

# Juvenile and Young Adult Mentally Disordered Offenders: The Role of Child Neuropsychiatric Disorders

Leila Siponmaa, Marianne Kristiansson, MD, PhD, Carin Jonson, Agneta Nydén, PhD, and Christopher Gillberg, MD, PhD

A retrospective study of the prevalence of child neuropsychiatric disorders was done involving pervasive developmental disorder (PDD), attention-deficit/hyperactivity disorder (ADHD), and Tourette syndrome in young offenders (15–22 years,  $n = 126$ ) consecutively referred for presentencing forensic psychiatric investigation (FPI) in Stockholm, Sweden. Most offenders were referred for FPI because of serious offenses. Case report sheets were prepared, and retrospective neuropsychiatric DSM IV diagnoses were made by the first two authors. For best-estimated diagnoses, the case report sheets were then submitted to the fifth author, a child neuropsychiatrist with expertise in this area. Fifteen percent of the subjects had a definite diagnosis of ADHD, and another 15 percent had PDD, including 12 percent PDD not otherwise specified (NOS) and 3 percent Asperger syndrome. Autistic disorder was not found in any case. Tourette syndrome occurred in two percent of the cases. The rate of PDD is particularly striking. Neuropsychiatric diagnoses had been determined in the FPI in only a few cases. The contribution of constitutional problems to later criminal development may have been underestimated.

*J Am Acad Psychiatry Law* 29:420–6, 2001

There is strong evidence that young offenders, including young forensic psychiatric patients, often have a turbulent background with a high degree of psychosocial adversity and familial loading toward criminality.<sup>1</sup> Much less is known about the contribution of individual risk factors to the development of criminality.<sup>2,3</sup> Results from different studies suggest an association between mental disorder and crime<sup>4–6</sup> and between intellectual deficiency and crime.<sup>7</sup>

Recent years have witnessed major developments in child neuropsychiatry, particularly in three areas: (1) attention-deficit/hyperactivity disorder

(ADHD)<sup>8,9</sup>; (2) autism and its spectrum of disorders—also referred to as pervasive developmental disorders (PDD)<sup>10,11</sup>—which include autistic disorder, Asperger syndrome, and PDD not otherwise specified (PDD NOS),<sup>12,13</sup> and (3) Tourette syndrome.<sup>14,15</sup> These disorders are more common than previously believed and together affect approximately five percent of the general population of school-age children.<sup>16</sup> A majority of affected individuals remain handicapped by impairments in adult life. PDDs are relatively uncommon, and less than one percent of the general population of young people are affected.<sup>16</sup>

Juvenile delinquents have been found to have extremely high rates of conduct disorder (CD), ranging from 87 to 100 percent.<sup>17,18</sup> Attention deficit disorder (ADD) or ADHD has been reported in 55 percent of juvenile delinquents.<sup>19</sup> CD and ADHD are often concomitant. CD has been reported to be present in approximately 50 percent of individuals with diagnosed ADHD.<sup>20</sup>

We hypothesized that child neuropsychiatric disorders of PDD, which often display symptoms such as impulsivity, diminished empathy, compulsive be-

Ms. Siponmaa is a Social Worker with the Department of Forensic Psychiatry, Huddinge, Sweden, and a Doctoral Student in the Department of Child and Adolescent Psychiatry, Göteborg University, Göteborg, Sweden. Dr. Kristiansson is in the Division of Forensic Psychiatry, Karolinska Institute and the National Board of Forensic Medicine, Huddinge, Sweden. Ms. Jonson is a Neuropsychologist with the Department of Forensic Psychiatry, the National Board of Forensic Medicine, Huddinge, Sweden. Dr. Nydén is a Neuropsychologist with the Department of Child and Adolescent Psychiatry, Göteborg University, Göteborg, Sweden. Dr. Gillberg is Professor in the Department of Child and Adolescent Psychiatry, Göteborg University, Göteborg, Sweden and in the Department of Psychiatry, St. George's Hospital Medical School, London University, London, UK. Address correspondence to: Leila Siponmaa, Department of Forensic Psychiatry, Karolinska Institute, Ambulansgatan 1, 141 00 Huddinge, Sweden. E-mail: leila.siponmaa@rmv.se

haviors, and difficulties in communication and social interaction—factors that theoretically would increase the risk of criminal behavior—would also be over-represented among young delinquents.

