

Natural Outcome of ADHD With Developmental Coordination Disorder at Age 22 Years: A Controlled, Longitudinal, Community-Based Study

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ABSTRACT

Objective: There is a need for controlled longitudinal studies in the field of attention disorders in the general population. **Method:** In a community-based follow-up study, 55 of 61 subjects aged 22 years, who had attention-deficit/hyperactivity disorder (ADHD) with and without comorbid developmental coordination disorder (DCD) at initial workup at age 7 years, were compared, on a multitude of outcome variables, with 46 of 51 age-matched subjects without such diagnoses. None of the subjects had received stimulant treatment. Psychiatrists performing the follow-up study were blind to original diagnostic group status. **Results:** In the ADHD/DCD group 58% had a poor outcome compared with 13% in the comparison group ($p < .001$). Remaining symptoms of ADHD, antisocial personality disorder, alcohol abuse, criminal offending, reading disorders, and low educational level were overrepresented in the ADHD/DCD groups. The combination of ADHD and DCD appeared to carry a particularly gloomy outlook. **Conclusions:** Childhood ADHD and DCD appears to be a most important predictor of poor psychosocial functioning in early adulthood. It would seem appropriate to screen for such disorders in schools and clinics so that therapies may be started early. *J. Am. Acad. Child Adolesc. Psychiatry*, 2000, 39(11):1424–1431. **Key Words:** attention-deficit/hyperactivity disorder, developmental coordination disorder, outcome, population study.

There is still much to learn about the longer-term outcome of attention-deficit/hyperactivity disorder (ADHD), particularly when combined with developmental coordination disorder (DCD)—previously referred to as attention deficit disorder (ADD) or minimal brain dysfunction (MBD)—in the general population (Gillberg and Hellgren, 1996). Several follow-up studies have been pub-

lished (Fischer et al., 1990; Gittelman et al., 1985; Hechtman and Weiss, 1986; Howell et al., 1985; Lambert et al., 1987; Mannuzza and Gittelman, 1984; Mannuzza et al., 1991, 1998; Menkes et al., 1967), but most of these are biased by selection factors or marred by the lack of comparison groups, restriction of group size, or short duration of follow-up. The earliest reports stressed the very poor prognosis of MBD syndromes. More recent studies of ADD and ADHD have highlighted the variability in outcome, suggesting that a subgroup does very well, while another has a bleak result in terms of psychosocial functioning, with a considerable proportion developing anti-social behaviors, including drug problems, and poor academic functioning (Gillberg and Hellgren, 1996).

Our group has published a series of outcome reports relating to a community-based group of children with the combination of ADD/ADHD and DCD (Gillberg, 1985; Gillberg and Gillberg, 1983, 1988, 1989; Gillberg et al., 1983, 1989; Hellgren et al., 1993, 1994; Rasmussen et al., 1983) and an age-matched comparison group without ADHD or DCD. In our first publications—reporting on the neuropsychiatric status of 6- and 7-year-olds—this

Accepted June 20, 2000.

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This work was supported by grants from the Swedish Medical Research Council (grant K98-21X-11251-04A), the Wilhelm and Martina Lundgren Foundation, and the state under the LUA agreement. The authors thank Gunilla Carlström, Andriette Bågenholm, Gunilla Campenhausen, I. Carina Gillberg, Ingela Enerskog, Andreas Gillberg, Nanna Gillberg, Lars Hellgren, Magnus Rasmussen, Thomas Rasmussen, and Ulla Welin for help with data collection and compilation.

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combination of problems was referred to as MBD. In the publications reporting on the status of these children at ages 10, 13, and 16 years the diagnostic term used was DAMP (deficits in attention, motor control, and perception).

This report deals with the neuropsychiatric outcome of index and comparison cases in the original cohort 15 years after initial workup, viz. at age 22 years. It is the first in-depth, community-based, controlled study of unmedicated children with ADHD (and DCD) to cover the whole span from the early school years through pre-adolescence and the teenage period into early adulthood.

METHOD

Ethics

The study was approved by the Medical Ethical Committee at the University of Göteborg.

