0196-206X/94/1505-0311$03.00/0
DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS

Vol. 15, No. 5, October 1994
Printed in U.S.A.

Original Articles

Attention Deficit Disorder in Children: Three Clinical Variants

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ABSTRACT. A clinic-referred population of 116 children with attentional problems was classified by DSM-III [attention deficit disorder (ADD)] with respect to inattention, impulsivity, and hyperactivity. The sample proved to subdivide into three groups: inattentive, impulsive, and hyperactive (HII), n = 60; inattentive and impulsive (II), n = 26; and inattentive (I), n = 30. The distinction between II and I resolves the confounding of impulsivity and inattention in previous studies of children who have ADD but are not hyperactive. The three groups were found to be similar in mean age, gender ratio, prevalence, and pattern of associated learning disabilities, family history of psychopathology, and probability of favorable response to methylphenidate. Group I differed from Groups HII and II in the frequency of externalizing relative to internalizing comorbid psychopathology. A group that is hyperactive and impulsive but not inattentive was not found. The preponderance of similarities in associated characteristics suggests that the three groups are differing clinical presentations of an ADD spectrum. *J Dev Behav Pediatr 15:311–319, 1994.* Index terms: *attention deficit disorder, hyperactivity, inattention, impulsivity.*

Attention-deficit hyperactivity disorder (ADHD), the most prevalent psychopathology of childhood,[1] has serious consequences for social and academic development. Although it appears to be biologically based,[2–5] its diagnosis relies on behavioral observations. The diagnostic behaviors differ only in degree from normal,[6] and they are subject to situational, individual, and developmental variation. This diversity of expression of the disorder poses a problem for taxonomy, which has been reflected in successive editions of DSM-III. DSM-III[7] substituted an emphasis on attention for the previously used term "hyperkinetic reaction of childhood," and recognized two subtypes—attention deficit disorder (ADD) with and without hyperactivity (it is still unclear whether they are two forms of a single disorder or represent two distinct disorders). DSM-III-R[8] no longer grouped individual symptoms along behavioral dimensions (hyperactivity, inattention, and impulsivity), as did DSM-III. A single construct, ADHD, was characterized by 14 multidomain symptoms, of which any 8 must be present in order to meet the diagnostic criterion. Attention deficit without hyperactivity (inattentive + impulsive) (ADDW) was excluded from the classification, because "the diagnosis is hardly ever made," and "it is unlikely that the DSM-III categories of attention deficit disorder with and without hyperactivity are subtypes of a single disorder."[8] A separate category, undifferentiated attention-deficit disorder (314.00) (UADD), which identifies children who are inattentive, not hyperactive, but, unlike ADDW, not impulsive, is included elsewhere in the manual. The appended definition is exclusionary: "a residual category for disturbances in which the predominant feature is the persistence of developmentally inappropriate and marked inattention, that is not the symptom of another disorder." This leaves the following issues unresolved: (1) do predominantly inattentive children constitute a valid diagnostic category, and, if so, should it be considered an extension of the ADHD spectrum? (2) Within the ADHD category, is there a substantial subgroup of children who are not only inattentive but also impulsive, and yet not hyperactive (ADDW)? (3) Are subgroups forms of a single disorder or distinct disorders?

The term "attention deficit disorder" reflects a shift in emphasis from the motor to the attentional components of the disorder. From this perspective, the coexistence of impulsivity and/or hyperactivity, however frequent, need not be considered essential to the diagnosis of a variant in the ADD spectrum. Indeed, descriptions of children classified as ADDW often give little prominence to behavioral impulsivity, and instead use terms such as sluggish, drowsy, apathetic, anxious, shy, withdrawn[9] (observations anticipated by Clements and Peters[10]).