To our knowledge, the prevalence of PDD has not been studied in youth delinquency. In the United Kingdom, Scragg and Shah<sup>21</sup> have reported that the rate of Asperger syndrome in patients in adult forensic security hospitals (1.5%–2.3%) is higher than that in the general population (0.4%).<sup>22</sup>

In Sweden, delinquents admitted for forensic psychiatric investigation (FPI) have not been routinely screened for child neuropsychiatric disorders. The main objective of the study was to examine to what extent such diagnoses occur in FPIs. Our hypothesis was that such diagnoses are often missed, especially PDDs.

## Materials and Methods

One hundred thirty young patients, 15 to 22 years old, (median: 20; 127 males, 3 females) were investigated and evaluated at the Forensic Psychiatric Department in Stockholm from 1990 through 1995, after committing serious offenses, mostly of a violent nature (Table 1). In four cases (all males) FPI records were not available at the time of the present retrospective study, which meant that 126 of the 130 cases could be included.

FPIs in Sweden may not exceed four weeks if the offender is on remand or six weeks if the offender is not on remand. All patients are examined by a psychologist, a social worker, and a psychiatrist during the investigation.

The subjects of the study had been seen individually by a qualified psychologist during the FPI, and the following tests had been administered to determine the intellectual level: the Wechsler Adult Intel-

ligence Scale-Revised (WAIS-R)<sup>23</sup> ( $n = 52$ ) or the Wechsler Intelligence Scale for Children-Revised (WISC-R)<sup>24</sup> ( $n = 4$ ), the Raven colored matrices<sup>25</sup> ( $n = 4$ ), or the Swedish SRB<sup>26</sup> ( $n = 47$ ). The Swedish SRB has three parts: Synonyms, Reasoning Test, and Kohs Block Design Test.<sup>27</sup> Seven individuals were given only the performance portions of the tests, because their knowledge of Swedish was too poor for them to perform the verbal test sections. Five patients with psychosis were not tested. Fourteen other individuals were given one of the tests, but their results were not available at the time of the study's completion. Thus, estimated IQ-levels were available for 107 members (84%) of the group ( $n = 126$ ).

A social worker had interviewed all the patients and, whenever possible, first- or second-degree relatives in connection with the FPI. Data from all accessible files from such institutions as social services, health care, and criminal justice were also included and reported.

A semistructured psychiatric interview and a psychiatric state examination had also been performed by a psychiatrist in all FPIs. The interview covered the areas in the Structured Clinical Interview for DSM III R,<sup>28</sup> but in the mid-1990s the diagnoses of the International Classification of Diseases (ICD)-9<sup>29</sup> were still used in Swedish clinical psychiatry and in clinical forensic psychiatry, as well.

The psychiatric diagnoses assigned in connection with the FPI are listed in Table 2. These diagnoses are shown for descriptive purposes and will not be used in the further presentation of results. In seven cases (5%), a neuropsychiatric diagnosis had been assigned as a main diagnosis and in 16 cases as a comorbid diagnosis. Only two cases had a PDD diagnosis and both had received the diagnosis in childhood. Alcohol and drug abuse was a main diagnosis in 2 cases and a comorbid diagnosis in 38 cases.

### Preparation of Summary Data Sheets and Retrospective Diagnostic Decisions Regarding Child Neuropsychiatric Disorders

The first author (L.S.) compiled all data in each case from the FPI reports and court sentences (and other documents, if any) on a data sheet specifically designed for the present study by the first two authors (L.S., M.K.). This data sheet included the following areas in detail: demographic data, heredity,

**Table 1** Index Crime Prompting Forensic Psychiatric Examination

| Crime                             | <i>n</i> | % of 126 Cases |
|-----------------------------------|----------|----------------|
| Murder                            | 18       | 14             |
| Manslaughter                      | 10       | 8              |
| Assault causing bodily harm       | 29       | 23             |
| Robbery with violence             | 18       | 14             |
| Rape or sexual assault            | 8        | 6              |
| Arson                             | 16       | 13             |
| Threatening behavior              | 7        | 6              |
| Unlawful confinement              | 2        | 2              |
| Possession of explosives          | 2        | 2              |
| Other types of crime (nonviolent) | 15       | 12             |

Total  $n = 126$ .

