-trained correction officer, between December 2006 and April 2009. Another purpose of screening was to identify eligible subjects for a diagnostic assessment evaluation for AD/HD before recruitment for a clinical trial. Therefore, we ended recruitment as we had randomised all required subjects for the trial in April 2009. As a consequence, prison inmates who were to be deported out of the country after served conviction were not approached (200 subjects), as they were not eligible for the trial. Furthermore, either inmates temporarily incarcerated, not inmates considered by correction officers as too mentally instable to participate, were approached for screening (74 subjects). Figure 1 demonstrates a study flow chart.

Following the screening survey, we performed extensive comprehensive diagnostic assessment evaluations for AD/HD and coexisting disorders among consecutively carried out in a group cohort of inmates after confirmation of eligibility by a pre-screening procedure. We selected the subjects first according to their origin, as the Stockholm County Council funded the assessments as part of regular clinical practice for their citizens. Thus, we successively invited all prison inmates indicating adult AD/HD by the screening, registered in the Stockholm County, with at least 14 months left to conditional release, and approved by the correction security officers at Norrtälje Prison to stay at the AD/HD ward. By this pre-screening we evaluated if subjects with ADHD would fulfil criteria for taking part in the following subsequent clinical trial with methylphenidate (Ginsberg and Lindefors, unpublished data). The pre-screening
included an evaluation of inclusion- and exclusion criteria for participation: Subjects with coexisting occurring disorders, such as ASD, anxiety and depression could take part if considered stable by the investigator at the time of assessment. Further, the general cognitive functioning had to be above the level of mental retardation. Also, subjects could continue as well as IQ>70, concomitant stable pharmacological treatment for coexisting disorders if we did not suspect treatment with psychotropic medication not potentially interfering with methylphenidate. was allowed if doses were considered stable by the investigator; Additionally, the subjects also had to be free healthy from serious medical illnesses. Thus, hence, after meeting if criteria for the were supposed to be met for inclusion in the following trial and providing the subject was eligible for participation in the diagnostic assessment after obtaining of a written informed consent, the subject could take part in the diagnostic evaluation.

We considered In summary, a total of 47 prison inmates were considered for assessment. However, we excluded one subject because of was excluded due to fulfilling an exclusion criterion, whereas six subjects denied taking part participation. Of 40 consented subjects, six dropped out during the assessments procedure. Therefore, we finally assessed whereas 34 subjects and could confirm were finally assessed, and ADHD among established in 30 of them (Figure 1). When appropriate, we extended the evaluation was extended to confirm establish a diagnosis of ASD in consistency with DSM-IV. We defined ASD as fulfilling the criteria for Autistic syndrome, Asperger syndrome or Pervasive developmental disorder, not otherwise specified (PDD-NOS). This evaluation included the Asperger Syndrome Screening Questionnaire (ASSQ) [13, 14], the Diagnostic Interview for Social and Communication Disorders (DISCO) [14, 15], and the
Autism Diagnostic Observation Schedule (ADOS), module 4 as decided by the investigator.

The psychiatric outpatient study comprised 20 adult men with AD/HD/ADHD. 18 of them with AD/HD/ADHD of the combined type, and two with AD/HD the predominantly inattentive subtype, and sub-threshold impulsivity. We consecutively recruited These subjects were consecutively recruited to another study between 2004 and 2006, from the Neuropsychiatric Unit, Karolinska University Hospital; a psychiatric outpatient tertiary unit specialized in AD/HD/ADHD. Notably, the exclusion criteria for participation were somewhat different among psychiatric outpatients compared to the prison cohort, as ongoing pharmacological treatment, concomitant psychotropic medication for coexisting disorders, APD, ASD, marginal mental retardation (IQ>70<85), or pure ‘sluggish, inattentive’ type of AD/HD/ADHD were excluded. Because of different criteria, we expected a group difference in IQ between groups. Thus, we controlled for IQ in the statistical analyses of the executive function tests.

The control group enrolled to this study comprised 18 adult healthy males not needing psychiatric care, assessment for learning difficulties or educational support assistance during childhood. Further, they did not need receive psychiatric care during the present course of the study. We recruited age-matched controls that were in the same age as probands, were recruited by advertisement on fitness training centres in Stockholm City and among friends of staff-members.
Procedures

Estimation of ADHD prevalence of ADHD among longer-term prison inmates

WURS is a 61-item self-administered scale for rating frequencies of ADHD childhood symptoms and behaviors retrospectively on a 5-point scale, from 0 = not at all or slightly, to 4 = very much. The subscale WURS-25 provides a total sum score (range 0-100) by summing those 25 of the items found to best discriminate between ADHD and controls [20][20]. According to the originators, a cut-off score of 36 has a sensitivity and specificity of 96% for identifying childhood ADHD among the general population [20][20].

The ASRS-Screener comprises the 6 out of 18 most predictive items of the Adult ADHD Self-Report Scale (ASRS) [21][24] for defining ADHD, found to be most predictive of present ADHD in adulthood, as defined by fulfilling at least 4 out of 6 significant items [22][22] on ASRS-Screener define. We defined adult ADHD. Both scales are standard tools in clinical practice, despite the lack of Swedish validations. In this study we defined adult ADHD as reaching the cut-off levels for WURS [25] and ASRS-Screener, respectively.

Assessment for ADHD among prison inmates

Board certified psychiatrists and clinical psychologists well experienced in ADHD, conducted the clinical assessments. We confirmed ADHD diagnoses were established in accordance to DSM-IV [23][23]. The evaluations included a semi-structured clinical diagnostic interview for ADHD based on the DSM-IV criteria [23][23]. Further, a Swedish version of the ASRS [24][24] is an 18-item self-administered scale with appropriate
psychometric properties [25][25], based on the DSM-IV criteria and adjusted, modified to reflect AD/HD symptoms as seen in adults [22][22]. We used a non-validated Swedish version of the ASRS [24] for rating symptom frequencies on a 5-point scale, from 0= never; to 4= very often, providing a total sum score (range 0-72).

