Adolescents with ADHD: Patterns of Behavioral Adjustment, Academic Functioning, and Treatment Utilization[*]

By: RUSSELL A. BARKLEY, PH.D., ARTHUR D. ANASTOPOULOS, PH.D., DAVID C. GUEVREMONT, PH.D., AND KENNETH E. FLETCHER, PH.D.

Abstract:

Adolescents with attention deficit hyperactivity disorder (ADHD) were compared with a control group on a comprehensive assessment battery. More ADHD teenagers had oppositional defiant disorder (68%) and conduct disorder (39%) and were rated as more impaired in social competence, behavioral and emotional adjustment, and school performance by parents and teachers than control teens. The ADHD youths, however, rated themselves as better adjusted than did their parents and teachers, differing only from controls in depressive symptoms and antisocial acts. Poorer performances in verbal learning and vigilance and greater ADHD behaviors during a math task also distinguished the ADHD from control teenagers. .1. Am. Acad. Child Adolesc. Psychiatry, 1991, 30, 5:752-761. Key Words: attention deficit hyperactivity disorder, adolescents, behavioral problems, substance use.

Article:

Attention deficit hyperactivity disorder (ADHD) is composed of developmentally inappropriate degrees of inattention, impulsivity, and overactivity that arise in early childhood and are believed to be relatively chronic for most children with the disorder. The disorder occurs in approximately 3% to 5% of the childhood population, with boys being almost three times more likely to manifest the disorder than girls (Barkley, 1990; Szatmari et al., 1989). ADHD children frequently have a higher risk for other childhood disorders, including aggression, or oppositional defiant disorder, and conduct disorder (Barkley et al., 1990a; Ross and Ross, 1982). School underachievement is rampant in this population, and as many as 20% to 30% may have a coexisting primary learning disability as well (Barkley et al., I 990a; Lambert and Sandoval, 1980). Social interaction problems with their family members have been consistently documented (Barkley, 1990), and over half of all ADI ID children have serious problems in their relations with peers (Milich and Landau, 1982; Pelham and Bender, 1982).

Although the disorder is considered by many to be the most thoroughly studied of the childhood psychiatric disorders, the vast majority of research in this area has focused on 6- to I 1-year-old children. This leaves open to considerable question whether the manifestations of the disorder in clinic-referred adolescents is comparable with those seen in the elementary school-age population on which much of the current description of the disorder is based. It is possible that the disorder remains relatively unchanged in adolescence, assuming a simple trajectory of development, thereby permitting the employment of the same dependent measures as those used in childhood research (Conners, 1985). One needs to insure, however, that the potential range of sensitivity of the measures is adjusted so as to adequately detect these continuing developmental deficiencies over this maturational period.

What little is known about ADHD as it appears in adolescents comes mostly from the relatively small number of long-term prospective follow-up studies of children diagnosed with ADHD in childhood and then followed into their adolescence. This research indicates that as adolescents, children previously diagnosed as ADHD or hyperactive are at higher risk for defiance, aggression, antisocial behavior, and substance abuse relative to normal or control children followed concurrently (Gittelman et al., 1985; Lambert et al., 1987). From 50% to 80% meet the criteria for ADHD in adolescence (Barkley et al., 1990b; Gittelman et al., 1985). Many continue to experience difficulties with academic achievement (Ackerman et al., 1977); whereas up to 58% may have been retained in grade (Barkley et al., 1990b; Brown and Borden, 1986), up to 40% have been in special educational services (Barkley et al., 1990b), and as many as 35% may have failed to finish high school (Weiss and Hechtman, 1986). The general picture then is one of continuing problems with inattention, impulsivity, and restlessness as well as antisocial behavior and academic failure in adolescence for many children diagnosed as ADHD in childhood.

Unfortunately, follow-up studies are limited in their ability to represent the nature of ADHD as it is seen in adolescents referred to clinics with the disorder. One reason is that a substantial minority (30% to 50%) of children with ADHD followed into adolescence may no longer meet diagnostic criteria for the disorder (Barkley et al., 1990b; Gittelman et al., 1985; Thorley, 1984; Weiss and Hechtman, 1986). The findings for such a sample of adolescents may therefore not reflect the pattern or severity of symptoms or comorbid problems seen in those cases referred to clinics as adolescents with ADHD. And, even among those ADHD children followed to adolescence who still meet full diagnostic criteria for the disorder, it is conceivable that their clinical symptoms and coexisting disorders may either be more severe, because of their earlier onset and referral in childhood, or milder (because of their more extensive history of treatment) than those cases of ADHD referred to clinics in adolescence.

Only a handful of studies have evaluated the nature of ADHD as it appears in clinic-referred adolescents, and these have primarily been studies on the efficacy of stimulant medication with this population (Klorman et al., 1987; Varley, 1985). These studies typically used no control groups for comparison purposes, and so those features that significantly differentiate ADHD adolescents from control teenagers cannot be deduced from these studies. It was therefore the major purpose of the present study to conduct a relatively comprehensive evaluation of the attention, impulse control, activity level, and general psychological adjustment of clinic- referred ADHD adolescents in comparison with a community control group. In addition, patterns of

antisocial conduct and the use of mental health and educational treatment in these groups of subjects were also evaluated. A separate paper reports on the parent—adolescent interaction patterns, family conflicts, and parental psychopathology observed in these samples (Barkley et al., 1990, submitted manuscript).

Method
Subjects
Two groups of adolescents and their mothers were evaluated in this study. All adolescents were between 12 and 17 years of age, had IQ estimates greater than 80 on the Peabody Picture Vocabulary Test-Revised (PPVT-R, Dunn and Dunn, 1981), were either the biological offspring of these mothers or were adopted by them shortly after birth, and had no evidence of deafness, blindness, severe language delay, cerebral palsy, epilepsy, autism, or psychosis, as established through parental and adolescent interview. The adolescents and their parents signed statements of informed consent as part of their volunteering to participate in this project. The project was reviewed and approved by the human research institutional review board of the university.