**Table 2** Main ICD-9 Psychiatric Diagnoses Assigned During the Forensic Psychiatric Examination

| Diagnosis   | <i>n</i> | % of Cases |
|---|----------|------------|
| Personality disorder  | 67       | 53         |
| Behavioral or emotional disorder  | 23       | 18         |
| Psychosis   | 16       | 13         |
| Organic syndrome, mental retardation, neuropsychiatric developmental disorder | 7        | 5          |
| Pyromania   | 5        | 4          |
| Depression  | 1        | 1          |
| Abuse of alcohol or drugs   | 2        | 2          |
| No diagnosis  | 5        | 4          |

Total cases = 126.

early psychomotor development, child neuropsychiatric symptoms/signs over time, social factors in childhood and adolescence (including early traumatic experiences, such as sexual abuse, assault and battering, verbal abuse), social adaptation/adjustment (including alcohol and drug abuse, housing), psychosexual maturity, earlier psychiatric contact/care, earlier criminality, actual criminality (type of crime, relation to victim, influence of alcohol or drugs), psychosocial stress over time, self-injury, impulsivity, empathy, physical disease, FPI results (diagnoses, psychiatric assessments and psychological assessments concerning intelligence level, personality, organic brain damage), and final court sentence after FPI. On the basis of this information, the two first authors assigned retrospective child neuropsychiatric diagnoses according to DSM-IV.<sup>30</sup>

The data sheets were then submitted to the fifth author (C.G.), a specialist in child neuropsychiatry, for best-estimated diagnoses of disorders usually first manifested in childhood or adolescence. These diagnoses were also based on DSM-IV. In the case of Asperger syndrome, the criteria of Gillberg<sup>31,32</sup> were used. These criteria, based on Asperger's descriptions of the syndrome, have good to excellent inter-rater reliability<sup>22</sup> and have been used in a number of different epidemiologic and clinical studies. Individuals meeting criteria for this category also met DSM-IV and ICD-10<sup>33</sup> criteria for Asperger disorder/syndrome, except that normal language and social development in the first three years of life could not be documented in any case. Wherever possible, the neuropsychiatrist assigned cases to one main diagnosis from the following list: ADHD (with or without developmental coordination disorder, DCD), PDD (comprising autistic disorder, PDD NOS, and Asperger syndrome), Tourette syndrome, other neuro-

psychiatric diagnoses (including mental retardation and organic brain damage—e.g., epilepsy), and psychotic disorder. Diagnoses were classified as “definite” when the case sheets were sufficiently detailed to ascertain that full diagnostic criteria were met, or “probable” when there was sufficient information to strongly suggest the diagnosis but not enough detail to allow assignment of a definite diagnosis. In the remaining cases the assignment “no main diagnosis” was made.

Whenever possible, cases with a child neuropsychiatric main diagnosis were also assigned comorbid diagnoses from the following list: CD, antisocial personality disorder, and substance abuse disorder. Each individual was also assigned to one of three groups that designated the overall level of intellectual functioning according to intellectual level; 85 to 115 or above (average or above), 71 to 84 (slightly below average), or 70 or below (mental retardation).

### Statistics

The results are presented as numbers or percentages. The fifth author remained blind to the diagnoses made by the first two authors throughout the study. His diagnoses were used as the gold standard when checking for inter-rater agreement for main diagnoses and throughout the tables in this article. The Cohen  $\kappa$  statistic<sup>34</sup> was used to check reliability.

The relationship between diagnosis and type of criminality was assessed by applying the chi-square test. A *p* value of less than .05 was considered significant.