Subjects

One hundred one individuals (62 males, 39 females) were included in the present study. Of these, 55 (42 males, 13 females) were index cases, 39 of whom had ADHD with DCD (13 were considered severe cases and 26 moderate; this combination of problems has been referred to as DAMP in previous publications), 11 had ADHD only, and 5 had DCD only. Forty-six individuals (20 males, 26 females) were comparison cases. The original index and comparison groups comprised 61 and 51 individuals, respectively (see below). This means that 90% of the original index group and 90% of the original comparison group participated in the follow-up study. The reasons for dropping out were moving abroad ($n = 2$) or personal refusal/nonresponse to several reminders to take part in the follow-up study ($n = 9$).

At the time of neuropsychiatric examination, the mean (SD) age and age range of the 101 individuals were 21.9 (0.4) and 21 to 23 years, respectively. There were no differences across groups with regard to age at examination.

Brief Outline of Previous Studies

In 1977, all 5,114 six-year-olds living in Gothenburg, Sweden, were screened for the occurrence of attentional, motor control, perceptual, intelligence, and behavioral deficits. Of these, 33 (0.6%) were already known to suffer from one or more of mental retardation, deafness, and cerebral palsy. An additional 284 children were not attending public preschools and so were unavailable for detailed screening. The screening was performed using a 34-item preschool teacher questionnaire (PSQ)—with good to excellent psychometric properties (Gillberg et al., 1982)—covering the areas outlined. Of the 4,797 six-year-olds who were in public preschools, 3,448 (72%) had a PSQ completed. Dropout was mostly related to teachers' refusal to participate and involved the attrition of whole groups or schools rather than individual children. On the basis of dropout analyses, it was concluded that the group who had a PSQ completed was representative of the general population of Gothenburg 6-year-olds. After factor analysis of the results obtained on the PSQ, 340 of the 3,448 children were identified as "MBD/DAMP-suspected" cases. A random group of 100 children from the PSQ sample was also identified. Eight of

these were found in the MBD/DAMP-suspected group, leaving 92 possible non-MBD/DAMP-suspected comparison cases.

After random sampling and some modest attrition (Gillberg et al., 1982), there remained 82 MBD/DAMP-suspected cases and 59 comparison cases, all of whom were subjected to comprehensive diagnostic examinations: (1) neuropsychiatric (by 2 child and adolescent psychiatrists examining the children independently and interviewing at least one parent at home visits); (2) neurodevelopmental (by a child physiotherapist); (3) neurological (by a child neurologist); and (4) neuropsychological (by a child psychologist). As a result of this process, several "PSQ-positive" children ($n = 29$) were deemed not to have problems compatible with the diagnosis of ADHD or DCD. Conversely, some "PSQ-negative" children ($n = 8$) did have problems qualifying for one or both of these diagnoses. In the end, a total of 112 children were left for follow-up studies: 42 with the combination of ADHD and DCD (referred to as DAMP), 12 with ADHD only, 7 with DCD only, and 51 comparison cases without ADHD or DCD (or other neurodevelopmental diagnoses). All of these, except those who moved abroad after the initial diagnostic study, have been approached in the various follow-up projects, including the one reported on here.

The child neurologist assigned the diagnoses of ADHD, mental retardation, or other neurological syndromes based on the information obtained at all the various assessments, but without knowledge of the psychiatric diagnoses made as above. The diagnosis of DCD was made on the basis of his own examination and that of the physiotherapist (Rasmussen et al., 1983).

The child and adolescent psychiatrists made best-estimate operationalized clinical psychiatric diagnoses on the basis of all information available to them after the home visit. ADHD and DCD were not considered psychiatric diagnoses but rather to be syndrome labels for specific neurodevelopmental problems. The child and adolescent psychiatrists did not consult with the other examiners in this process (Gillberg, 1983).

The child neuropsychologist, who performed an IQ-test (WISC-R) and the Southern California Sensory Integration Tests (SCSIT) (Ayres, 1972), did not make clinical diagnoses.

Original Diagnoses and Their Corresponding DSM-IV Labels

The criteria used in the original study as well as those applied in the subsequent follow-up studies are detailed here. The original diagnoses of ADD and motor perception dysfunction (MPD) have been checked against the *DSM-IV* categories of ADHD and DCD as described in the following sections.