The first group consisted of 84 adolescents who were consecutive referrals to a university medical center clinic specializing in ADHD. This group met the criteria for ADHD and volunteered to be in this project. There were 76 boys and eight girls in this group; five were adopted, and all of the subjects were Caucasian. A total of 76% of the mothers in this group were married at the time of their participation. To be considered as ADHD, the adolescents in this group had to have 1) parent and/or teacher complaints of inattention, poor impulse control, and overactivity, as established through the parental interview; 2) have at least eight of the 14 symptoms of ADHD as set forth in the *DSM-III-R;* 3) have a duration of these symptoms of at least 12 months; 4) have an age of onset of these symptoms by 7 years; 5) have a *T* score greater than 65 on the hyperactivity scale of the Child Behavior Checklist (CBCL, Achenbach and Edel-brock, 1983), as completed by the mother; and 6) if currently receiving stimulants, have approval from their prescribing physician to discontinue medication 48 hours before participation in this study.

The community control group consisted of 77 adolescents (63 boys, 14 girls) and their mothers who were recruited through newspaper advertisements in a regional newspaper and advertisements throughout the medical center. One of the adolescents in this group had been adopted, and all but one were Caucasian. As in the ADHD group, 76% of these mothers were married at the time of their participation. To be eligible for this group, these adolescents had to have the following qualifications: I) no parent or teacher complaints of significant problems with inattention, impulsivity, or hyperactivity, as established in the parental interview; 2) have fewer than four of 14 symptoms of ADHD from the *DSMIII-R;* and 3) have a T score below 60 on the hyperactivity scale of the CBCL, as completed by the mother. Of the 77 teenagers meeting all of these criteria, 16 were learning disabled (LD) students receiving special educational services through their school district for their learning disorders. This subgroup of LD subjects was included with the community control group as a means of controlling for possible group differences that might emerge on the psychological tests because of the significant percentage of ADHD adolescents who have a comorbid learning disability, estimated to be 15% to 20% (Barkley et al., I 990a; Lambert and Sandoval, 1980). In other words, without such controls, it is possible that differences between ADHD and normal adolescents on a psychological test battery

could be due to the subgroup of ADHD having a learning disability and not due to the ADHD itself. To insure that these LD subjects were equivalent to the other control subjects on all dependent measures except the achievement tests, these groups were compared using 1-tests. The LD group had significantly lower scores than the control group only on the Wide-Range Achievement Test-Revised (Jastak and Wilkinson, 1984) and the PPVT-R IQ estimate (see below), as would be expected from the nature of a learning disability in these subjects. The LD and control subjects were, therefore, combined into a single control group for all analyses in this study.

The ADHD and community control groups did not differ significantly in their percentage of boys and girls, their percentage of adopted children, their racial membership, or the percentage of married mothers in each group. Efforts were made to see that the two groups were matched in the age and IQ of the adolescents and the age, education, and socioeconomic status of the parents (Hollingshead Two Factor Index of Social Position; [Hollingshead, 19751). The demographic information and results for the initial subject selection measures are shown in Table 1. Differences between the groups on these measures were analyzed using two-tailed t-tests for independent samples, and these results are also shown in Table 1 . As this table indicates, the at-tempts at matching were successful in that no significant differences between the groups were noted on any of the demographic or matching variables. As expected from the selection criteria, the ADHD adolescents differed significantly from the control group in having a greater number

TABLE 1. *Demographic and Initial Subject Characteristics by Group*

Measure	ADHD (N = 84)		Control (N = 77)		t	p<[a]
	X̄	SD	X̄	SD		
Adolescent age (yrs)	14.1	1.4	14.3	1.9	−1.11	—
Adolescent IQ (PPVT-R)	103.3	15.5	107.8	15.4	−1.82	—
Mother age (yrs)	40.4	5.6	41.1	5.1	−0.85	—
Mother education (yrs)	13.7	2.4	14.4	2.1	−1.84	—
Mother socioeconomic status	45.7	24.9	52.6	24.3	−1.77	—
Father age (yrs)	42.0	5.9	43.6	5.9	−1.66	—
Father education (yrs)	14.2	2.9	14.8	2.8	−1.22	—
Father socioeconomic status	54.7	23.1	59.4	23.3	−1.23	—
Number of ADHD symptoms	10.2	1.9	0.9	1.5	34.82	0.001
Onset of ADHD symptoms (yrs)	4.1	2.0	7.0	1.4	−10.56	0.001
CBCL Hyperactive Scale	78.9	8.6	56.4	2.9	22.66	0.001

Note: ADHD = attention deficit hyperactivity disorder; PPVT-R = Peabody Picture Vocabulary Test-Revised; CBCL = Child Behavior Checklist (Parent Report); Socioeconomic status was determined by the Hollingshead Two-Factor Index of Social Position.

[a]$p<$ indicates the probability value for the t-test (two-tailed) between groups if $p < 0.05$.

of ADHD symptoms, an earlier age of onset of any of these ADHD symptoms, and a higher T-score on the hyperactivity scale of the CBCL.

Procedures
Once written informed consent was obtained, the subjects and their mothers received a lengthy battery composed of structured interviews, rating scales of behavioral adjustment and family conflicts, parental self-report measures of psychological adjustment, and psychological tests administered to the adolescents. The teenagers were then videotaped in a clinic room while they completed math problems for a later coding of their ADHD symptoms. The mothers and their

teenagers were videotaped while they discussed a neutral topic for at least 10 minutes and then discussed a list of their current significant conflicts with each other for 10 to 15 minutes. These videotapes were then coded for a variety of categories of social interactions by the mother and teenager. Afterwards, the English and math teachers of these teenagers were sent the CBCL to complete concerning the subjects' school performance and adjustment. The present paper reports the results for the structured psychiatric interviews conducted with the mothers and for the behavior rating scales, psychological tests, and behavioral observations. The results of the parent—child interaction measures, the ratings of family conflicts, and the parent self-report measures of their own psychological adjustment are reported in a separate paper (Barkley et al., 1990, submitted manuscript). Arrangements were made with prescribing physicians for all subjects taking stimulant medication to discontinue this medication 48 hours before the evaluation.

The interviews were all conducted by a clinical psychologist, and the testing of the adolescents was done by a research assistant thoroughly trained in these procedures. The interviewer and research assistant were not blind to the group membership of the subjects. At the end of the evaluation, all parents were provided with a $50 stipend for themselves and their adolescent for participating in this project.