Whenever possible, we collected collateral information was obtained from parents or other significant others by questionnaires, before psychologists or psychiatrists prior performed interviews. The questionnaires included the Five to Fifteen (FTF) questionnaire [26, 27] and the Conners’ Brief Parent Rating Scale – Conners’ Hyperactivity Index [28, 29], respectively. The FTF elicits childhood symptoms and developmental problems of AD/HD and coexisting disorders in ages five to fifteen years. The FTF which shows acceptable to excellent inter-rater and test-retest reliability and comprises 181 items scored on a 3-point scale, from 0=does not apply, to 2=definitely applies.

The Conners’ Brief Parent Rating Scale – Conners’ Hyperactivity Index is validated in several countries. This scale describes AD/HD and oppositional defiant symptoms and behaviours in children up to 10 years of age [28][28], comprising 10 items, scored 0-3, and providing a total sum score (0-30). We collected additional collateral information was obtained by medical records from child- and adolescent psychiatry, school health services, adult psychiatry and forensic psychiatry. Furthermore, coexisting disorders were evaluated by the Structured Clinical Interview for DSM-IV Axis I Disorders.
(SCID-I) [30][34], the Hare Psychopathy Check List-Revised (PCL-R), a semi-structured interview defining in which psychopathy was defined by a total sum-score cut-off score of ≥ 30 [31][34], and the self-rated screening version of the Structured Clinical Interview for DSM-IV Axis II personality disorders, the SCID II Patient Questionnaire Disorders (SCID-II PQ). We estimated frequencies of personality disorders by increasing the screening cut-off level for each personality disorder by one score. This procedure has shown an acceptable agreement with the SCID II interview [32][32]. Furthermore, the evaluation comprised a medical history, physical examination, routine laboratory tests, urine drug screening and a neuropsychological test battery assessing IQ and executive functions. As prison inmates often present learning disabilities such as reading difficulties [9] (Rasmussen et al. 2001), we assessed those neuropsychological tests that do not require reading, writing or mathematic skills – the latter included several subtests from the Wechsler Adult Intelligence Scale – III (WAIS-III) [33]. We estimated FSIQ was estimated by the Wechsler Adult Intelligence Scale-III subtests Vocabulary and Block Design, a dyadic short form correlating 0.92 with WAIS-III FSIQ [33][33]

[34][35].

Neuropsychological tests of executive functions

Such as Vocabulary, Block Design (BD), Digit Span (DS) and Span Board (SB), in addition to the Conner’s Continuous Performance Test II (CCPT). Hence, verbal intelligence was measured by Vocabulary, correlating 0.84 with the full scale IQ (FSIQ), and 0.80 with the verbal IQ (VIQ) [33]. Moreover, non-verbal intelligence was measured by BD, correlating 0.72 with the FSIQ and 0.70 with non-verbal IQ performance IQ (PIQ) [33]. Digit Span [33] measures verbal working memory (WM) whereas Span Board [35] measures visuo-spatial WM, whereas Span Board [34]. For comparison between subjects,
the results on the WAIS subtests are expressed on age-scaled scores with population mean = 10, standard deviation = 3. Finally, FSIQ was estimated by the Vocabulary/BD dyadic short form correlating 0.92 with WAIS-III FSIQ [35]. Further, we measured sustained attention, impulse inhibition and several other executive functions aspects of EF were further assessed by the computerized The Conners’ Continuous Performance Test II (CCPT) [36]. The CCPT measure variables are often grouped into those Hit RT reflecting basic reaction time (Hit RT), whereas Hit RT SE, Variability, Hit RT block change, Hit SE block change, Hit RT ISI change, Hit SE ISI change, and Perseverations reflect variability dependent measures. Finally, Omission errors, Commission errors, Detectability (d’), and Response style (β) reflect accuracy dependent measures. and accuracy dependent measures (Omission errors; Commission errors; Detectability (d’); Response style (β)).

Assessment for ADHD among psychiatric outpatients

The diagnostic evaluation procedures comprising neuropsychological tests was similar as among prison inmates to the assessments conducted in prison, including the neuropsychological tests. However, we did not assess SCID-I, SCID-II PQ-screening, and PCL-R among ADHD psychiatric outpatients. Case files provided information on psychiatric comorbidity was obtained from the case files. Besides, Moreover, Instead, psychopathology was evaluated by the self-rated Beck Depression Inventory (BDI)
Healthy controls

We interviewed controls for confirming their survey absence of learning difficulties or psychiatric problems during childhood and the during the course of the study, respectively. Further, we used the same self-rating scales for present psychiatric symptoms as among the psychiatric outpatients. Finally, the neuropsychological tests were similar as for the other groups. The controls were further screened for psychopathology by the self-rated BDI, BAI, and the Current ADHD Symptom Scale – Self Report Form, respectively. The neuropsychological test battery was the same as for the AD/HD groups.

Statistical analysis

Descriptive statistics summarised demographic data and clinical characteristics of subjects. We carried out inferential statistics by analyses of variance (ANOVA), Student’s t-test or Mann-Whitney U-test, when appropriate for continuous measures, and chi-square test or Fisher’s exact probability test, when appropriate for categorical measures. Further, for comparing between groups on neuropsychological measures, we performed a series of analysis of variance (ANOVA) with Bonferroni corrected post hoc comparisons. Additionally, in case of significant results in the main analyses, reached significance, were employed to compare results between groups on neuropsychological tests. Also, we aimed to control for IQ differences in IQ, Thus, we reanalysed measures of the results of the neuropsychological tests of executive functions (DS, SB, and CCPT) were re-analyzed by performing in a series
of ANCOVA with the dyadic estimation of IQ entered as a covariate. By these analyses we evaluated if lower IQ among prison inmates could explain their performed in order to explore whether the executive dysfunctions were solely due to the lower IQ in the ADHD prison group. We present As since most variables in the EF tests did not covary with IQ, statistics from both ANOVAs and ANCOVAs, as most measures of executive functions did not co-vary with IQ are presented. We set the alpha-level at p=.05. Finally, we performed all statistical analyses by were carried out with SPSS 17.0 and 18.0, respectively.
Results

AD/HD/ADHD prevalence

Figure 1 presents a study flow chart of the study is presented in Figure 1. As can be calculated from this figure, the total response rate was 62% (194/315). We defined adult ADHD as reaching the cut-off levels for both childhood and adult ADHD. By this procedure we increased the specificity of the screening survey. When applying our predefinition of adult ADHD, the prevalence rate was 45%, as 88 out of 194 subjects fulfilled this definition (Figure 1). Overall, responders were slightly older and served longer convictions compared with non-responders (Table 1). However, when we assessed 34 subjects marking ADHD by the screening, we confirmed ADHD among 30 of them. Thus, the screening survey pointed out to be 88% (30/34) specific. Therefore, we imply a more conservative 40% ADHD prevalence (0.88 X 45) among longer-term prison inmates.