### Results

Definite and probable main diagnoses were pooled and grouped into ADHD, PDD, and other specific diagnosis. There was good agreement for main diagnosis across raters (Cohen  $\kappa$  = .65).<sup>35</sup>

The number of patients with PDD was high (Table 3). Fifteen percent of the whole group had a definite PDD diagnosis, and 12 percent had a probable PDD diagnosis. The occurrence of PDD NOS was particularly high. Autistic disorder was not found in any case.

The rate of definite ADHD was also high (15%). Definite ADHD, combined with definite DCD, occurred in 10 percent of all cases. This combination is known in the Nordic countries as severe deficits in attention, motor control, and perception (DAMP).

There were often enough symptoms to warrant

**Table 3** Main DSM-IV Child Neuropsychiatric Diagnoses Assigned by Child Psychiatrist

| Diagnosis                        |                    | <i>n</i> | % of 126 Cases | % of 112 Classifiable Cases |
|----------------------------------|--------------------|----------|----------------|-----------------------------|
| PDD                              | All                | 34       | 27             | 30                          |
|                                  | Definite           | 19       | 15             | 17                          |
| PDD NOS                          | All                | 21       | 17             | 19                          |
|                                  | Definite           | 15       | 12             | 13                          |
| Asperger syndrome                | All                | 13       | 10             | 12                          |
|                                  | Definite           | 4        | 3              | 4                           |
| ADHD                             | All                | 31       | 25             | 28                          |
|                                  | Definite           | 19       | 15             | 17                          |
| ADHD with DCD*                   | All                | 17       | 13             | 15                          |
|                                  | Definite           | 12       | 10             | 11                          |
| Tourette syndrome                | All                | 3        | 2              | 3                           |
|                                  | Definite           | 2        | 2              | 2                           |
| Any of the above                 | All                | 68       | 54             | 61                          |
|                                  | Definite           | 40       | 32             | 36                          |
| Other neuropsychiatric diagnoses | All                | 8        | 6              | 7                           |
|                                  | Psychotic disorder | 8        | 6              | 7                           |
| Other diagnoses                  | All                | 28       | 22             | 25                          |
| Not classifiable                 |                    | 14       | 11             |                             |

All includes definite and probable diagnoses. Of the 126 cases studied, 112 had informative data sheets.

\* ADHD with DCD is DAMP.

diagnoses of both PDD and ADHD, but in such cases a decision was made as to which of these should be considered the main diagnosis. Only data referring to the main diagnosis was detailed in this respect.

Definite Tourette syndrome occurred in two percent of the whole group. Tourette syndrome was also an associated diagnosis in one patient where the main diagnosis was ADHD.

Altogether, 32 percent (40/126) had a diagnosis of definite PDD, ADHD, or Tourette syndrome, and another 22 percent had a diagnosis of probable PDD, ADHD, or Tourette syndrome. However, it is important to note that for 14 subjects there was not enough information to assign a main diagnosis, which means that 61 percent of those whose data were classifiable had one of these diagnoses (definite or probable).

CD was the most common comorbidity diagnosed, occurring in 26 percent (29/112) of those who had informative data sheets. Of these, 15 patients had ADHD as their main diagnosis. Antisocial personality disorder was diagnosed in another 14 percent (16/112). Drug abuse was a comorbidity diagnosed in 25 percent (28/112) of the whole group.

Thirty-four of 107 tested patients (32%) had an IQ level slightly below average (71–84), whereas 11

patients (10%) had mental retardation (IQ of 70 or below).

Sixteen individuals had committed arson (as a main crime); the diagnoses (definite and probable) for these individuals are shown in Table 4. The diagnoses of PDD NOS and Asperger syndrome were statistically more frequent in the arson group than it was in the other crime groupings ( $F = 12.74$ ,  $df = 1$ ,  $p < .001$ ;  $\chi^2$  test). This was the only significant relationship between type of crime and diagnosis that was found.