Measures
Parental interview. The structured psychiatric interview used was constructed specifically for this project. It consisted of questions pertaining to the current status of the family, demographic data, and the academic, social, and mental health histories of the teenagers. Information was also collected on the occurrence of symptoms of the disruptive behavior disorder diagnoses using the *DSM-III-R* criteria for each (i.e., ADHD, oppositional defiant disorder, and conduct disorder).

Parent Ratings of Adolescent Behavior
   1. *Child Behavior Checklist* (CBCL) (Achenbach and Edelbrock, 1983). This scale yields *T* scores for a number of narrow-band scales for boys ages 12 to 10 years: social competence, anxiety, somatic complaints, social withdrawal, hyperactive, aggressive, and delinquent. T-scores for each scale were used here. For girls, only those factors from this scale that corresponded to these factors from the boys' profile were included for analyses. The reliability and validity of the CBCL are quite satisfactory (Achenbach and Edelbrock, 1983; Barkley, 1988).

   2. *Revised Conners Parent Rating Scale (RCPRS).* This 48-item rating scale uses a 4-point response for each item and yields factors for conduct problems, learning problems, psychosomatic problems, impulsive-hyperactive, and anxiety as well as a total score (Goyette et al., 1978). The scale has satisfactory reliability and validity and is one of the most commonly used rating scales with ADHD children (Barkley, 1988).

Teacher Ratings of Adolescent Behavior
The Child Behavior Checklist-Teacher Report Form (CBCL-TRF) (Achenbach and Edelbrock, 1986) was used for obtaining teacher ratings. This 118-item scale yields *T* scores for two broad-band scales of internalizing and externalizing dimensions as well as subscales labeled anxious, social withdrawal, unpopular, self-destructive, obsessive- compulsive, immature, inattentive, and

aggressive for the age range used in this study. The subscale 7' scores were used for analysis in this study. For girls, only those scales corresponding to these factor scales for boys were analyzed. The reliability and validity of this scale are excellent (Barkley, 1988). Both the math and English teachers of each subject provided ratings on this scale. The dependent measures were the average 7' scores of these two sets of ratings for each scale.

Adolescent Self-Report Measures of Adjustment
  1. *Child Behavior Checklist-Youth Self-Report* (CBCLYSR) (Achenbach and Edelbrock, 1987). This scale is designed to be similar to the item format of the CBCL and CBCL-TRF except that items are worded in the first person. 'Two profiles are scored: competence and behavior problems. The competence scale contains two subscales, these being activities and social relationships. The behavior problems profile contains subscales for depressed, unpopular, somatic complaints, thought disorder, delinquent, and aggressive. The scale has excellent internal consistency and reliability. The *T* scores for these subscales served as the dependent measures.

  2. *Reynolds Adolescent Depression Scale (RADS).* This is a 30-item scale completed by adolescents, using a 4-point rating for each item; higher scores indicated greater depression (Reynolds, 1981).

  3. *Adolescent Stressful Life Events Scale.* For this project, a 65-item (yes/no) scale was constructed, consisting of stressful life events that may be experienced by adolescents. The score was the total number of life events endorsed by the teenager. No data on test-retest reliability, internal consistency, or validity were available on this scale as it was constructed specifically for this evaluation.

  4. *Locus of Control Scale.* To assess the perceived locus of control among the adolescents in each group, Connell's (1980, 1985) Multidimensional Measure of Children's Perceptions of Control (MMCPC) was used. This well-standardized measure contains 24 items involving causal attributions that pertain to internal, external, or unknown sources of control in life events. Each item is rated on a 4-point response. Half of the items pertain to successes and half to failures. Scores are derived for six scales: internal success and failure, external other success and failure, and external unknown success and failure.

Psychological Tests
  1. *Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn and Dunn, 1981). This* test of receptive language vocabulary was administered at follow-up to obtain a quick estimate of the subjects' verbal IQ.

  2. *Academic achievement skills.* The Wide Range Achievement Test-Revised (WRAT-R) (Jastak and Wilkinson, 1984) was used to assess academic skills. For the present study, three age-referenced standard scores were computed, reading (word recognition), spelling (written spelling), and arithmetic (math computation).

  3. *Impulse control.* The Kagan Matching Familiar Figures Test-20 (MFFT-20) (Cairns and Cammock, 1978) was employed as one measure of impulse control. In this task, the adolescent

was shown a page containing a sample picture. Below this was a set of six very similar pictures, only one of which was identical to the sample. The teenager was instructed to point to the picture that exactly matched the sample. Scores obtained were the mean time to the first response and the total number of incorrect responses. The MFFT-20 is believed to be more reliable and more appropriate for adolescents than the original Kagan Matching Familiar Figures est (MFFT) (Kagan, 1966).

4. *Vigilance and distractibility:* A continuous performance test developed by Gordon (1987) was used to assess sustained attention and distractibility. This test uses a small mechanical device containing a computer that permits tests to be administered to the subject in a machine-paced procedure. The device is a metal box with a digital display screen on the front surface and a large blue button beneath it. In the vigilance task, the subject sat in front of the device while a series of numbers were shown on the screen at the rate of I per second. The numbers appear for 200 msec, with an 800 msec pause between each presentation. The subjects were instructed to press the blue button whenever the two-digit sequence of a 1 followed by a 9 appeared. Scores were the number of target pairs not detected (omissions errors) and the number of responses to nontarget signals (commission errors). For the purposes of this study, the standard 9-minute vigilance task was lengthened to 12 minutes to increase the task difficulty to try to provide for a more sensitive assessment of any differences in attention between the ADHD and control subjects. This procedure allowed for 60 target pairs of digits to be presented to the subject. The distractibility task, administered in its standard 9-minute format, was the same as the vigilance task except that numbers were flashed to either side of the target numbers to provide a distraction during the task. A total of 45 target pairs was therefore presented in this time period. The distractibility task yields the same two scores as the vigilance test. Satisfactory test-retest reliability has been reported by Gordon (1985) and Gordon and Mettelman (1988).