ADHD/ADD. In the original diagnostic study, ADD was diagnosed in children who did not have mental retardation or cerebral palsy and who showed "severe signs of attention deficit in at least two of the four examination settings" (Gillberg, 1983). The children all met the *DSM-III* criteria for ADD.

The research records were again scrutinized in connection with this new study with a view to re diagnosing all cases in accordance with the criteria of the *DSM-IV* (American Psychiatric Association, 1994). All the ADHD symptoms listed in the *DSM-IV* had been specifically covered in the parent interview in connection with the original diagnostic study. An ADHD *DSM-IV* checklist was used by a researcher blind to original diagnostic group status, and all index and comparison cases were re diagnosed. A total of 85% of the children in whom ADD was diagnosed in the original study (46/54, 42 of whom had ADD with DCD and 12 of whom had ADD only) were shown to meet criteria for *DSM-IV* ADHD. These are absolute

minimum rates given that in the original diagnostic study the specific symptoms listed in the *DSM-IV*, although covered in the interviews, were not probed into in great detail as would have been done had the study been performed today. One (2%) of the 51 children in the non-ADD/non-DCD comparison group met criteria for *DSM-IV* ADHD, predominantly inattentive type.

DCD/MPD. In the diagnostic study, MPD was diagnosed in children who did not have mental retardation or cerebral palsy and who had "severe motor control problems according to the neurologist/physiotherapist or who had severe perceptual problems according to testing with the SCSIT" (Gillberg et al., 1982). All cases meeting criteria for MPD also fulfilled the diagnostic requirements for *DSM-IV* DCD.

Severe and Moderate ADHD With DCD. Children meeting criteria for both ADD and MPD were referred to as having MBD in the first published study and as having DAMP in later publications. They were subdivided into severe and moderate cases. Children who had ADD and gross motor dysfunction and fine motor dysfunction and perceptual dysfunction and speech and language problems were categorized as having "severe DAMP." Those who met criteria for both ADD and MPD but did not fulfill the requirements for severe cases were categorized as having "moderate DAMP."

Of the children with severe DAMP participating in the follow-up ($n = 13$), all met criteria for ADHD. Seven of these were cases of combined inattentive and hyperactive-impulsive ADHD, and the remaining 6 were mainly inattentive. Of the children with moderate DAMP participating in the follow-up, 65% met *DSM-IV* criteria for ADHD (17/26). Only 3 of these (11% of all those with moderate DAMP) met criteria for combined ADHD. The remaining 14 (54% of all those with moderate DAMP) had the mainly inattentive subtype of ADHD.

Psychiatric Disorders. In the diagnostic study, psychiatric diagnoses (depression, conduct disorder, autistic features/psychotic behavior, anxiety disorder, psychosomatic disorder, or no major psychiatric disorder) were made by the child and adolescent psychiatrists, independently of the neurologist's diagnoses of ADD and MPD, according to operationalized criteria (Gillberg, 1983). Depression, conduct disorder, and anxiety disorder correspond to the same-named concepts of the *DSM-IV*; autistic features/psychotic behavior to pervasive developmental disorder not otherwise specified (PDD NOS), or Asperger's disorder, and psychosomatic disorder to somatoform disorder. Of the collapsed index groups, 51% had a diagnosis of at least one psychiatric disorder. Of these, depression accounted for 35%, PDD NOS and Asperger's disorder 16% and 10%, respectively, anxiety disorders 19%, conduct disorder 13%, somatoform disorder 3%, and other disorder 3%.

Mental Retardation. Mental retardation was diagnosed in children with a tested IQ of less than 73 and a clinical impression and impairment level consistent with mental retardation. By definition, no one in the ADHD, DCD, or comparison groups had mental retardation.

Comparison Group. The comparison (COMP) group did not have ADHD, DCD, mental retardation, or another neurodevelopmental disorder, but they were not necessarily free of psychiatric disorder. In fact, 10% of the original cohort of 51 individuals included in the COMP group were given a diagnosis of psychiatric disorder by the child and adolescent psychiatrists.

Methods Used in Follow-up Study at Age 22 Years

All 101 individuals included in the follow-up study (Table 1) were subjected to the same kind of assessment, which comprised neuropsychiatric assessment, a brief neurodevelopmental examination, and a reading test.