Of the responders, 110 out of 194 (57%) indicated childhood AD/HD symptoms (WURS >36), and 101 out of 194 (48%) indicated present adult AD/HD symptoms (ASRS Screener ≥1 significant item), respectively. When we applied our pre-definition of adult AD/HD, as reaching the cut-off levels for both childhood and adult AD/HD, thereby increasing the specificity of this screening procedure, the prevalence rate decreased to 45%, as 88 out of 194 fulfilled this definition (Figure 1). The responders of the screening survey were slightly older and served longer convictions as compared to the non-responders (Table 1).
Clinical characteristics of ADHD among adult male prison inmates

In this study, we performed an extensive diagnostic evaluation of ADHD and coexisting disorders among a cohort of prison inmates (Figure 1). Table 2 shows the clinical characteristics of those 30 subjects confirmed with ADHD. As shown, almost all subjects confirmed ADHD of the combined type. Further, coexisting disorders were present in all cases. In fact, all 30 subjects presented a lifetime history of SUD, with amphetamine as the most preferred drug of choice among almost two thirds of subjects. In general, the subjects showed an early onset of abuse and antisocial behaviour. Additionally, life-time mood and anxiety disorders were evident in a vast majority of cases and treated almost half of subjects at the time of assessment. Besides, ASD was established in almost one fourth confirmed subjects, much more common than expected. On the other hand, psychopathy was present among only one tenth of subjects, which was far less than expected. Further, personality disorders were present among 96% (22/23) of subjects. Among personality disorders, antisocial, borderline, paranoid, narcissistic, or obsessive-compulsive personality disorder were most obvious. Further, there was a striking finding of this study; despite most subjects reported prior need of contact with health services and educational support at school, very few were diagnosed with ADHD during childhood. In summary, this prison cohort inmates showed severe symptoms and severity was highly symptomatic and disabled from ADHD, SUD, overlapping ASD, personality disorders, mood- and anxiety disorders.
Comparisons between **AD/HD** in prison inmates, **ADHD** psychiatric outpatients with **AD/HD**, and **healthy** controls

As depicted in Table 2, all three groups were of similar age. Notably, 83% of the **ADHD**-prison inmates group fulfilled nine-year of compulsory school or less, as compared with 30% among the **ADHD**-psychiatric outpatients group, and 6% among **healthy** controls, thereby reflecting a remarkably compellingly lower educational level among the prison inmates.

**Standardized questionnaires**

The **ADHD**-prison group rated significantly more **ADHD**-related symptoms and behaviours during both childhood and present in adulthood, respectively, as compared to the **ADHD**-psychiatry group (Table 3). By contrast, when parents/significant others retrospectively rated childhood symptoms and behaviours, the differences between groups were negligible, which we did not expect as an unexpected finding. Table 3 presents statistics as presented in Table 3, and Figure 2 presents mean values (+/- 2 SE), respectively in Figure 2.

**Neuropsychological tests**

The dyadic estimation of IQ displayed comparable FS-similar IQ for controls and the **ADHD**-psychiatry group (Controls, n = 18, M = 112 (± 9.65), range 97 – 132); (ADHD-psychiatry, n = 20, M = 108.25 (±11.48), range 89 – 132). On the other hand, whereas FS-IQ was substantially lower among the **ADHD**-prison inmates; (M = 95.18 (± 9.99), range 78 – 113), group (Control group, n = 18, M = 112 (± 9.65), range 97 – 132, ADHD-psychiatry n = 20, M = 108.25 (±11.48), range 89 – 132).
The ADHD-prison group (n = 22) had data missing data for 8 subjects individuals. M = 95.18 (± 9.99), range 78 – 113. We expected significant between-group differences between groups on estimated IQ (F=14.76, p < .001, \( \eta^2 = .341 \)) because of were expected due to slightly different inclusion criteria. for exclusion, the ADHD-In fact, only the ADHD – prison group included subjects with IQ between 70 and 85. As a result, 10% (3/30) of prison inmates presented estimated dyadic IQ within this range, specifically between 78 and 85. was the only group including marginal mental retardation, 70< IQ<85 and three individuals (3/30, 10%) showed IQ within this range, (specifically between 78 and 85). Therefore, we excluded those three inmates with IQ<85 for making inclusion criteria homogenous. However, when excluding those three individuals were excluded to uniform inclusion criteria, the However, the ADHD-prison group still showed significantly lower estimated IQ after performing this procedure, as compared with both to the other two groups (F=10.49, p < .001, \( \eta^2 = .28 \)).

The ADHD-prison group demonstrated poorer results on almost all neuropsychological tests as compared to the other groups (Statistics in Table 4; mean values (+/–2 SE) in Figures 3–4).

Neuropsychological tests of executive functions

The ADHD-prison group showed poorer results on several measures of executive functions as compared with the other groups, also when controlled for IQ (Statistics in Table 4).

Wechsler scales (WAIS-III)

As can be seen in Table 4 and Figure 3, Vocabulary, highly correlated to VIQ, demonstrated comparable results for controls and the ADHD-psychiatry group, as both outperformed the ADHD-prison group. BD, highly correlated to PIQ,
demonstrated the same pattern. Moreover, on measures of working memory, controls outperformed the ADHD-psychiatry group on measures of both verbal WM (DS) and visuo-spatial working memory WM (SB). On the other hand, the ADHD-psychiatry group in its turn, outperformed the ADHD-prison group on the same measures. Additionally, the dyadic estimation of IQ demonstrated comparable FSIQ for controls and the ADHD-psychiatry group, whereas FSIQ was substantially lower in the ADHD-prison group (Control group n = 18, M = 112 (± 9.65), ADHD-psychiatry n = 20, M = 108.25 (±11.48), ADHD-prison n = 22 data missing for 8 individuals, M = 95.18 (± 9.99)). What is more, however, when controlling for IQ, the differences in working memory between ADHD-groups no longer remained significant, but controls still outperformed both ADHD-groups. Thus, both working memory tests showed executive dysfunctions associated with the ADHD diagnosis. Also when controlled for IQ.