5. *Selective Reminding Test.* Developed by Hannay and Levin (1985), this test was used to assess verbal learning and memory. This measure follows the selective reminding paradigm described by Buschke and Fuld (1974) that attempts to measure separately encoding into and retrieval of material from long-term storage. A list of 12 unrelated words was read once to the subject who then was asked to recall as many of the words as possible. The examiner then re-minded the subject of only those words the subject failed to recall. The subject then attempted to recite the entire list again. 'Ilk process continued until the subject recalled the entire list on three subsequent trials or until 12 trials had been given. Three scores were calculated: total recall, longterm storage, and consistent long-term retrieval.

Behavioral observations of ADHD symptoms. For obtaining direct assessments of the subjects' ADHD symptoms, the restricted academic situation was used (RAS; Barkley, 1990). In this procedure, the adolescent is given a packet of math problems to perform while sitting alone in the testing room. The math problems involved basic operations, with enough problems across difficulty levels provided to ensure that the adolescent did not finish the task before the 15 minutes of observation were completed. All subjects were presented with the same set of math problems, and these ranged in difficulty from third- to fifth-grade levels. These problems were designed to be well within the math ability levels of most of our subjects. A stereo cassette tape player was set on a shelf in the room. It played music previously recorded from a local rock music station popular with teenagers at a moderate volume to serve as a distractor during the

task. During the 15-minute task, the adolescent was videotaped through a one-way mirror, with the tape later coded for five categories of behavior using a time sampling procedure. A tape recorder was used to superimpose cues on the videotape that signalled the coder to the occurrence of every 30-second interval. The coder scored the occurrence of each of the behaviors, with the category checked as occurring only once, regardless of the frequency of its occurrence during that 30-second interval. The five categories each had a specific operational definition and were off-task, fidgeting, vocalizing, playing with objects, out of seat.

Previous research has demonstrated that similar restricted academic situation and coding systems discriminated attention deficit disorder from normal and from non-attention deficit disorder conduct problem children (Fischer et al., 1990; Milich et al., 1982) and showed excellent sensitivity to stimulant drug effects (Barkley et al., 1988). Test-retest reliability has been shown to be significant over a few weeks' time for hyperactive children (Barkley et al., 1988), with significant stability also demonstrated over a 2-year period for both normal and clinic referred children (Milich, 1984; Milich et al., 1983). The behavior coder in this study was not blind to group membership of the subjects. In a recent adolescent outcome study with hyperactive children in the authors' laboratory (Fischer et al., 1990), intercoder reliability for this coding system was evaluated using a second coder, who was blind to the group membership of the subjects, to conduct reliability checks from the videotapes. Intercoder reliability was computed on a random sample of 29 of the subjects by dividing the number of agreements for occurrences only by the total number of agreements plus disagreements. The agreement was 0.87 for the off-task category, 0.83 for fidgeting, 0.90 for vocalizing, 0.98 for playing with objects, and 0.99 for out of seat.

Results
The results are reported within each domain of adjustment examined. To reduce the likelihood of Type I errors in view of the large number of statistical tests conducted, several steps were taken. First, multivariate statistics were employed on conceptually or empirically related sets of measures. These were followed by univariate statistics only where the multivariate test was significant. Second, in each multivariate analysis, the p value for statistical significance was set at $p < 0.01$. And third, in those cases where nonparametric statistics were used to evaluate the categorical measures, a Bonferroni correction was applied to limit the entire family-wise error across all statistical tests to $p < 0.05$, thereby requiring that any single statistical test have a $p < 0.002$ to be considered significant.

Adolescent Antisocial Behavior and Drug Use
Parents were interviewed by clinical psychologists regarding their adolescents' symptoms of oppositional defiant disorder and conduct disorder as well as acts of antisocial behavior and traffic offenses. Adolescents were not specifically interviewed about these antisocial acts or substance use, as results from the authors' recent study of hyperactive children followed into adolescence indicated close agreement between parent and teen reports of these offenses or acts. Chi-square methods with Yates corrections were used to analyze these measures for possible group differences. As noted above, a Bonferroni correction was applied, setting the family-wise error for all tests to $p < 0.05$. Thus, any single statistical test had to have a $p < 0.002$ to be considered significant. Significantly more ADHD teenagers met *DSM-III-R* criteria for oppositional defiant disorder ($x^2 = 32.1$, $p < 0.001$) and conduct disorder ($x^2 = 16.2$, $p < 0.001$)

than did the control group of adolescents. Consequently, the ADHD adolescents were also found to have significantly more of the symptoms of oppositional defiant disorder X = 4.3, SD = 2.0) and conduct disorder = 1.2, SD = 1.2) relative to the control group, oppositional deficient disorder (X = 0.4, SD = 0.9, t = 13.82, p < 0.001) and conduct disorder (X = 0.2, SD = 0.5, t = 6.84, p < 0.001), respectively.

Except for a significantly greater occurrence of cigarette smoking among the ADHD adolescents (x^2 = 14.3, p < 0.001), no other types of drug use were found to significantly differentiate these groups. Among the various antisocial acts by the adolescents about which the parents were interviewed, the acts of vandalism (x^2 = 11.4, p < 0.001), theft (x^2 = 26.1, p < 0.001), assault (x^2 22.4, p < 0.001), and possession or use of a weapon (x^2 = 13. 1 , p<0.001) were found to occur among significantly more of the ADHD than control teenagers. Arrest rates for these antisocial acts, however, did not distinguish these groups.

School suspensions and expulsions are typically used as consequences for antisocial acts in the school setting. The authors' results indicated that significantly more ADHD teens had been suspended from school than the control teens (x^2 = 29.8, p < 0.001), but the groups did not differ in their rate of expulsions, which were quite low in both groups. The groups also differed significantly in the mean number of suspensions, with the ADHD group having more sus-pensions (X = 3.0, SD = 5.4) than the control group (X = 0.1, SD = 0.5; t = 4.72, p < 0.001).

A small percentage of this study's subjects had received their driver's licenses, and there was a trend for more controls (19.5%) than ADHD teens (8.3%) to have done so (x^2 = 3.34, p < 0.07). The percentage of teens having automobile accidents or traffic offenses was not significantly different between these groups. However, in view of the fact that twice as many controls than ADHD teens had their licenses, it was felt that a more accurate method of evaluating accident rates was to adjust for the number of teens in each group with licenses. When the accident or traffic ottense rate was calculated as a percentage of those subjects having driver's licenses, there was a trend *(p* < 0.08) for more ADHD adolescents to have had an accident (57%) relative to the control adolescents (20%), but the groups were not significantly different in percentage of drivers in each group having a traffic citation (57% vs. 27%, respectively).