Sixty-three patients (50% of those included in the study) had been in contact with child and adolescent psychiatric services (Table 5). Fifteen percent (19/126) had had their first psychiatric consultation after the age of 18, in adult psychiatry. Thus, 65 percent (82/126) of the subjects had received some kind of psychiatric care before the FPI.

## Discussion

This preliminary study was of a retrospective design and did not include controls of any kind. However, it appears that the rate of child neuropsychiatric disorders in young offenders referred for FPI before sentencing is much higher than in the general population of adolescents and young adults. Even though no cases of classic autism were found, the rate of PDD (15% definite cases) was particularly striking, and we are confident that this represents at least a 15-fold increase over the incidence in the general population.<sup>16</sup> The incidence of severe DAMP (that is, ADHD with DCD) was also very high (10%), and we believe that this is evidence of at least a fivefold increase above the reported rates of 1.2 to 1.7 percent for this diagnosis in young children.<sup>36,37</sup> It should be noted that the prevalence in the general population of clear-cut DAMP (and ADHD) tends to be considerably higher in young children than it is in adolescents and young adults.<sup>38,39</sup> Another striking finding was the high rate of intellectual impairment, regardless of the main diagnosis. The prevalence of

**Table 4** Diagnoses for Individuals Who had Committed Arson

| Diagnosis (definite and probable)   | <i>n</i> | % of 16 |
|-------------------------------------|----------|---------|
| ADHD                                | 2        | 12.5    |
| PDD (Asperger syndrome and PDD NOS) | 10       | 63      |
| Mental retardation                  | 2        | 12.5    |
| Other diagnosis                     | 1        | 6       |
| Not classifiable                    | 1        | 6       |

Total *n* = 16.

Table 5 Previous Child and Adolescent Psychiatric Consultations

| Diagnosis                        | n   | Psychiatric Consultation | % of Respective Cases |
|----------------------------------|-----|--------------------------|-----------------------|
| ADHD                             | 31  | 25                       | 81                    |
| PDD                              | 34  | 17                       | 50                    |
| Tourette syndrome                | 3   | 2                        | 67                    |
| Other neuropsychiatric diagnoses | 8   | 1                        | 13                    |
| Psychotic disorder               | 8   | 4                        | 50                    |
| Other diagnoses                  | 28  | 10                       | 36                    |
| Not classifiable                 | 14  | 4                        | 29                    |
| Total                            | 126 | 63                       | 50                    |

clear mental retardation (10%) was several times higher than it is in the general population (0.4%).<sup>40-42</sup>

Before any firm conclusions are drawn, some caveats should be mentioned. When comparing the present results with those from other studies, one must consider that the present sample was recruited from a particular young forensic population submitted for a presentencing psychiatric investigation, and it may not be possible to generalize the results to other young offenders. In Sweden, only four percent of offenders who are sentenced to prison are referred for presentencing FPI. The retrospective design of the study also hampers the interpretation of the results.

Courts in Sweden are restrictive in sentencing young individuals to prison, and especially in the case of serious crime, the courts want or need psychiatric support for their decision. Thus, the cohort we studied may be biased toward more violent offenders, but there is little to suggest that this in itself introduced any bias toward those who had neuropsychiatric disorder diagnosed in childhood, such as ADHD, PDD, and Tourette syndrome. Even in persons with severe childhood symptoms, the disorder usually remained undiagnosed in childhood. Nevertheless, most of those with ADHD and half of the group with PDD had attended child and adolescent psychiatric clinics when younger (Table 5). This provides further validation, albeit indirectly, of the neuropsychiatric diagnoses.