On The Conner’s Continuous Performance Test II (CCPT), on the CCPT, controls, and the ADHD-psychiatry group showed similar results. However, at least one of the other groups outperformed the ADHD-prison group was outperformed by at least one of the other groups on all four accuracy dependent measures, and in three out of seven variability dependent measures, respectively. On the other hand, there were no significant differences in reaction time between groups (Table 4 and Figure 3). Moreover, controls and the ADHD-psychiatry group showed comparable results on CCPT. Notably, 5 out of 27 (18.5 %) subjects among the ADHD-prison group showed remarkably increased values (T-score >200).
Perseverations—a measure considered to reflect flexibility. Therefore, we performed analyses were therefore employed both including and excluding the subjects with extreme values. However, we observed similar results on Perseverations were observed also when excluding those subjects, thereby implying decreased flexibility among prison inmates with ADHD. Further, Moreover, the results of the CCPT did not co-vary with estimated FS IQ did not explain the CCPT results in this study (Table 4).
Discussion

The present study included an estimation of ADHD prevalence among adult male longer-term prison inmates from a high-security Swedish prison. Further, we evaluated ADHD and executive functions among prison inmates and then compared results with characterization of ADHD and cognitive abilities in a prison cohort, as compared to ADHD psychiatric outpatients, and to healthy controls. We estimated a prevalence rate as high as 40.5% among these prison inmates. Further, those inmates we later confirmed with ADHD were severely affected and disabled from ADHD and co-existing disorders, such as SUD, ASD, personality disorders, mood- and anxiety disorders. Previous studies reported increased frequencies of major mental disorders, personality disorders, and early adjustment problems among prison inmates; regardless of ADHD [41]. The present study confirms these observations. In addition, they demonstrated a compellingly low educational level and poorer cognitive abilities executive functions were poorer among ADHD prison inmates as compared with ADHD psychiatric outpatients and controls to the other groups. These findings remained after controlling for IQ. Thus, our findings imply prison inmates with ADHD to present a severely affected group of ADHD.

Although ADHD is shown to be common among prison inmates, prevalence rates are inconsistent, probably because of different used criteria among different cohort prison populations [5-9][6-10]. Further, symptoms of ADHD, such as especially hyperactivity and impulsivity, have shown to decline by age, whereas inattention and executive dysfunction continue across time. Besides,
Moreo\text{\textemdash}ver, most prevalence studies on male prison inmates have been conducted among younger inmates \cite{8} \cite{9}. Further on, knowledge is sparse\textemdash limited on clinical features and executive functions\textemdash cognitive abilities in adult male prison inmates confirmed\textemdash clinically diagnosed with ADHD \cite{6-10}, especially as compared with adults with ADHD among other groups\textemdash populations, and to controls.

To our best knowledge, this study is the first to report an initial screening survey for ADHD, followed by extensive\textemdash comprehensive diagnostic evaluations of ADHD and coexisting disorders among adult male longer-term prison inmates. The evaluations incorporated both self-reports and confirming collateral information from parents, medical records, and school reports. Additionally, evaluations included a physical examination, as well as neuropsychological assessments. Further, in addition, we compared ADHD\textemdash this prison cohort inside compared to with ADHD psychiatric outpatients and controls for diagnosed with ADHD symptom load and to healthy controls, with respect to symptoms of ADHD, coexisting\textemdash coexisting disorders, and executive\textemdash aspects of cognitive functioning, such as executive functions.

Prevalence of ADHD among prison inmates

As hypothesized, adult ADHD was prevalent among in these prison population\textemdash comprising adult male longer-term prison inmates with a median age of 31 years. We estimated\textemdash the prevalence as high as 40–50%, compared to which is consistent with previous findings by Rösler et al \cite{8}\cite{9}, who also reported a prevalence of 45% prevalence, though in substantially younger inmates (mean age 19). Thus, additionally, our results suggest that ADHD to be comparably present among older and younger inmates. Our finding contradicts the common view...
of ADHD to does not decline by age. Thus, this symptom reduction by age might not hold true for male ADHD prison inmates, as AD/HD tends to be as highly prevalent in older as in younger inmates. This finding of persistence is not in line with the results by Rösler [8] who suggested the prevalence of AD/HD to substantially decline by age, though in female prison inmates. Therefore, in future studies on prison inmates, sex differences should be further explored as well. Further, the total response rate was 62% in this survey, which could be viewed as acceptable, despite, considering the characteristics of a prison population, including a common mistrust against authorities among prison inmates. However, we have to when considering the attrition rate and its impact on the results. We imply, it could be argued, that within the prevalence rate of AD/HD is not exaggerated the AD/HD prevalence, as we did a portion of inmates were not approach inmates who we considered too psychiatric affected to take part. In some of these cases, ADHD might contribute to their for screening due to psychiatric instability symptoms, which might be explained by AD/HD in some of these cases. Moreover, non-responders were younger than responders, and in the commonly held view of AD/HD to decrease by age, we could hypothesize that AD/HD is at least as common among younger non-responders as in older responders. On the other hand, we can not exclude the possibility of some selection bias, especially at the end of the study period when the study was more commonly known in the Swedish prison and probation service. It might be assumed, that some inmates were informed about the study, recognized themselves as having suffering from AD/HD and therefore applied for serving conviction incarceration at Norrtälje prison Norrtälje Prison in hope for assessment and treatment. However, as we screened the majority was screened at the beginning of the study period, we imply this potential bias to be selection was probably due only to a of minor importance in cases. In summary, when considering the specificity of the
screening procedure, we suggest a 40% ADHD prevalence rate among the prevalence rate of 45% to be representative of this population of adult male longer-term inmates from a high-security prison.