Parent and Teacher Ratings of Adolescent Behavioral Adjustment
A multivariate Hotelling's T^2 was used to compare the groups on all of the parent rating scales yielding a significant overall group difference, Hotelling's T^2 = 4.75, *F* = 42.74, *p < 0.001.* t-tests were then used to evaluate differences on each scale. The results showed that the ADHD teenagers had significantly higher ratings of problems with conduct, learning, anxiety, psychosomatic symptoms, and impulsivity-hyperactivity on the RCPRS.

The t-tests applied to each of the CBCL scales indicated that the ADHD teenagers were rated as having significantly fewer social activities in which they were involved, less social competence, and poorer school performance than the control teens. The ADHD adolescents were also rated as having significantly more problems with anxiety, somatic complaints, social interaction conflicts (withdrawal), aggression, and delinquency. These results are consistent with those from the Conners scale described above. They are not surprising in view of the use of parent ratings to

select these subject groups, thereby increasing the likelihood that group differences on other parent ratings of behavior would be found because of a common source of opinion.

To evaluate which of these parent scales contributed most to the group differences, a discriminant function analysis was conducted that was significant and revealed a four- variable solution that correctly classified 98.7% of the subjects (Eigen value = 4.64, r = 0.91, lambda = 0.177, x^2 = 219.63, $p < 0.001$). The four variables (and their standardized canonical coefficients) were, in rank order, RCPRS learning problems (0.67), RCPRS impulsive-hyperactive (0.43), CBCL social withdrawal (0.37), and RCPRS anxious (— 0.20). This enormously successful classification rate, however, is not surprising considering that parent ratings on related CBCL scores were used to classify the subjects.

The teacher ratings on the CBCL-TRF were also evaluated using a multivariate Hotelling's T^2 analysis that was significant, Hotelling's 1^{12} = 0.36, F = 4.87, $p < 0.001$, for the school adjustment scales and for the behavior problem scales, Hotelling's T^2 = 0.48, F = 34.15, $p < 0.001$. The subsequent t-tests indicated that the ADHD adolescents were rated as significantly poorer in school performance and adjustment and as experiencing greater difficulties on scales assessing social relationships, anxiety, unpopularity, obsessive-compulsive symptoms, immaturity, self-destructive behavior, inattention, and aggression. Thus, clinic-referred adolescents with ADHD are rated by their teachers as significantly more maladjusted across all dimensions of behavioral and social adjustment.

Again, to determine which of these scales contributed most to the discrimination of the subject groups, a discriminant function analysis was conducted using these scales. It was highly significant and yielded a two variable solution that correctly classified 79.5% of the subjects (Eigen value = 0.86, r = 0.68, lambda = 0.539, x^2 = 73.63, $p < 0.001$). The two variables, in rank order, were the school adjustment rating from the adaptive functioning profile (0.89) and the obsessive-compulsive scale from the behavior problem profile (— 0.27).

Adolescent Self-Report Ratings of Adjustment
The results for all of the self-report rating scales completed by the adolescents concerning their own perceptions of their adjustment were analyzed by a Hotelling's T^2 multivariate analysis, the results of which were significant, Hotelling's T^2 = 0.49, F = 3.24, $p < 0.001$. Subsequent t- tests conducted on each scale indicated that the ADHD adolescents rated themselves as having significantly poorer adjustment in activities and social relations, being more unpopular, and having more problems with delinquent conduct than the control adolescents on the CBCL-YSR. They did not, however, rate themselves as having any greater difficulties with depression, somatic complaints, self-destructive behavior, thought disorder, or aggression on this scale than the control teens.

In contrast, the ADHD teens did rate themselves as having greater sadness or depression on the RADS and reported higher rates of life stress within the past 12 months than the control teenagers. The adolescent ratings of perceived locus of control on the MMCPC scale revealed that ADHD teens had significantly lower scores on the subscales of powerful other failure and unknown success than the control teens.

To determine which among these many scales most contributed to the group discrimination, a discriminant function analysis was conducted using all self-report scales, the results of which were significant and yielded a six variable solution that correctly classified 77.1% of the subjects (Eigen value = 0.44, r = 0.55, lambda = 0.693, X^2 = 45.94, $p < 0.001$). The six variables, in rank order, were the delinquent (— 1.19) and aggressive (0.77) scales from the CBCL-YSR, the adolescent stressful life events scale (0.51) the Social (0.50) and Activities (0.44) scales of the CBCL-YSR, and the self-destructive scale (0.32) from the CBCL-YSR.

Psychological Tests and Behavioral Observations
The scores from the lab measures and achievement tests are shown in Table 2. All of these measures were analyzed using a multivariate I Hotelling's T^2 test, the results of which were significant, 1^2 = 0.65, F = 4.80, $p < 0.001$. The WRAT-R scores were then submitted to t-tests, which indicated that the ADHD adolescents were significantly more impaired than the control subjects in simple word recognition (reading), written spelling, and math performance.

The results for the scores from the verbal selective reminding test were significant, indicating significant impairment in immediate recall, storage, and consistent longterm retrieval of information from verbal memory in the ADHD adolescents as compared with the control teens. Both