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Contrary to DSM-III-R, many children are perceived as having ADD although not hyperactive,[11] and according to many studies ADDW can be reliably diagnosed.[9–22] However, the ADDW subjects sampled by different investigators may be heterogeneous. Thus, reported differences in comorbidity between attention-deficit disorder with hyperactivity (ADDH) and ADDW have been far from consistent. Conduct disorder was found to be more frequent in ADDH than in ADDW in two studies[14,22] but not in two others.[12,17] A likely explanation for this discrepancy is (1) that ADDW inclusion criteria were primarily based on the absence of hyperactivity, (2) sample sizes were small, and (3) impulsivity ratings varied widely across studies. For example, Swanson, Nolan and Pelham Rating Scale (SNAP)[13] impulsivity group means were 3.90 for ADDH and 2.30 for ADDW in the study by Hynd et al,[22] which was a significant difference ($p < .05$). Reported values in the study of Lahey et al[17] were 3.94 and 3.28, respectively, the difference between which was statistically nonsignificant. Maladaptive levels of impulsivity were a selection criterion for ADDW in the work of Lahey et al.[17] It may well be that ADDW (inattentive and impulsive) and UADD (inattentive but not impulsive) subjects were present in different proportions in the two studies. Perhaps different children exhibit inappropriate levels of functioning on just one, two, or all three of the behavioral dimensions. This would lend support to the existence of distinct ADDW and UADD groups.

Cognitive differences between ADDH and ADDW groups have also been reported. Teachers have rated children with ADDW as sluggish and drowsy,[16] and as exhibiting more learning difficulties than children with ADDH.[14,15] According to Levine,[23] many children are inattentive and cognitively impulsive, but not behaviorally impulsive or hyperactive. Hynd et al[22] found academic underachievement in 60% of an ADDW sample but in no ADDH subjects. However, numerous reports show an association between ADDH and learning disabilities.[24–29]

In summary, reported differences between ADDH and ADDW are contradictory, while the UADD diagnostic category (as distinct from ADDW) has not been systematically studied. The present study seeks to determine whether inattentiveness, impulsivity, and hyperactivity vary independently, and if so, whether these are multiple syndromes, multiple presentations of the same syndrome, or multiple levels of severity of the same syndrome. In the work that follows, we use the labels HII, II, and I for inattentive subgroups differing with respect to whether criterion is reached for impulsivity and for hyperactivity. This avoids confounding terminology from two different versions of DSM (III and III-R), and involving the UADD category, which is underspecified in DSM-III-R. It enables us not to generate more terminology in a situation that is in taxonomic flux.

METHOD

Sample

One hundred twenty-six children who were referred to the Attention Deficit Clinic because of poor school performance, short attention, or behavior problems served as the subject pool for this study. Statements of informed consent and assent were signed by parents and children, respectively. Referrals were made by pediatricians, psychologists, school personnel, and parents. In 56% of the children, the presenting problem was inattention to classroom instruction, and in 11%, impulsive and disruptive and/or oppositional behavior was noted. In 33%, observers stressed both domains of difficulty. For inclusion, intelligence evaluated by the Peabody Picture Vocabulary Test had to be within the normal range. Children were additionally considered to have a learning problem if they were so diagnosed before referral and were attending special classes. The ages ranged from 6 to 16 years; 96 (76%) were male and 30 (24%) were female. In no case was the attention deficit secondary to another disorder. When other psychiatric disorders coexisted at the time of examination, the symptoms of attention deficit were documented as having begun much earlier in life. None of the children were neurologically handicapped, and none were taking nonstimulant psychoactive medication.

Procedure

Clinical Diagnosis. Subjects and their parents were interviewed separately. Clinical diagnosis was made by two experienced pediatric neurologists with reference to the totality of the available information on each child, based on DSM-III and DSM-III-R criteria.[7,8] Symptoms were evaluated according to the clinical history, extended well beyond parents' and teachers' behavior ratings. Children were initially assigned to two experimental groups: children who met criteria for inattention and impulsivity (II) and children who met criteria for hyperactivity, inattention, and impulsivity (HII). The remaining children met criteria for inattention, but were neither impulsive nor hyperactive. This group, which we labeled I (cf. DSM-III-R undifferentiated attention-deficit disorder category), constituted our third experimental group. Agreement as to diagnosis between the two judges was $r = .92$ ($z = 5.47$, $p < .0001$). Ten cases were excluded from the study because no agreement was reached on their diagnosis. Sixty subjects were classified as HII (52%), 26 as II (22%), and 30 as I (26%). The other combinations that were theoretically possible, impulsivity and/or hyperactivity without inattentiveness, and inattentiveness and hyperactivity without impulsivity, did not emerge in this sample. Thus all children were inattentive, some also impulsive, and some of these hyperactive as well. None were considered overactive but normally attentive. Specifically, we did not find children who met criteria for impulsivity and hyperactivity but not for inattention.[30] According to teachers' and parents' reports, the disorder was pervasive in 88% of HII, 79% of II, and 77% of I, and situational in the rest.[31]