Clinical characteristics of ADHD

This study only partially supported our hypothesis that ADHD the prison cohort inmates would present more severe ADHD symptoms across the lifespan, compared with the ADHD psychiatric outpatients group was only partially supported. The ADHD-prison group reported more ADHD symptoms and behaviours during both childhood and adulthood.

However, whereas collateral information from parents on childhood symptoms obtained from parents did not reveal any differences between groups. As a result, the subjects rated more childhood symptoms retrospectively compared to parental ratings by their parents. This observation contradicts which is on the contrary to previous findings by Barkley [42] who displayed demonstrated adults with ADHD to underreport their symptoms in comparison to previous ratings. Thus, in this case, when considering the negative trajectory of the prison cohort inmates and continuing persistence of ADHD symptoms into adulthood, you would predict substantial symptoms to be obvious having been present during childhood, in consistence with the self-reports ratings. Further, most majority of subjects reported previous need of contact with health services and requirement of educational support assistance at school during childhood, pointing to obvious indicating substantial childhood difficulties, although apparently not recognized as ADHD. Notably, this prison cohortmates showed demonstrated a remarkably considerably lower educational level as compared with both other comparison groups. This might be...
partly be explained by lower IQ levels among these inmates overall, as seen in this prison cohort, might partially explain these findings. Further, executive dysfunctions may contribute to the lower school attendance and performances. In fact, we expect educational Academic underachievement among is an expected feature of ADHD, also within the normal IQ range. Additionally, more hindering symptoms from ADHD and coexisting learning disabilities, including dyslexia and externalising symptoms such as ODD and CD, possibly contribute to poorer educational disorders achievements and early drop-outs from school. Another explanation might be prison inmates exaggerating their symptoms in hope for methylphenidate treatment. However, parents of both ADHD groups rated similarly on Conners’ Hyperactivity Index. This index reflects externalising symptoms besides ADGD, which is notable, considering the negative trajectory of our ADHD-prison group. Therefore, self-reported childhood symptoms by prison inmates seem more in line with their negative trajectories across time. A low educational level could reflect more impairing symptoms from ADHD and co-existing disorders, resulting in poorer academic achievements and early drop-outs from school. Further, symptoms of substance abuse, depression and anxiety could mimic ADHD. However, our inmates were kept from drugs for more than three months, in some cases for years. Further, all coexisting disorders were stable and treated at the assessment, thus implying present symptoms to be ADHD related. To summarise, these findings imply the importance of early recognition of ADHD early and offering effective treatment immediately. Prospective studies should evaluate if employing effective interventions will reduce the risk for serious outcomes, thereby hopefully reducing the risk for serious outcomes, which should be explored in future prospective studies.
Coexisting disorders

As hypothesized, coexisting disorders were more prevalent among our prison study cohort inmates as compared to psychiatric outpatients with ADHD. In fact, all prison subjects reported a lifetime history of SUD, with amphetamine as the most preferred drug of choice. Besides, abuse and antisocial behaviour had an early onset of abuse and antisocial activities, consistent with previous findings. Additionally, anxiety disorders and depression were common, and half of inmates received treatment at the time of assessment. Further, all but one subject displayed CD before a conduct disorder prior to developing APD. Notably, psychopathy was present among only one tenth of subjects, which was fewer than we expected, as all but one subject displayed APD, defined by a PCL-R cut-off score of 30, which was less than we expected, as all subjects fulfilled the criteria for APD. However, previous studies reported that most psychopaths fulfill the criteria for APD, whereas the opposite is true for only a minority about one-third to one-half of inmates. These findings signal that psychopathy would be more homogenous than APD. In addition, Soderstrom demonstrated, by using a three-factor model of PCL-R among forensic subjects for distinguishing psychopathy traits, and evaluating if certain traits reflected ADHD setting. By this model, he showed that the total PCL-R scores, as well as the Factor 2 (unemotionality) and the Factor 3 (behavioural dyscontrol), reflected correlated to ADHD. However, but not Factor 1, defining exaggerated self-opinion towards others and dishonesty did not reflect ADHD. In fact, the literature considers traits reflecting interpersonal traits of Factor 1 to be more specific of psychopathy.
Moreover, we confirmed ASD among was established in almost one fourth of ADHD prison inmates subjects, mainly most often as pervasive developmental disorder, not otherwise specified (PDD-NOS). We are not aware of any previous reports exploring the prevalence of ASD among prison inmates. However, Anckarsater [46][44] showed that ASD was more common among forensic subjects than in the general population. In that study (45), especially PDD-NOS presented the most common ASD, which is paralleling our findings. In summary, we suggest that ASD is common also among prison inmates. However, studies comprising larger samples need to confirm these preliminary findings, indicating a great need for future studies on prevalence rates of ASD in prison inmates. If ASD will turn out to be prevalent in prison inmates, we need to consider this for special considerations need to be taken into account, to successfully meeting the specific needs of inmates population. Previous studies reported that personality disorders are common among different ADHD populations, such as prison inmates [9]. Recently, Rydén et al observed that personality disorders were common among adults with “pure” ADHD, ADHD combined with bipolar disorder, and bipolar disorder only, although most prevalent among “pure” ADHD (Rydén E, and collaborators, personal communication). For defining personality disorders, they used the same procedure as in the present study. By comparing those “pure” ADHD with our ADHD prison inmates, most personality disorders implied more common among inmates. However, histrionic, depressive, and schizoid personality disorder implied more common among “pure” ADHD subjects (Rydén E, and collaborators, personal communication).
Cognitive abilities