TABLE 2. *Results of Achievement Tests and Laboratory Measures by Group*

Measure	ADHD ($N = 84$)		Control ($N = 77$)		t	$p<^a$
	$\bar{X}$	SD	$\bar{X}$	SD		
WRAT-R						
Reading	98.5	16.2	105.2	14.0	— 2.79	0.006
Spelling	93.8	16.6	101.3	16.5	— 2.86	0.005
Math	87.7	17.3	100.5	16.8	— 4.73	0.001
Selective Reminding Test						
Total recalled	105.5	16.0	117.8	14.9	— 5.03	0.001
Long-term storage	102.5	20.5	118.3	17.7	— 5.20	0.001
Long-term retrieval	57.1	30.0	79.8	33.8	— 4.51	0.001
Matching Familiar Figures Test-20:						
Meantime (sec)	14.5	7.4	13.0	6.0	1.45	—
Total errors	12.6	7.5	12.5	6.8	0.07	—
Vigilance test						
Omission errors	3.5	4.7	1.6	2.2	3.19	0.002
Commission errors	5.7	8.8	2.0	4.2	3.38	0.001
Distractibility test						
Omission errors	7.3	7.9	6.3	7.6	0.78	—
Commission errors	6.7	10.9	3.6	8.0	2.01	—
Restricted Academic Observations (%)						
Off-task	14.4	16.9	2.3	3.8	6.12	0.001
Fidgets	23.4	21.8	7.4	13.9	5.49	0.001
Vocalizes	8.7	18.1	4.1	7.7	2.06	—
Plays with objects	1.2	3.4	0.3	1.1	2.24	—
Out of seat	0.9	2.0	0.3	0.7	2.82	0.005
Total ADHD behavior	16.3	12.1	11.3	12.3	2.63	0.009
Number math problems completed	81.3	24.7	105.8	31.1	— 5.56	0.001
Percent math correct	90.5	8.4	91.9	5.2	— 1.32	—

$^a p<$ indicates the probability value for the t-test (two-tailed) between groups, if $p < 0.01$ and if the multivariate Hotelling's T^2 was significant.

scores from the MFFT-20 were then evaluated and were not significant.

The scores from both the vigilance and distractibility tests were evaluated and revealed that the ADHD adolescents made significantly more errors of both omission and coin- mission on the vigilance test and more commission errors on the distractibility test than did the control adolescents. However, the two groups did not differ significantly in their omission errors on the distractibility task.

The results from the direct behavioral observations taken during the restricted academic task were also analyzed using t-tests for each of the behavioral categories shown in 'fable 2. Four of the five behavioral categories distinguished these groups. The ADHD teens were noted to display significantly more problems with off-task behavior, fidgeting, vocalizing, and out-of-seat behavior than were the control teens. Moreover, the ADHD teens did not complete as many of the math problems during this period as did the control teenagers, although the groups did not differ in the accuracy of the problems they completed.

Once again, to determine which measures most contributed to the group discrimination, these lab measures were submitted to a discriminant function analysis that was significant and yielded a 12-variable solution that correctly classified 72% of the subjects. In rank order, these variables were the long-term storage score from the selective reminding test (0.50), the number of math problems completed (-- 0.36) and percentage of vocalizing (0.33) during the restricted academic situation, the math score on the WRAT-R (— 0.32), off--task behavior during the RAS (0.32), the time to first response on the MFFT-20 (0.29), the spelling test on the WRAT-R (0.24), the omission score from the vigilance test (0.23), fidgeting from the RAS (0.22), the error score from the MFFT-20 (0.22), the omission score from the distractibility test (0.21), and the percentage of math correctly completed during the RAS (0.19).

Treatment Utilization
The extent to which these ADHD teenagers had received various treatments typically used with ADM) children was also evaluated. Parents were interviewed about the treatments their adolescents had ever received for their behavioral problems. The results for these questions from the parental interview were analyzed using t-tests or chi-square analyses, as appropriate, and are reported in Table 3. Again, a Bonferroni correction was applied to limit the family-wise error to $p < 0.05$. Thus, a $p < 0.002$ was required for any single statistical test to be considered significant. Not surprisingly, significantly more ADHD adolescents had been treated with stimulant medications, specifically Ritalin", and for a significantly longer period of time than the control group. Significantly more AMID teens had also received individual and family therapy than the control teens, although from 22% to 26% of the control teens had received this type of treatment. It was also found that significantly more of the ADHD adolescents than the controls had re-

Measure	ADHD (N = 84)	Control (N = 77)	χ²/t	p<ᵃ
Ritalin® use (%)	44.0	1.3	38.34	0.001
Mean duration (mo)	13.3 (24.8)	0.1 (0.2)	4.69	0.001
Dexedrine® use (%)	2.4	0.0	0.40	—
Mean duration (mo)	0.6 (5.3)	0.0 (0.0)	—	—
Cylert® use (%)	6.0	0.0	3.00	—
Mean duration (mo)	0.3 (1.5)	0.0 (0.0)	—	—
Tranquilizers (%)	0.0	1.3	0.00	—
Mean duration (mo)	0.0 (0.0)	0.1 (0.7)	—	—
Other psychoactive drugs (%)	1.2	3.9	0.33	—
Mean duration (mo)	0.1 (0.1)	0.4 (2.8)	−1.27	—
Individual therapy (%)	51.8	26.0	10.11	0.002
Mean duration (mo)	9.8 (16.5)	2.2 (7.8)	3.66	0.001
Group therapy (%)	9.6	1.3	3.78	—
Mean duration (mo)	1.1 (5.6)	0.1 (0.7)	1.55	—
Family therapy (%)	53.0	22.1	14.92	0.001
Mean duration (mo)	5.6 (11.8)	2.2 (9.9)	1.98	—
Inpatient treatment (%)	2.4	0.0	0.43	—
Mean duration (mo)	0.1 (0.2)	0.0 (0.0)	—	—
Special education placement				
Learning disability (%)	69.0	23.4	31.81	0.001
Mean duration (mo)	30.3 (32.1)	11.2 (24.1)	4.24	0.001
Emotionally disturbed (%)	11.9	0.0	7.83	0.006
Mean duration (mo)	2.7 (9.4)	0.0 (0.0)	—	—
Speech therapy (%)	13.1	20.8	1.19	—
Mean duration (mo)	4.3 (13.6)	4.6 (11.2)	−0.20	—
Retained in grade (%)	48.8	9.1	28.41	0.001
Mean number of times	0.8 (1.6)	0.2 (1.1)	2.41	—

Note: Standard deviations appear in parentheses for mean duration measures.
ᵃ*p*< indicates the probability value for the statistical test between groups if *p* < 0.01.

ceived special education through both programs for the learning disabled and emotionally disturbed, and that more ADHD teens had been retained in grade as another means of handling their academic performance problems.