TABLE 1
Total Number of Subjects, Number of Subjects With Poor Outcome, and Number of Poor Outcome Criteria According to Original Diagnostic Group Status

Diagnostic Groups	All Subjects: <i>n</i>	Subjects With Poor Outcome					
		<i>n</i>	%	No. of Poor Outcome Criteria			
				1	2	3	4
ADHD+DCD							
Severe	13	9	69 ^c	2	4	1	2 ^d
Moderate	26	14	54 ^c	8	5	1	0
All cases	39	23	59 ^c	10	9	2	2
ADHD only	11	5	45 ^a	1	3	1	0
DCD only	5	4	80 ^b	1	3	0	0
Index groups collapsed	55	32	58 ^c	12	15	3	2
COMP	46	6	13	4	2	0	0

Note: For definition of "poor outcome" and "poor outcome criteria" (range 1–6, no subject met more than 4 criteria), see text. ADHD = attention-deficit/hyperactivity disorder; DCD = developmental coordination disorder; COMP = comparison group.

^a $p < .05$; ^b $p < .01$; ^c $p < .001$ index groups versus COMP group (χ^2 test with Yates correction); ^d $p = .05$ severe ADHD+DCD versus COMP (Mann-Whitney test).

Neuropsychiatric Assessment. Versions I and II of the Structured Clinical Interview for *DSM-III-R* were used in the psychiatric interview of probands and comparison subjects (Spitzer et al., 1988, 1989, 1992; Williams et al., 1992). Three child and adolescent psychiatrists were involved in these interviews, which were performed blind to original study diagnostic group status of the individuals (who were themselves unaware of the diagnoses assigned). The versions yielding *DSM-III-R* algorithm diagnoses (American Psychiatric Association, 1987) were used. In addition, a modified version of the Asperger Syndrome Diagnostic Interview (ASDI) (Ehlers and Gillberg, 1993; Gillberg, 1991; Gillberg et al., in press) and the Current ADHD Symptoms Interview (CASI) were used (ASDI and CASI available from the authors on request).

The first part of the ASDI (which has good to excellent psychometric properties), concerned with (1) impairment in reciprocal social interaction, (2) all-absorbing narrow interests, and (3) imposition of routines and interests, was used as an interview checklist. In connection with the interview the psychiatrist made observations according to the remaining items of the ASDI concerned with (4) verbal communication problems, (5) nonverbal communication problems, and (6) motor clumsiness. Each of the 20 symptoms covered was scored as 0, 1, or 2, with 2 indicating an obvious problem. A total score was calculated for each of the 2 parts. The score pertaining to the psychiatrist's observations was considered more reliable in assessing whether the individual had problems within the autism spectrum or not. A score of 14 or more for the whole of the ASDI with at least a score of 8 on the observation part (maximum possible total score 40; 20 for each of the 2 parts) was regarded as strongly indicative of a symptom complex within the autism spectrum.

The CASI comprises 7 items relating to symptoms of hyperactivity-impulsivity (scored 0, 1, 2, with 2 indicating an obvious problem) and 13 items relating to symptoms of inattention (also scored 0, 1, 2). Possible hyperactivity-impulsivity scores ranged from 0 to 14, and 10 or more was regarded as indicative of severe hyperactivity-

impulsivity. Possible inattention scores ranged from 0 to 26, and 10 or more was regarded as indicative of severe inattention.

Reading Tests. Several standardized reading and writing tests were applied by an experienced special teacher. All of these were Swedish tests, not available in other languages (available on request from the authors). For the purpose of the present study (1) reading speed corresponding to reading quotients of 85 or less, (2) reading accuracy corresponding to quotients of 85 or less, and (3) inability to read or write were used as indicators of reading/writing disorder.

In addition, several other instruments were used, but they are not reviewed here because no data directly related to their use will be presented.

Poor Outcome. Poor outcome was defined as one or more of (1) permanent sick pension; (2) conviction for criminal offense; (3) a *DSM-III-R* diagnosis of alcohol or substance abuse disorder; (4) a diagnosis of any other *DSM-III-R* psychiatric disorder—except depressive disorder, which tended to be common in the comparison group as well as in the index group—leading to marked impairment in global functioning; (5) at least 1 *DSM-III-R* personality disorder diagnosis or 2 *DSM-III-R* “subthreshold” personality disorder diagnoses; and (6) a diagnosis of an autism spectrum disorder.