The diagnostic procedure used during the FPI was not specifically geared to detect a history of child neuropsychiatric disorders, which meant that the data basis for diagnostic decisions was less than optimal in many cases. However, cases assigned definite diagnoses were described in sufficient detail to allow fairly secure diagnostic judgments. Also, inter-rater

reliability for main diagnoses was good. Thus, the rates of definite main diagnoses should be regarded as minimum figures, which are unlikely to be inflated by overdiagnosis. The retrospective child neuropsychiatric diagnoses had been diagnosed in the FPIs mainly with diagnoses of personality disorder (antisocial, immature, narcissistic, phobic, borderline, schizoid, paranoid—sometimes characteristics from more than one personality disorder in one individual) or behavioral/emotional diagnoses. Our child neuropsychiatric diagnoses are not necessarily in conflict with the diagnoses of personality disorder, but we believe they clarify the disability better and should have an influence on the treatment. Five of our patients with PDD diagnoses had a rather imprecise diagnosis of psychosis in the FPI (patient 1, psychotic syndrome; patient 2, questionable schizophrenia NOS; patient 3, subchronic schizophrenia with acute exaltation/schizophrenia in remission; patient 4, psychotic syndrome; patient 5, atypical psychosis) and one had pyromania.

The rate of definite cases of Asperger syndrome (3%) was higher than that in the general population (0.4%),<sup>22</sup> but was of the same order of magnitude as that found by Scragg and Shah (1.5%–2.3%),<sup>21</sup> who studied adult subjects in a secure hospital who were undergoing forensic psychiatric treatment. The subjects in the present study were young individuals in an FPI setting, and only approximately one third of the group were sentenced to compulsory psychiatric institutional care after the FPI. These methodologic differences between the studies may have contributed to the diverging results. To our knowledge, there are no studies that examined the prevalence of Asperger syndrome and PDD NOS in subjects referred for presentencing forensic assessment or in the prison system. In our study, three of the four individuals with a definite Asperger diagnosis were subsequently sentenced to compulsory institutional psychiatric care.

However, the number of patients with Asperger syndrome was small, both in the British study and in ours, and we would maintain a cautious attitude before concluding that this particular autism spectrum disorder variant is over-represented in forensic psychiatry. Nevertheless, the number of patients with diagnosis of probable Asperger syndrome was high, as was the prevalence of PDD NOS, which suggests that there may have been a number of false-negative diagnoses of Asperger syndrome and that the main

reason for the relatively low absolute numbers was that the clinical detail required to make a definite diagnosis was unavailable. All individuals with a PDD diagnosis were socially handicapped and dysfunctional from early childhood, and most of them had problems with control of aggression in certain social situations, when they had to compromise or change their minds or when they were too slow or rigid to understand what other people meant or intended. Those in whom we diagnosed PDD NOS had several examples from DSM IV criteria (A, B, and C) of Asperger syndrome. When diagnosing Asperger syndrome in our study we used the criteria of Gillberg *et al.*<sup>31,32</sup> with more detailed symptoms.

Sixteen (47%) of 34 individuals with a definite or probable PDD diagnosis in our study were assessed in connection with FPI to have "severe mental illness" (a Swedish legal term) at the time of the crime, but only 12 of them were sentenced to psychiatric hospital care. Ten of the individuals with a PDD diagnosis were sentenced to prison and the remainder, 12 individuals, were released on probation or admitted to the social services system.

Autistic disorder did not occur in any case, possibly because individuals with this severe PDD usually had received diagnosis at a much earlier age and were cared for in special services.

In the present study group, the prevalences of comorbid CD and definite ADHD were much lower—26 percent and 15 percent, respectively—than in other studies.<sup>17-20</sup> This can probably be explained by the fact that CD and/or ADHD would very seldom be considered a severe mental disorder according to Swedish law, and thus, the courts with their knowledge about the offenders' backgrounds do not in most cases find any reason to refer them for FPI. The relationship of ADHD and CD to juvenile delinquency and the legal implications of this have previously been discussed.<sup>43</sup> It may be that Asperger syndrome and PDD NOS should also be discussed with regard to the latter.

Cases of Tourette syndrome were also few, and we therefore cannot draw any conclusions in this area. Judging from our scrutiny of the FPI reports, tics were only rarely considered and reported.