Discussion

The present study found that adolescents who are clinically referred and diagnosed as ADHD display significantly more antisocial behavior than a matched sample of community teenagers that included a substantial minority of learning disabled adolescents. The ADHD teens were three times more likely to have an associated oppositional defiant disorder (68%) and four times more likely to have a comorbid conduct disorder (39%) than were teenagers in the community control group (22% and 10%, respectively). The pattern of antisocial acts in these ADHD adolescents suggests that theft (43%) is the most common activity followed in order by assault (27%), vandalism (21%), and disorderly conduct (12%), all of which were significantly more common than in the control group. The ADHD adolescents were not found to have more substance use than the control teenagers, except for cigarette smoking.

The ADHD teenagers were also rated as less socially competent, involved in fewer social and organized activities, and had fewer friends than the control group. They were also noted to be more impaired than control teenagers in their behavioral adjustment in both internalizing and ex ternalizing domains as rated by parents and teachers. In contrast, the teens' own self-reports did

not reflect this degree of severity or pervasiveness of maladjustment. Instead the ADHD adolescents reported a pattern primarily of poorer social competence and more antisocial conduct (delinquency) than the control teens. Findings for symptoms of depression were inconsistent, being significant for the RADS but not for the CBCL Depression Scale. This is likely due to the differences in item content, as the RADS contains items pertaining more to milder forms of depressive symptoms, such as unhappiness and low self-esteem, whereas the CBCL reflects more serious degrees of depression. Surprisingly, the ADHD adolescents attributed less of their failure experiences to powerful others and less of their success experiences to unknown sources on the locus of control scale than the control group in contrast to findings from studies of ADHD children (Linn and Hodge, 1982). This overall pattern of results suggests that ADHD children referred to clinics as adolescents report considerably less serious behavioral and emotional adjustment problems in themselves relative to their parents' and teachers' views of them. This likely reflects a diminished degree of self-awareness in this disorder and has been documented on similar measures taken on ADHD children followed into adolescence (Barkley et al., 1991; Fischer et al. , 1990).

An issue worth considering is whether the ADHD subjects referred to clinics *as adolescents* may be comparable with those seen in ADHD children in other studies who were clinically referred as children but then *followed into adolescence.* When the findings for antisocial behavior and drug use arc contrasted with those of the authors' recent follow- up study of hyperactive children into adolescence, using exactly the same dependent measures (Barkley et al., 1990b) and the same age of subjects as those in the present study, they are quite comparable. Similarly, the findings for parent and teacher ratings of behavior as well as for the objective laboratory tests and observations are in close agreement with those from the adolescent follow-up studies of hyperactive children (Fischer et al. , 1990; unpublished manuscript, 1990) in noting a pervasive degree of behavioral, emotional, and social maladjustment as well as specific problems in objectively assessed inattention, restlessness, and impulsivity. Where differences are found between our adolescent- referred ADHD subjects and ADHD children followed to adolescence, they appear primarily to be in the area of treatment use, specifically medication use. The subjects were considerably less likely to be treated with methylphenidate (44%) than were hyperactive children followed to adolescence (81%) (Barkley et al., 1990b) but were more likely to have been placed in special education programs for the learning disabled or to have been retained in grade.

Several limitations of this study are deserving of note as they may have affected the interpretation or generality of these findings. For one thing, the lack of a clinic-referred control group of non-ADHD adolescents precludes the ability to attribute these findings to teens specifically having ADHD as opposed to some other adolescent disorder. This is clearly an issue for future research to evaluate. For another, the sample consisted almost entirely of Caucasian teenagers, preventing the generalization of these results to minority groups with ADHD. The fact that a large minority of subjects had previously or were now taking stimulant medication may also have decreased their school performance problems, educational maladjustment, and instances of antisocial acts relative to ADHD teens who had not taken such medication. Finally, the interviewer and observer were not blind to the group membership status of the subjects, which could have potentially introduced some bias into the findings from these particular

instruments. These results, however, are in agreement with many past studies on ADHD children, using similar assessment methods.

The present results have several implications for assessment of clinic-referred ADHD adolescents. They imply that clinicians should not rely heavily on the self-reports of adolescents about their possible ADHD symptoms, as these reports are likely to be underestimates of actual levels of these symptoms or of the degree of impairment reported by parents and teachers. The results also suggest that the current battery of measures has some use for assessing ADHD in teenagers. Perhaps extending the time limits of the vigilance test and the behavioral observations of math performance would make them even more sensitive to the inability of these teens to persist in their work effort under such boring and tedious conditions.

In summary, the present study found that individuals with ADHD clinically referred at adolescence display significant impairments in objectively assessed attention, impulsivity, and overactivity, and in academic achievement, social competence, and behavioral adjustment. They also have higher risks for comorbid antisocial disorders and school maladjustment and a considerable pattern of treatment use as compared with control subjects. A battery of parent and teacher rating scales as well as objective laboratory measures found to be useful in assessing ADHD in children was similarly found to be sensitive to the ADHD symptoms of clinic-referred adolescents. Despite the dearth of previous research findings on ADHD adolescents, the present findings suggest that the disorder is quite similar in adolescence, as it has been found to be in a plethora of research on ADHD children.

References
Achenbach, T. M. & Edelbrock, C. (1983), *Manual for the Child Behavior Checklist and Revised Child Behavior Profile.* Burlington, VT: University of Vermont Department of Psychiatry.
____ (1986), *Manual for the Teacher's Report Form and Teacher Version of the Child Behavior Profile.* Burlington, VT: University of Vermont Department of Psychiatry.
____(1987), *Manual for the Youth Self-Report Form and Youth Version of the Child Behavior Profile.* Burlington, VT: University of Vermont Department of Psychiatry.
Ackerman, P. T., Dykman, R. A. & Peters, J. E. (1977). Teenage status- of hyperactive and nonhyperactive learning disabled boys. *Am. J. Orthopsychiatry,* 47:577-596.
Barkley, R. A. (1988), Child behavior rating scales and checklists. In: *Assessment and Diagnosis in Child Psychopathology,* eds. M. Rutter, H. Tuma & I. Lann. New York: Guilford, pp. 113-155.
____(1990), *Attention Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment.* New York: Guilford.
Fischer, M., Newby, R. F. & Breen, M. J. (1988), A multi-method clinical protocol for assessing stimulant drug response in children with Attention Deficit Disorder. *Journal of Clinical Child Psychology, 17:14-24.*
DuPaul, G. & McMurray M. B. (1990a), A comprehensive evaluation of attention deficit disorder with and without hyperactivity as defined by research criteria. *J. Consult. Clin. Psychol.* 58:775-789.
Fischer, M., Edelbrock, C. S. & Smallish, L. (1990b), The adolescent outcome of hyperactive children diagnosed by research criteria, I: An 8-year prospective follow-up study. *J. Am. Acad. Child Adolesc. Psychiatry,* 29:546-557.