Statistical Methods. Chi-square tests with the Yates correction were used whenever appropriate.

RESULTS

Poor Outcome

A poor outcome was seen in 58% of index and 13% of COMP cases ($p < .001$) (Table 1). The severely affected ADHD with DCD group and the small group with DCD only had the worst prognosis, with 69% and 80%, respectively, being categorized as having poor outcomes. The moderately affected ADHD with DCD group had a poor outcome in 54% of cases and the ADHD-only group in 45%. All of the index groups differed significantly ($p < .05$ or less) from the COMP group with respect to poor outcome.

There was a nonsignificant tendency for boys in the collapsed index groups to have a worse outcome than girls, with 64% of males and 38% of females belonging in the poor outcome category.

Individuals in the index groups who had poor outcome tended to meet a larger number of the 6 “poor outcome criteria” (5 of 32 subjects met 3 or more criteria) compared with those having a poor outcome in the COMP group (all 6 subjects met only 1 or 2 criteria). This difference between index and comparison groups reached statistical significance in the case of severe ADHD with DCD ($p = .05$) (Table 1).

DSM-III-R Axis I and II Diagnoses

Autism Spectrum Disorders. Eight children in the group with severe ADHD with DCD had an autism spectrum

disorder when first examined at age 7 years. Four of these 8 individuals (1 with autistic disorder, 1 with Asperger’s disorder, 2 with autistic traits) had ASDI scores indicative of an autism spectrum problem at the present follow-up (Table 2), and an additional 2, who had Asperger’s syndrome at age 7 years, now had ASDI scores close to cutoff for autism spectrum problems. One boy with autistic traits at original examination now had antisocial personality disorder. The final case, a boy with autistic traits at age 7 years, now had no clear indication of an autism spectrum problem. One woman and one man in the moderate ADHD with DCD group had high ASDI scores at the present examination. They were regarded as having an autism spectrum problem and, hence, a poor outcome.

Other Psychiatric Disorders. Major depression (referring to having met criteria for this disorder for at least 2 weeks on at least one occasion ever) was very common in all groups. However, only 3 individuals had current depression, all of whom were in the ADHD with DCD group.

Alcohol abuse occurred in 24% of the index groups and 4% of the COMP cases ($p < .02$). Other kinds of substance abuse disorders were also more common in the collapsed index groups, but the difference vis-à-vis the COMP group did not reach statistical significance.

Personality Disorders. Personality disorder of any kind was seen in 33% of all individuals in the index groups and in 7% in the COMP group ($p < .01$). Antisocial personality disorder was the most common type diagnosed, with a relative risk of 8.4 in the collapsed index groups compared with the COMP group ($p < .05$).

Current ADHD. Severe hyperactivity-impulsivity was present in 15% of the index groups and 2% of the COMP group ($p < .06$). Severe inattention was present in 44% of the index groups and 7% of the COMP group ($p < .001$). A combination of hyperactivity-impulsivity and inattention was seen in 9% of index individuals and in no individual in the COMP group. Altogether 49% of the index cases and 9% of the individuals in the COMP group had marked symptoms of ADHD at age 22 years ($p < .001$). A current tic disorder was reported by 16 subjects in the index groups (29%) and in 3 in the COMP group (7%) ($p < .01$).

Criminal Offense

Criminal offense according to interview data was recorded in 8 cases in the index groups (19%), all of whom were males. No index group females or any indi-

TABLE 2
DSM-III-R Axis I and Axis II Diagnoses According to Original Diagnostic Group Status: Number of Subjects