The results suggest that arson is more specifically related to behaviors seen in autism spectrum disorders. The retrospective design and the small number of cases in each group of diagnoses make it difficult to draw any firm conclusions. The findings would have

to be corroborated in prospective studies using logistic regression models that take into account various factors that may contribute to specific criminal behavior. In this context we observed that only two individuals with a PDD diagnosis, who had committed arson, had alcohol abuse as the diagnosis in the FPI (one main and one comorbid diagnosis) group. Only 5 of the 34 individuals with retrospective PDD diagnosis had abuse or intoxication with alcohol as a main or comorbid diagnosis, and one had comorbid abuse of *Cannabis* in the FPI.

Because there are no prospective studies with more methodologically rigorous design to compare with ours, we must accept certain skepticism about the results, but we believe that the findings of this study reflect even higher rates of true disorder in young forensic psychiatric patients who have committed serious offenses. PDD, ADHD, and DAMP (ADHD with DCD) appear to be highly over-represented in this population. The same is probably valid for intellectual impairment as well. What is needed now is a systematic prospective study of autistic-type problems and attention disorders in cohorts of forensic psychiatric patients (and in other forensic populations), using the most appropriate and up-to-date methodology and relevant control groups. In clinical practice, forensic psychiatrists, psychologists, and social workers should be informed about child neuropsychiatric disorders so that they can better understand a significant number of their patients and suggest appropriate interventions.

## References

1. Adler H, Frisk M, Lidberg L: Severe delinquency in young people: background factors and characteristic features. *Nordic J Psychiatry* 49:263-74, 1995
2. Raine A, Brennan PA, Mednick B, *et al*: High rates of violence, crime, academic problems, and behavioural problems in males with both early neuromotor deficits and unstable family environments. *Arch Gen Psychiatry* 53:544-9, 1996
3. Brennan PA, Raine A: Biosocial bases of antisocial behaviour, psychophysiological, neurological and cognitive factors. *Clin Psychol Rev* 17:589-604, 1997
4. Hodgins S, Mednic SA, Brennan PA, *et al*: Mental disorder and crime: evidence from a Danish birth cohort. *Arch Gen Psychiatry* 53:489-96, 1996
5. Hodgins S: Epidemiological investigations of the associations between major mental disorders and crime: methodological limitations and validity of the conclusions. *Soc Psychiatry Psychiatric Epidemiol* 33:29-37, 1998
6. Tehrani JA, Brennan PA, Hodgins S, *et al*: Mental illness and criminal violence. *Soc Psychiatry Psychiatric Epidemiol* 33:81-5, 1998