(1991), The adolescent outcome of hyperactive children diagnosed by research criteria, III: mother–child interactions, family conflicts, and maternal psychopathology. *J. Child Psychol. Psychiatry.* 32:233-256.

Brown, R. T. & Borden, K. A. (1986), Hyperactivity at adolescence: some misconceptions and new directions. *Journal of Clinical Child Psychology, 15:194-209.*

Buschke, H. & Fuld, P. A. (1974), Evaluating storage, retention, and retrieval in disordered memory and learning. *Neurology,* 24:10191025.

Cairns, E. 7 Cammock, T. (1978), Development of a more reliable version of the Matching Familiar Figures Test. *Dev. Psychology, 11:244-248.*

Connell, J. P. (1980), *A Multidimensional Measure of Children's Perceptions of Control: Manual.* Denver, CO: University of Denver.

___ (1985), A new multidimensional measure of children's perception of control. *Child Dev.,* 56:1018-1041.

Conners, C. K. (1985), Issues in the study of adolescent ADD-Hyperactivity. *Psychopharmacol. Bull.,* 21:243-250.

Dunn, L. M. & Dunn, L. M. (1981), *Peabody Picture Vocabulary Test—Revised.* Circle Pines, MN: American Guidance Service. Fischer, M., Barkley, R. A., Edelbrock, C. S. & Smallish, L. (1990), The adolescent outcome of hyperactive children diagnosed by re-
search criteria, II: academic, attentional, and neuropsychological status. *J. Consult. Clin. Psycho/.* 58:580-588.

Gittelman, R., Mannuzza, S., Shenker, R. & Bonagura, N. (1985), Hyperactive boys almost grown up: I. psychiatric status. *Arch. Gen. Psychiatry,* 42:937-947.

Gordon, M. (1985, August), *Current GDS research: the vicissitudes of validation.* Paper presented at the 93rd Annual Convention of the American Psychological Association, Los Angeles.

_____(1987), *The Gordon Diagnostic System.* DeWitt, NY: Gordon Systems, Inc.
 Mettelman, B. B. (1988), The asessment of attention: I. Standardization and reliability of a behavior-based measure. *J. Clin. Psychol.,* 44:682-690.

Goyette, C. H., Conners, C. K. & Ulrich, R. F. (1978), Normative data for Revised Conners Parent and Teacher Rating Scales. *J. Abnorm. Child Psycho!.* 6:221-236.

Hannay, H. J. & Levin, H. S. (1985), Selective Reminding Test: an examination of the equivalence of four forms. *J. Clin. Exp. Neurop.sychol.* 7:251-263.

Hollingshead, A. B. (1975), *Four Factor Index of Social Status.* New Haven, CT: Yale University Sociology Department.

Jastak, S. & Wilkinson, G. S. (1984), *The Wide Range Achievement Test—Revised.* Wilmington, DE: Jastak Associates, Inc.

Kagan, J. (1966), Reflection-impulsivity: the generality and dynamics of conceptual tempo. *J. Abnorm. Psycho'. 71:17-24.*

Klorman, R., Coons, H. W. & Borgstedt, A. D. (1987), Effects of methylphenidate on adolescents with a childhood history of attention deficit disorder: I. clinical findings. *J. Am. Acad. Child Adolesc. Psychiatry,* 26:363-367.

Lambert, N. M. & Sandoval, J. (1980), The prevalence of learning disabilities in a sample of children considered hyperactive. *J. Ab- norm. Child Psychol.,* 8:33-50.
 Hartsough, C. S., Sassone, D. & Sandoval, J. (1987), Persistence
of hyperactivity symptoms from childhood to adolescence and associated outcomes. *Am. J. Orthopsychiatry,* 57:22-32.

Linn, R. T. & Hodge, G. K. (1982), Locus of control in childhood hyperactivity. *J. Consult. Clin. Psycho/.,* 50:592-593.

Milich, R. (1984), Cross-sectional and longitudinal observations of activity level and sustained attention in a normative sample. *Abnorm. Child Psycho/.,* 12:261-276.

Landau, S. (1982), Socialization and peer relations in hyperactive children. *In: Advances in Learning and Behavioral Disabilities,* Vol. 1, eds. K. D. Gadow & I. Bialer. Greenwich, CT: JAI Press, pp. 283-339.

Loney, J. & Landau, S. (1982), The independent dimensions of hyperactivity and aggression: a validation with playroom observation data. *J. Abnorm. Psycho/.,* 91:183-189.

Whitten, P. (1983, August). Two *year stability and validity of playroom observations of hyperactivity.* Paper presented at the Annual Convention of the American Psychological Association, Anaheim, CA.

Pelham, W. E. & Bender, M. E. (1982), Peer relationships in hyperactive children: description and treatment. In: Advances *in Learning and Behavioral Disabilities,* Vol. I, K. D. Gadow & 1. Bialer (Eds)., Greenwich, CT: JAI Press, pp. 365-436.

Reynolds, A. (1981), *The Reynolds' Adolescent Depression Scale.* Madison, WI: University of Wisconsin.

Ross, S. & Ross, D. (1982) *Hyperactivity.* New York: Wiley. Szatmari, P., Offord, D. R. & Boyle, M. H. (1989), Ontario child health study: prevalence of attention deficit disorder with hyperactivity. *J. Child Psycho'. Psychiatry,* 30:219-230.

Thorley, G. (1984), Review of follow-up and follow-back studies of childhood hyperactivity. *Psycho'. Bull.* 96:116-132.

Varley, C. K. (1985), A review of studies of drug treatment efficacy with attention deficit disorder with hyperactivity in adolescents. *Psychopharmacol. Bull.* 21:216-221.

Weiss, G. & Hechtman, L. T. (1986), *Hyperactive Children Grown Up.* New York: Guilford Press.