The present study supported our hypothesis that ADHD prison inmates with 
ADHD psychiatric outpatients with AD/HD and to healthy controls, was supported by our findings. As expected, the ADHD-prison group performed poorer on almost all neuropsychological tests, including presenting lower estimated FSIQ. However, the different inclusion criteria could not explain the observed IQ differences between groups, as seen in FSIQ were not only might be explained by somewhat different exclusion criteria between study participants (as subjects with 70< IQ< 85, and current psychoactive medication were excluded from the ADHD-psychiatry group, in contrast to the ADHD-prison cohort where 70< IQ< 85, and concomitant medication were allowed) since differences remained when excluding prison inmates. Analysis including only subjects with IQ< 85 still showed significant group differences. Thus, as presented, Both ADHD groups displayed poorer executive functions compared with controls, also when adjusting for IQ. Nonetheless, the ADHD-psychiatry group may reflect better functioning subjects, both compared to the prison cohort and compared to those with ADHD usually seen at psychiatric clinics, as they often are treated for co-existing disorders. Working memory functions were similar between both ADHD AD/HD- groups performed similarly in WM tests when adjusting for IQ. Considering the CCPT results overall, controls and the ADHD-psychiatry group showed similar results. Further, at least one of them outperformed ADHD prison inmates on all accuracy dependent measures, and on several variability dependent measures, respectively. But they were both outperformed by controls. Further, the ADHD-prison group demonstrated poorer results on most accuracy- and variability dependent measures of the CCPT, also when
controlling for IQ, whereas on the other hand, reaction time was comparable between groups, thus implying slow reaction time not to be a concern among adult ADHD.

Summarising taken together, these findings are in line with the theories of ADHD as an executive disorder [47]. Willcutt EG, Doyle A, Nigg JT et al, 2005, Validity of the executive function theory of ADHD... Biol Psych. In addition, these findings parallel recent reports by Wood et al [48, 49] who suggested that lower IQ does not account for the key cognitive problems noted among ADHD. Further, one striking notion of the present study’s observation was the substantially increased levels of Perseverations on the CCPT, which is considered to reflect difficulties in holding back or adjusting non-proper inhibiting or modifying maladaptive behaviours.

Previou studies reported Response perseveration among has previously been found in subjects with ADHD subjects suffering from and co-existing co-existing Conduct Disorder (CD) [50-52][45-47], as well as among pathological gamblers [53][48]. However, researchers interpreted response perseveration among ADHD in different ways. Quay [50, 51][45, 46] suggested increased thriving for rewards among CD, overactivity because of a more actively working the behavioural activation (reward) system (BAS) compared with relative to the behavioural inhibition system (BIS) in CD, indicating increased sensitivity to rewards. In contrast, reverse, he suggested less an under active BIS compared with relative to BAS among in ADHD. Beauchaine interpreted the opposite way, he suggested proposed that an under less active BAS among CD, resulting in a less active reward-seeking behaviour as a stimulation seeking. Finally, a third explanation as argued by Seguin [55][50], and Newman and Wallace [56, 57][51, 52] respectively, suggested a deficit in attending to peripheral information, which usually directs the subject to changing for a more effective
behaviour strategy. Therefore, future studies should explore **Hence** the cognitive underpinnings of response perseveration, as they remain elusive and should be further explored.

**Limitations**

We have to consider several limitations have to be considered in this study. Firstly, as the attrition rate of the screening survey was 38%, we must interpret the results with caution. However, even though we imply exaggeration of the results are not exaggerated the prevalence rate of ADHD. Further, both rating scales used for screening lack Swedish validations. Nevertheless, these scales are used as standard tools in clinical practice an over-estimation. Secondly Besides, this study included was conducted only in male longer-term prison inmates, why results can not be extended to female inmates or to inmates serving shorter-term convicts. Further, Thirdly, there might have been selection bias when in recruiting for the screening survey mainly at the end of the study period, when the study was commonly known in the Swedish Prison and Probation service. It could be that some inmates recognised themselves as suffering from ADHD and therefore applied for serving conviction at Norrtälje Prison in hope for treatment. However, as we screened the majority at the end of the study period, we imply this potential bias as minor important. Further, there might have been selection bias because of different inclusion criteria between groups. Therefore, it implies a selection of subjects among ADHD psychiatric outpatients, functioning better than average, as treatment for coexisting disorders excluded for the present study. Actually, in clinical practice, adults with ADHD often receive treatment for common coexisting disorders both in the screening survey as previously described, as well as in the diagnostic assessment procedure, with respect to somewhat different exclusion criteria between cohorts, as
previously mentioned in detail. Hence, this could indicate a selected group of subjects in the AD/HD-psychiatry group, functioning better than average psychiatric outpatients with AD/HD. On the other hand, their AD/HD-psychiatry group may better reflect ADHD among the general population, as considered presenting less severe symptoms and severities compared with psychiatric outpatients. psychiatric cohort may be more representative of adults with AD/HD in the community, as it could be predicted that they demonstrate less severity as compared to psychiatric outpatients with AD/HD. Additionally, there may have been a selection bias when recruiting prison inmates for diagnostic assessment. We noticed a few prison inmates denied taking part in the study in lack of motivation for changing their behaviour, or resistance to stay at the ADHD ward. Therefore, a selection bias towards more motivated prison inmates could have been present. If so, the bias probably worked towards better performances and higher functioning, than the reverse. Finally, the study samples were small. However, results were statistically significant despite the small sample sizes. Notably, the strength of this study was the extensive clinical description, characterisation of ADHD, co-existing coexisting disorders and executive functioning cognitive abilities among prison inmates, as well as and comparisons with ADHD psychiatric outpatients with AD/HD and to controls. The extensive, by conducting comprehensive diagnostic evaluations, including both self-reported information, collection of and collateral information, physical examination, structured diagnostic interviews, and as well as neuropsychological assessments. To our best knowledge, such extensive evaluations of longer-term prison inmates have not previously been reported, which has not previously been reported, to our best knowledge. We infer our reported findings of ADHD symptom severity, coexisting disorders and executive functioning among prison inmates, are clinical important and relevant. We need to
consider these severities when adjusting existing, or designing new ADHD treatment programmes for prison inmates. Further, these extensive evaluations might provide helpful insight for addressing future research on exploring ADHD endophenotypes, of ADHD. Moreover, to extend the knowledge beyond executive functioning in ADHD, we will report on learning and memory functions in this prison cohort, as compared to ADHD in psychiatric outpatients and to controls, in another paper (Ginsberg et al, unpublished data). Further, this knowledge on endophenotypes may promote individually tailored treatments could be essential by identifying those individuals who will benefit most from different treatment options, thereby facilitating individually tailored treatments to optimize outcomes. Finally, we will report on effects of methylphenidate treatment among those with methylphenidate in this prison inmates cohort will be addressed in another paper (Ginsberg and Lindefors, unpublished data).