Subjects were also interviewed for psychopathology, both externalizing (conduct disorder, all subtypes, and oppositional disorder) and internalizing (overanxious disorder, obsessive-compulsive disorder, and affective disorder) according to DSM-III-R criteria. Aggression-defiance was evaluated according to the Iowa-Conners criteria.[32]

The family history for adults focused primarily on affective disorders, alcohol abuse, and attention problems in

first-degree relatives. Only those individuals who met DSM-III-R criteria for affective disorder were so classified. The criteria of Wender et al[33] were followed to diagnose attention deficit disorder, residual type. Alcoholism was recorded in those who attended or had attended alcohol abuse treatment programs. There were 16 adoptive parents (through 8 nonrelative adoptions) who had no history of such disorders. These cases were excluded from the analysis of the family history, but included in all other analyses.

Rating Scales. Both parents independently completed the Abbreviated Conners Questionnaire (ACQ)[34] and the Swanson, Nolan and Pelham Rating Scale (SNAP), which transforms the DSM-III checklist items into a 0 to 3 rating scale. Teachers also completed the ACQ. The Hyperactivity Index (a cutoff score of 1.5) has been used as the diagnostic criterion for the ACQ. On the SNAP, subscale scores were expressed as an average rating per item (sum of subscale item ratings divided by number of items).

Teacher ratings were available for 57 children (HII = 26, II = 14, I = 17); however, Biederman et al[35] reported a 90% probability of a positive diagnosis based on teacher reports, given a positive parent-based diagnosis.

Medication Assessment. The cognitive expression of the attention deficit was evaluated in terms of paired-associate learning. Paired-associate learning has been shown to be predictive of attention-deficit hyperactivity disorder children's stimulant response in the field,[36] when used in a double-blind drug/placebo design.[37]

The Continuous Paired Associates Learning Test (CPALT) uses consonant pairs as stimulus terms (S) and digits (0 to 9) as response terms (R) on an Apple-Macintosh microcomputer. The task begins with the presentation of an S-R pair for study for 8 seconds, followed by a test sequence in which only the stimulus term is presented. The subject is allowed 5 seconds to key in the corresponding response term. If the response is correct, the S-R pair is presented simultaneously with "YES," and a new S-R pair is presented for study and added to the S-R pool. This sequence continues until an error is made. If the response was incorrect or if the subject failed to respond in the allowed time, the correct answer is again given, although together with a "NO." The earliest presented pair is then dropped from the active S-R pair string and the subject is immediately tested on the remaining pairs. The main dependent variable is the total number of stimuli for which the child offered the correct response term. Performance variability was also recorded in terms of the coefficient of variation.

An acute double-blind drug-placebo crossover design was used to determine the child's response to methylphenidate (MPH). After a practice session to familiarize the child with the computerized task, the evaluation consisted of four 30-minute sessions, in which the child was tested 2 hours after the 9:00 a.m. administration of placebo and of three levels of MPH (5, 10, 20 mg) (in a randomized sequence counterbalanced across subjects). Both medication and placebo were enclosed in opaque gelatin capsules to mask their taste and appearance. The computer generates independent S-R sequences for each session. Children do not improve in CPALT performance over successive test sessions; i.e., the interaction of performance with order is nonsignificant.

Based on their performance (number of correct responses), subjects were classified as responders (at 5, 10, or 20 mg) or nonresponders. A subject was considered to be a responder if there was a 25% increase in performance relative to placebo on any single dose or performance improved on all three doses relative to placebo.

RESULTS

Groups were initially compared for age and sex, and between-group comparisons were then made for comorbidity, family history of psychopathology, IQ as measured by the Peabody Picture Vocabulary Test (PPVT) (standard score), learning problems, behavior ratings, and response to medication.

No significant differences were found between groups in mean age (±SD) [children who met criteria for hyperactivity, inattention, and impulsivity (HII), 10.1 ± 2.3 years; children who met criteria for inattention and impulsivity (II), 11.5 ± 3.0 years; children who met criteria for inattention, but were neither impulsive nor hyperactive (I), 10.5 ± 2.6 years; $F(2,113) = 2.71$, $p > .05$] or sex distribution ($\chi^2 = 0.81$, $p > .10$). Seventy-two percent of HII were male, compared to 77% of II, and 80% of I.