Diagnosis at 22 Years	ADHD+DCD (<i>n</i> = 39)	ADHD Only (<i>n</i> = 11)	DCD Only (<i>n</i> = 5)	Index Collapsed (<i>n</i> = 55)	COMP (<i>n</i> = 46)
<i>DSM-III-R</i> Axis I diagnosis					
ADHD	19	5	3	27 ^d	4
Inattention	18	3	3	24 ^d	3
Hyperactivity/impulsivity	6	2	0	8	1
Combined	5	0	0	5	0
Autism spectrum	6	0	0	6 ^a	0
Tic disorder	13	1	2	16 ^c	3
Depression ever	8	2	1	11	8
Depression current	3	0	0	3	0
Hypomania	1	0	0	1	0
Dysthymia	0	0	0	0	1
Schizophrenia	1	0	0	1	0
Panic disorder	0	0	0	0	2
OCD	0	0	0	0	0
Agoraphobia	1	0	0	1	0
General anxiety	0	0	0	0	1
Somatiform	0	0	0	0	0
Alcohol abuse	6	4	3	13 ^b	2
Psychoactive substance abuse	1	1	2	4	1
<i>DSM-III-R</i> Axis II diagnosis					
Antisocial	7	2	1	10 ^a	1
OCPD	1	0	0	1	1
Phobic	1	0	1	2	1
Dependent	0	0	0	0	0
Passive-aggressive	2	0	0	2	0
Paranoid	1	0	0	1	0
Schizotypic	0	0	0	0	0
Schizoid	1	0	0	1	0
Histrionic	0	0	0	0	1
Narcissistic	0	0	0	0	2
Borderline	1	0	0	1	0
Personality disorder NOS	3	0	0	3	0
Any personality disorder	14	2	2	18 ^c	3

Note: ADHD = attention-deficit/hyperactivity disorder; DCD = developmental coordination disorder; COMP = comparison group; OCD = obsessive-compulsive disorder; OCPD = obsessive-compulsive personality disorder; NOS = not otherwise specified.

^a *p* < .05; ^b *p* < .02; ^c *p* < .01; ^d *p* < .001 index groups versus COMP group.

vidual in the COMP group had been charged for a criminal offense.

Sick Pension

Eleven percent of those in the index groups and 0% in the COMP group (*p* < .05) had been given a full sick pension for reasons associated with neuropsychiatric problems.

Schooling

A full 80% of the index and 26% of the COMP groups (*p* < .001) had had fewer than 12 years in school. Five of them, all in the severe ADHD with DCD group (38%), had attended mental retardation classrooms for

more than 1 year, even though they had not received a formal diagnosis of mental retardation. Only one individual in the index groups (2%) had attended a university. This contrasts with the outcome in the COMP group, in which 14 individuals (30%) were at a university at the time of the follow-up (*p* < .001).

Reading/Writing Disorder

Three individuals in the ADHD with DCD group could not read or write at all at age 22 years. This did not apply in any of the other diagnostic or COMP groups.

Fifty-eight percent of the ADHD with DCD group and 15% of the COMP group had a reading/writing disorder at age 22 years as defined in the present study (*p* <

.001). Reading speed was markedly reduced in 55% of the ADHD with DCD and 11% of the COMP group ($p < .001$). In the severe ADHD with DCD group reduced reading speed was found in 77%, whereas in the moderate ADHD with DCD group the corresponding rate was 44%. Reading accuracy was markedly reduced in 39% of the ADHD with DCD group, with no differences across severe and moderate cases. The corresponding rate in the COMP group was 15% ($p < .01$).

The DCD-only group showed reading/writing problems at a rate consistent with that of the ADHD with DCD group, whereas those with ADHD only had rates of such problems slightly above that in the COMP group.

DISCUSSION

The early adult psychosocial outcome of so many of the individuals with ADHD and DCD in this study was worse than expected. The validity of the results is underscored by the fact that study groups were recruited from the general population, not treatment clinics, and that the research clinicians performing the follow-up (and the individuals examined) were blind to the original diagnostic status. None of those involved in the study had been treated with stimulants at any time. Thus, it appears that ADHD with DCD is a significant clinical problem.

Almost 60% of the individuals in the ADHD with DCD groups had a poor outcome (compared with 13% among those without ADHD with DCD), meaning that they were living off a pension; had drug or alcohol abuse, major personality disorder, chronic severe psychiatric disorder, or autism spectrum disorder; or had been convicted of a crime. Moreover, index group individuals often had 2 or more of the problems regarded as indicating a poor outcome whereas the few comparison cases with poor outcome only had 1 or 2 of those problems. It is important to note that persisting symptoms of ADHD/DCD per se, reading/writing disorder, or inadequate schooling was not regarded as a sign of poor outcome.