Conclusions
This study suggested ADHD to be present among 40.5% of adult male longer-term prison inmates. Subsequent diagnostic evaluations for ADHD among 30 inmates showed them to be severely disabled from ADHD and coexisting psychiatric disorders, such as SUD, overlapping ASD, personality disorders, as well as mood- and anxiety disorders. Further, these prison inmates displayed poorer cognitive abilities, executive functions, with respect to also when controlling for estimated FS IQ and executive functioning, as compared to with ADHD psychiatric outpatients with ADHD and to healthy controls. We infer the reported findings of ADHD symptom severity, coexisting disorders and executive functioning among prison inmates, are clinical important and relevant. These findings imply the need for
considering these severities when introducing ADHD treatment programmes for prison inmates.

Competing interests
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. Both All other authors declare that they have no conflicts of interest.

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Authors’ contributions
YG designed the study in collaboration with NL and TH, applied to the Ethical Board in collaboration with NL, prepared the Case Report Forms, conducted clinical assessments, collected data, planned and executed the analyses, interpreted the results in collaboration with TH and NL, interpreted the results in collaboration with fellow authors, and prepared all drafts of the first draft of the manuscript in collaboration with TH. NL revised the manuscripts critically. TH was responsible for assessments and analyses of the psychiatric outpatients and controls. All authors read, commented on and approved the final manuscript.

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Figures

Figure 1. Flow chart of the screening procedures and diagnostic assessments

Prison inmates at Norrtälje correction facility, Dec 2006 - April 2009 (n=589)

Approached for screening (n=315)

Responders (n=194)

WURS (≥36) and ASRS-Screener (≥4) (n=88)

Consecutively considered for diagnostic assessment (n=40)

Clinically assessed group (n=34)

Diagnosed with ADHD (n=30)

Not approached (n=274)

Practical reasons or too mentally instable 74

Deported after conviction 200

Non-responders (n=121)

Active refusals or not returning questionnaires 116

Returned unanswered questionnaires 5

WURS (<36) and/or ASRS-Screener (<4) (n=106)

Not assessed for ADHD (n=6)

Not eligible due to inclusion and/or exclusion criteria for RCT by prescreening

Consented but dropped out from diagnostic assessment

Not fulfilling ADHD criteria (n=4)

Not assessed for ADHD (n=6)

Not eligible due to inclusion and/or exclusion criteria for RCT by prescreening

Consented but dropped out from diagnostic assessment

Not fulfilling ADHD criteria (n=4)
Figure 2. Retrospective ratings of childhood symptoms by the Five to Fifteen questionnaire as completed by significant others, for the ADHD-psychiatry group (n=15) and the ADHD-prison group (n=14), respectively.

Figure 3 a) Verbal intelligence, as measured by Vocabulary, versus verbal executive functions (working memory), as measured by Digit Span, divided by the three groups.
controls (n=18), the ADHD-psychiatry group (n=20), and the ADHD-prison group (n=22, data missing for 8 subjects).

b) Non-verbal intelligence, as measured by Block Design, versus non-verbal executive functions (working memory), as measured by Span Board, divided by the three groups, controls (n=18), the ADHD-psychiatry group (n=20), and the ADHD-prison group (n=22).
Figure 3. The Conners’ Continuous Performance Test II (CCPT). Results are demonstrated for controls (n=18), the ADHD-psychiatry group (n=20), and the ADHD-prison group (n=27), respectively. The results in the CCPT did not covary with IQ.

Note: * the AD/HD prison group performed significantly poorer than at least one of the other two groups (AD/HD psychiatry and controls).
### Table 1: Demographic and Clinical Characteristics of Prison Survey Sample

<table>
<thead>
<tr>
<th></th>
<th>Responder (n=194)</th>
<th>Non-responders (n=121)</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men, n (%)</strong></td>
<td>194 (100)</td>
<td>121 (100)</td>
<td></td>
</tr>
<tr>
<td><strong>Age, median(^b) (IQR), y</strong></td>
<td>31.3 (14)</td>
<td>29.4 (12)</td>
<td><em>p</em>=.028(^d)</td>
</tr>
<tr>
<td><strong>Conviction time, median(^b) (IQR)(^c), months</strong></td>
<td>69 (66)</td>
<td>60 (54)</td>
<td><em>p</em>=.030(^d)</td>
</tr>
</tbody>
</table>

\(^a\) Non-responders were defined as those approached but actively refused participation, those consented but not returning the questionnaires, and those returning unanswered questionnaires; \(^b\) Medians were used as measures of central tendencies as age and conviction time were non-normally distributed; \(^c\) IQR: Interquartile range; \(^d\) Mann-Whitney U-test was employed due to non-normal distributed data.
Table 2. Demographic and Clinical Characteristics of Assessed Groups: ADHD-prison group, ADHD-psychiatry group, Healthy controls. Not applicable = N/A.