7. Hodgins S: Mental disorder, intellectual deficiency, and crime: evidence from a birth cohort. *Arch Gen Psychiatry* 49:476–83, 1992
8. Barkley RA: ADHD and the Nature of Self-Control. New York: Guilford Press, 1997
9. Biederman J, Faraone SV, Taylor A, *et al*: Diagnostic continuity between child and adolescent ADHD: findings from a longitudinal clinical sample. *J Am Acad Child Adolesc Psychiatry* 37:305–13, 1998
10. Wing L: The Autism Spectrum. London: Constable, 1996
11. Rapin I: Autism: review. *N Engl J Med* 337:97–104, 1997
12. Frith U: Autism and Asperger syndrome. Cambridge, UK: Cambridge University Press, 1991
13. Gillberg C: Asperger syndrome and high-functioning autism. *Br J Psychiatry* 172:200–9, 1998
14. Comings DE: Tourette syndrome and human behaviour. Duarte, CA: Hope Press, 1996
15. Leckman JF, Peterson BS, Anderson GM, *et al*: Pathogenesis of Tourette's syndrome. *J Child Psychol Psychiatry* 38:119–42, 1997
16. Gillberg C: Clinical Child Neuropsychiatry. New York: Cambridge University Press, 1995.
17. Eppright TD, Kashani JH, Robison BD, Reidm JC: Comorbidity of conduct disorder and personality disorders in an incarcerated juvenile population. *Am J Psychiatry* 150:1233–6, 1993
18. Myers WC, Burket RC, Lyles WB, Stone L, Kempf JP: DSM-III diagnoses and offenses in committed female juvenile delinquents. *Bull Am Acad Psychiatry Law* 18:47–54, 1990
19. Zagar R, Arbit J, Hughes JR, Busell RE, Busch K: Developmental and disruptive behaviour disorders among delinquents. *J Am Acad Child Adolesc Psychiatry* 28:437–40, 1989
20. O'Shaughnessy RJ: Clinical aspects of forensic assessment of juvenile offenders. *Psychiatr Clin North Am* 15:721–35, 1992
21. Scragg P, Shah A: Prevalence of Asperger's syndrome in a secure hospital. *Br J Psychiatry* 165:679–82, 1994
22. Ehlers S, Gillberg C: The epidemiology of Asperger syndrome: a total population study. *J Child Psychol Psychiatry* 34:1327–50, 1993
23. Wechsler D: Wechsler Adult Intelligence Scale-Revised. New York: Harcourt Brace Jovanovich, 1981
24. Wechsler D: Manual of the Wechsler Intelligence Scale for Children-Revised. New York: The Psychological Corporation, 1974
25. Raven J: Guide to the Standard Progressive Matrices. London: HK Lewis, 1960
26. Dureman I, Sälde H: Manual till DS-batteriet (in Swedish). Stockholm: Skandinaviska Testförlaget, 1971
27. Kohs SC: Kohs Block Design Test. Wood Dale, IL: Stoelting, 1919
28. Diagnostic and Statistical Manual of Mental Disorders-Revised (ed 3). Washington, DC: American Psychiatric Association, 1987
29. World Health Organisation: International Classification of Diseases-Revised (ed 9). Geneva: World Health Organization, 1978
30. Diagnostic and Statistical Manual of Mental Disorders (ed 4). Washington, DC: American Psychiatric Association, 1994
31. Gillberg C: Clinical and neurobiological aspects of Asperger syndrome in six family studies, in Autism and Asperger Syndrome. Edited by Frith U. Cambridge, UK: Cambridge University Press, 1991, pp 122–46
32. Gillberg IC, Gillberg C: Asperger syndrome: some epidemiological considerations—a research note. *J Child Psychol Psychiatry* 30:631–8, 1989
33. International Classification of Diseases and Related Health Problems-Revised (ed 10). Geneva: World Health Organization, 1992
34. Cohen J: A coefficient of agreement for nominal scales. *Educ Psychol Meas* 20:37–46, 1960
35. Armitage P, Berry G: Kappa measure of agreement, in Statistical Methods in Medical Research (ed 3). Edited by Armitage P, Berry G. Cambridge, UK: Cambridge University Press, 1994, pp 443–7
36. Gillberg C, Rasmussen P, Carlström G, *et al*: Perceptual, motor and attentional deficits in six-year-old children: epidemiological aspects. *J Child Psychol Psychiatry* 23:131–44, 1982
37. Kadesjö B, Gillberg C: Attention deficit and clumsiness in Swedish 7-year-olds. *Dev Med Child Neurol* 40:796–804, 1998
38. Barkley RA: Attention Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment. New York: Guilford Press, 1990
39. Rasmussen P, Gillberg C: The natural outcome of ADHD with DCD at 22 years: a controlled longitudinal community-based study of individuals first diagnosed at age 7 years. *J Am Acad Child Adolesc Psychiatry* 39:1424–31, 2000
40. Hagberg B, Hagberg G, Lewerth A, *et al*: Mild mental retardation in Swedish school children. I: prevalence. *Acta Paediatr Scand* 70:441–4, 1981
41. Fernell E: Mild mental retardation in schoolchildren in a Swedish suburban municipality: prevalence and diagnostic aspects. *Acta Paediatr* 85:584–8, 1996
42. Landgren M, Pettersson R, Kjellman B, Gillberg C: ADHD, DAMP and other neurodevelopmental/neuropsychiatric disorders in six-year-old children: epidemiology and comorbidity. *Dev Med Child Neurol* 38:891–906, 1996
43. Foley HA, Carlton CO, Howell RJ: The relationship of attention deficit hyperactivity disorder and conduct disorder to juvenile delinquency: legal implications. *Bull Am Acad Psychiatry Law* 24:333–45, 1996