Comorbidity was equally prevalent among the three diagnostic categories ($\chi^2 = 2.6$, $p > .05$). Table 1 presents the percentage of subjects in each group who received a codiagnosis of internalizing or externalizing psychopathology. An overall χ^2 test was significant ($\chi^2 = 8.67$, $p < .05$). The proportion of externalizing versus internalizing psychopathology differed significantly between HII and I ($\chi^2 = 6.18$, $p < .03$), between II and I ($\chi^2 = 7.02$, $p < .01$), but not between HII and II ($\chi^2 = 0.68$, $p > .05$). None of the children with externalizing psychopathology met DSM-III-R criteria for conduct disorder. Most of them met criteria for aggression-defiance (Table 1).

The incidence of alcoholism, attention deficit, and depression in first-degree relatives did not differ significantly among the groups (Table 2). Families of HII subjects tended to be the most affected but not significantly so. Attention deficit was much more frequent than either of the other two conditions. Three HII families featured bipolar disorder (the father in two cases, the mother in one). Less frequent were simple phobia (II, one) and obsessive-compulsive disorder (HII, one).

Group means on the PPVT were as follows: HII = 105.69 ± 16.63 (n = 48); II = 101.60 ± 23.7 (n = 20); I = 113.40 ± 16.39 (n = 20). The differences were nonsignificant [$F(2,85) = 2.16$, $p = .12$], although there was a trend toward

TABLE 1. Cormobidity[a]

	HII (n = 60)	II (n = 26)	I (n = 30)
Psychopathology			
Internalizing	10	4	17
Externalizing	27	27	3
Total comorbidity	37	31	20

[a]Values are percentages. HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

TABLE 2. Family History (First-Degree Relatives)[a]

	HII (n = 60)	II (n = 26)	I (n = 30)
Depression	8	7	5
Alcoholism	17	7	14
Attention deficit disorder	69	47	59

[a]Values are percentages. HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

higher IQ on the part of the I children. Although every child received a PPVT during the subject selection phase, some of the data could not be located for the present analysis. The missing data affected the three groups equally (Table 3).

Learning disorders were frequent in all groups. The total number of subjects failing in one or more academic areas and receiving remedial education was recorded for each group, and the group means were compared using χ^2. Between-group comparisons were also made for individual academic areas. More HII subjects (33%) had a learning disorder than II (12%) and I (23%) subjects. However, these differences were statistically nonsignificant. The higher proportion of HII subjects experiencing difficulties in the three specific academic areas was also nonsignificant. Only two subjects (one HII, one II) received a diagnosis of language disorder.

Comparisons of the three groups on parent and teacher rating scales are presented in Table 4. Means on the Abbreviated Conners Questionnaire (ACQ) and on each subscale of the Swanson, Nolan and Pelham Rating Scale (SNAP) were entered into separate analyses of variance (ANOVAs), and, when F values were significant, the omnibus F was decomposed using pairwise t tests. Correlations were also computed between raters and between rating scales.

Consistent with their definitions, the groups differed significantly on the Hyperactivity, $F(2,113) = 73.14$, $p < .0001$, and Impulsivity, $F(2,113) = 66.04$, $p < .0001$, subscales of the SNAP. More interestingly, the groups also differed significantly on the Inattention subscale, $F(2,113) = 6.35$, $p < .01$. Post hoc t tests showed that the HII and II groups differed on the Impulsivity subscale[19,38] as well as on the Hyperactivity subscale (but not on the Inattention subscale).[14] An analysis of covariance (ANCOVA) using Impulsivity as covariate showed that although Impulsivity was significantly related to Hyperactivity [$F(1,83) = 22.5$, $p < .0001$], the between-group differences in Hyperactivity found in the original analysis remained highly significant, $t = 10.00$, $p < .0001$. Thus the HII were more hyperactive than the II subjects, independent of being more impulsive.