<table>
<thead>
<tr>
<th></th>
<th>ADHD-prison, n=30</th>
<th>ADHD-psychiatry, n=20</th>
<th>Controls, n=18</th>
<th>$F$ or $x^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>34.4 (10.67)</td>
<td>33.4 (8.65)</td>
<td>35.2 (9.85)</td>
<td>.14</td>
<td>.87</td>
</tr>
<tr>
<td>Educational level, nine-year-compulsory school or less, n (%)</td>
<td>25 (83)</td>
<td>6 (30)</td>
<td>1 (6)</td>
<td>39.2</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>ADHD, combined, n (%)</td>
<td>28 (93)</td>
<td>18 (90)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>ADHD, inattentive, n (%)</td>
<td>2 (7)</td>
<td>2 (10)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>&gt;1 current co-morbid disorder, n (%)</td>
<td>15 (50)</td>
<td>12 (60)</td>
<td>N/A</td>
<td>N/A</td>
<td>.569</td>
</tr>
<tr>
<td>Autism spectrum disorder</td>
<td>7 (23)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Mood and anxiety disorder, lifetime</td>
<td>22 (73)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Personality disorders, mean (SD), n</td>
<td>7.4 (3.18)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Substance use disorder, n (%)</td>
<td>30 (100)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Amphetamine-preferred, n (%)</td>
<td>19 (63)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Cocaine-preferred, n (%)</td>
<td>4 (13)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Alcohol-preferred, n (%)</td>
<td>4 (13)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Psychopathy, n (%)</td>
<td>3 (10)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Concomitant psychotropic's, n (%)</td>
<td>13 (43)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Onset of alcohol, mean (SD), y</td>
<td>11.9 (1.81)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Onset of illegal drugs, mean (SD), y</td>
<td>14.0 (2.41)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Onset of criminality, mean (SD), y</td>
<td>11.2 (3.40)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Educational assistance at school, n (%)</td>
<td>24 (80)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Child psychiatry/school health, n (%)</td>
<td>18 (60)</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>ADHD diagnosed in childhood, n (%)</td>
<td>2 (7)</td>
<td>N/A</td>
<td>N/A</td>
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</tbody>
</table>
Table 3. Self-rated AD/HD symptoms and behaviours in both childhood and adulthood: parental ratings of childhood AD/HD symptoms. All results are divided by group.

<table>
<thead>
<tr>
<th></th>
<th>ADHD - psychiatry n=20</th>
<th>ADHD - prison n=30</th>
<th>t</th>
<th>p</th>
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<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
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<td>Self-rating questionnaires</td>
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<tr>
<td>Wender Utah Rating Scale (WURS-25)</td>
<td>54.70 (14.31)</td>
<td>67.43 (13.48)</td>
<td>-3.19</td>
<td>.002</td>
</tr>
<tr>
<td>ADHD Self-Report Scale$^a$</td>
<td>45.11 (12.85)</td>
<td>55.30 (8.89)</td>
<td>-3.28</td>
<td>.002</td>
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<tr>
<td>Parental rating/questionnaires completed by significant others</td>
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<tr>
<td>Five to Fifteen – Executive Functions Subscale$^b$</td>
<td>1.23 (0.59)</td>
<td>1.20 (0.44)</td>
<td>0.19</td>
<td>.848</td>
</tr>
<tr>
<td>Conners Hyperactivity Index$^b$</td>
<td>13.47 (10.34)</td>
<td>15.19 (8.07)</td>
<td>-0.52</td>
<td>.608</td>
</tr>
</tbody>
</table>

$^a$ Data missing for one subject in the ADHD - psychiatry group. $^b$ The FTF Executive Functions Subscale includes ADHD criteria according to DSM-IV. For 15/20 (75%) in the ADHD - psychiatry group and 16/30 (53%) in the ADHD - prison group, a significant other completed the FTF and the Conners Hyperactivity Index. Higher scores correspond to more problems in all questionnaires.
Table 4. ANOVA statistics, including post hoc adjustments for IQ, for neuropsychological measurements/tests of executive functions. The statistics \( F \), \( p \), and \( \eta^2 \) are presented for ANOVAs without IQ adjustment. In the results from the Wechsler scales working memory tests, higher scores mean better results, whereas in Conner’s CPT-II, higher scores mean poorer results.

<table>
<thead>
<tr>
<th>Test and measured function</th>
<th>N</th>
<th>F</th>
<th>p</th>
<th>( \eta^2 )</th>
<th>Post-hoc test</th>
<th>( \overline{f} )</th>
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<td>12.28</td>
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<td>&lt;.001</td>
<td>.301</td>
<td>C=Psych&gt;Prison</td>
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<td>Block Design</td>
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<td>Dyadic estimation of IQ</td>
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Note: CCPT = Conner’s Continuous Performance Test; RT = reaction time; SE = standard error; ISI = interstimulus interval; N/A = not applicable
Figures

Figure 1. Flow chart of the screening procedures and diagnostic assessments

Prison inmates at Norrtälje correction facility, Dec 2006-April 2009 (n=589)

Approached for screening (n=315)

Responders (n=194)

WURS (≥36) and ASRS-Screener (≥4) (n=88)

Consecutively considered for diagnostic assessment (n=47)
Screening positively for adult ADHD Stockholm catchment area (primarily) ≥ 14 months to conditional release

Clinically assessed group (n=34)

Diagnosed with ADHD (n=30)

Not approached (n=274)
Practical reasons or too mentally instable 74
Deported after conviction 200

Non-responders (n=121)
Active refusals or not returning questionnaires 116
Returned unanswered questionnaires 5

WURS (<36) and/or ASRS-Screener (<4) (n=106)

Not assessed for ADHD (n=13)
Did not fulfill inclusion criteria (not consented) n=1
Denied participation (not consented) n=6
Consented but dropped out from diagnostic assessment n=6

Not fulfilling ADHD criteria (n=4)
Figure 2. Retrospective ratings of childhood symptoms by the Five to Fifteen questionnaire as completed by significant others, for the ADHD-psychiatry group (n=15) and the ADHD-prison group (n=14), respectively.
Figure 3. The Conners' Continuous Performance Test II (CCPT). Results are presented for controls (n=18), the ADHD-psychiatry group (n=20), and the ADHD-prison group (n=27), respectively. The CCPT results did not co vary with IQ.

Note: * the ADHD-prison group performed significantly poorer than at least one of the other two groups (ADHD psychiatry and controls).
Additional files provided with this submission:

Additional file 1: Revised manuscript Table 1_Nov 9
2010_ylva_ginsberg_BMC.pdf, 9K

Additional file 2: Revised manuscript Table 2_Nov 9
2010_ylva_ginsberg_BMC.pdf, 171K
http://www.biomedcentral.com/imedia/7851455454785289/supp2.pdf

Additional file 3: Revised manuscript Table 3_Nov 9
2010_ylva_ginsberg_BMC.pdf, 68K

Additional file 4: Revised manuscript Table 4_Nov 9
2010_ylva_ginsberg_BMC.pdf, 171K

Additional file 5: Paper 1_final version with lines without track changes for BMC 1, 458K
http://www.biomedcentral.com/imedia/2073552063478530/supp5.doc