The results are very similar to those of the follow-up study at age 16 years (Hellgren et al., 1994). It can be argued that the poor outcome is a reflection not so much of the ADHD and/or DCD in itself but rather of various psychiatric conditions appearing very early in life in affected children. Fifty-one percent of the individuals in the collapsed index group of the present study had a diagnosis of at least one psychiatric condition already at age 7 years. Recent Swedish community-based studies of children with ADHD and associated conditions confirm

this high prevalence of psychiatric comorbidity early in life as well as the partial overlap between ADHD and other neuropsychiatric disorders like Tourette's disorder and autism spectrum disorders (Kadesjö and Gillberg, 1998, 1999).

The rate of antisocial personality disorder was very high in the index groups, 18% versus 2% in the comparison group. This is in agreement with the long-term follow-up study of Mannuzza et al. (1998), who also found high rates of nonalcohol substance abuse, similar to the level ascertained in our study. However, in our index groups an even more striking finding was the high rate of alcohol abuse, 24% compared with 4% in comparison cases.

A considerable proportion of the subjects in the group with severe ADHD with DCD had marked problems within the autism spectrum. This was clearly shown in the follow-up of the present series at age 16 years (Hellgren et al., 1994). Some kind of autism spectrum problem had been identified already at age 7 years, although not fully meeting criteria for a diagnosis of autistic syndrome (Gillberg, 1983). The overlap between the diagnostic domains of ADHD with DCD on the one hand and autism spectrum disorders on the other hand obviously needs to be addressed in future studies of ADHD.

It is interesting that persistent inattention was present in almost half the index groups, while persistence of hyperactive-impulsive symptoms, often regarded as the hallmark of the syndrome, was much less frequent. Hart et al. (1995), who followed a large cohort of clinic-referred boys with ADHD over a 4-year period, showed that problems of inattention declined much less than symptoms of hyperactivity-impulsivity. In addition, these findings seem to be commensurate with the results of a series of follow-up studies by Achenbach et al. (MacDonald and Achenbach, 1999).

Reading disorders were extremely common in the ADHD with DCD groups. They probably contributed to the low level of schooling and university education seen in the index groups. Further follow-up in this respect is warranted before more definite conclusions can be drawn. It is possible that some of the young people with a low level of education in the current study may pursue higher education later.

The high rate of reading and academic problems could be taken as a sign of there being a high rate of children with developmental disorders in the index groups, with DCD being a possible marker for a whole range of developmental disorders. It is of particular interest that the

measures we included as indicating poor outcome were not related to reading or other academic functions.

Limitations

The samples were small, meaning that firm conclusions with respect to subgroups cannot be drawn. There was a tendency for the females in the collapsed index groups to be underrepresented among those who had a poor outcome, and the same tendency can be seen in each of the index groups separately. However, the number of females in the index groups was too small for conclusions to be drawn.

The ADHD with DCD group tended to have worse outcome than the ADHD-only group. The difference appeared not to be accounted for by the mere addition of one problem to another (DCD added to ADHD), but rather by ADHD plus DCD—referred to in Scandinavia as DAMP—being a particularly ominous combination, or by DCD being perhaps, in itself, a strong marker for poor outcome. The latter interpretation was supported by the very poor outcome in the DCD-only group and the somewhat better prognosis in the ADHD-only group. However, any conclusions in this respect need to be tempered by the fact that the study groups were small. In another recent population-based study of neuropsychiatric and neurodevelopmental disorders in a young school-age population in Sweden, the frequent co-occurrence of ADHD and DCD was underscored as was the importance of DCD as a negative prognostic factor in children with ADHD (Kadesjö and Gillberg, 1998, 1999).

Clinical Implications

ADHD and DCD, particularly in combination, appears to carry a poor psychosocial prognosis. Effective treatments are available (e.g., Gillberg et al., 1997; Jensen et al., 1999). The young adults taking part in this study had not received systematic therapies according to current clinical praxis, and no one had been treated with stimulants. The high prevalence of these disorders (Kadesjö and Gillberg, 1998) and the poor outcome found in this study—and in many clinic-based studies—indicate that we may be dealing with a very important predictor of poor psychosocial functioning and psychiatric morbidity in early adulthood.

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