TABLE 3. Psychoeducational Variables[a]

	HII (n = 55)	II (n = 17)	I (n = 26)
Learning problems	33	12	23
Reading	24	6	15
Math	13	6	4
Spelling	27	6	19
Language problems	6	2	0

[a]Values are percentages. HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

TABLE 4. Rating Scales[a]

	HII	II	t	df	p
SNAP					
Hyperactivity	1.86	0.65	10.40	84	<.0001
Inattention	2.33	2.35	0.18	84	NS
Impulsivity	2.08	1.81	2.49	84	<.05
ACQ					
Mother	1.91	1.43	4.36	84	<.0001
Father	1.59	1.38	1.12	53	NS
Teacher	1.64	1.49	0.84	38	NS
	HII	I	t	df	p
SNAP					
Hyperactivity	1.86	0.77	8.75	88	<.0001
Inattention	2.33	2.00	3.49	88	<.001
Impulsivity	2.08	0.99	11.61	88	<.0001
ACQ					
Mother	1.91	1.15	6.80	88	<.0001
Father	1.59	0.93	4.19	63	<.0001
Teacher	1.64	1.02	3.41	41	<.01
	II	I	t	df	p
SNAP					
Hyperactivity	0.65	0.77	1.04	54	NS
Inattention	2.35	2.00	2.86	54	<.01
Impulsivity	1.81	0.99	8.08	54	<.0001
ACQ					
Mother	1.43	1.15	2.12	54	<.05
Father	1.38	0.93	2.86	40	<.01
Teacher	1.49	1.02	2.14	29	<.05

[a]HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive; SNAP, Swanson, Nolan and Pelham Rating Scale; ACQ, Abbreviated Conners Questionnaire; NS, not significant.

The I differed significantly from the HII subjects on all three subscales, and from the II group on the Inattention and Impulsivity subscales. While their means on the Impulsivity and Hyperactivity subscales were by definition low, the means on the Inattention subscale, although they were above the SNAP cutoff score of 1.5 and met DSM-III criteria for inattention (three or more positive of five), were significantly lower than the means of the other two groups. An ANCOVA was done to determine the contribution of the Inattention variable to the overall group differences. Although it significantly covaried with Impulsivity, Inattention did not account for a significant amount of variance between any pair of groups.

Each child was then matched to his or her age-appropriate, gender-appropriate norm on the SNAP (James Swanson and William Pelham, unpublished data, 1988). As norms are available only for children aged 6 to 11, they were applicable to 46 subjects in the HII category, 13 II subjects, and 20 I subjects. Pairwise t tests showed that all three groups differed significantly from controls on the Inattention subscale (HII, $t = 21.19$, $p < .0001$; II, $t = 9.06$, $p < .0001$; I, $t = 11.37$, $p < .0001$). The II ($t = 7.28$, $p < .0001$) and the HII ($t = 19.22$, $p < .0001$) differed from controls on the Impulsivity subscale. Only the HII group differed from controls on the

Hyperactivity subscale ($t = 15.01$, $p < .0001$). Product moment correlation between parents on the SNAP ratings was .62.

On the mothers' ACQ, all three groups differed significantly from each other (HII > II > I). The I group was rated significantly lower than both II and HII on the fathers' ACQ. A trend only was found for II to be rated lower than HII. Only the HII subjects' means were above the cutoff score of 1.5, both on the mothers' and fathers' ACQ. Correlation between parents was .57. The mothers' ACQ ratings also correlated strongly with their ratings on the Hyperactivity (.71) and Impulsivity (.57) subscales of the SNAP. The correlation with the Inattention subscale was relatively low (.47).

Teacher ACQ ratings were available on a subset of the sample, which consisted of 26 HII, 14 II, and 17 I subjects. An overall ANOVA showed a significant difference between groups, $F(2,54) = 5.96$, $p < .01$. Pairwise comparisons showed that the I subjects were rated significantly lower than both the II and HII groups. The HII was again the only group whose mean was above the ACQ cutoff score. The correlation of teachers' ACQ with the mothers' ACQ was low (.30). Correlation with the fathers' ACQ was also low (.21).

Table 5 presents means for the three groups on individual items of the SNAP. These data were entered into a discriminant analysis. Results are shown on Table 6. One Hyperactivity item correctly classified 97% of HII and 96% of II subjects. Four Impulsivity items discriminated between the HII and the I group, and correctly classified 93% of HII and 97% of I subjects. Four items (hyperactivity, 1; impulsivity, 3) also discriminated between II and the I, and correctly classified 85% of II and 93% of I subjects. The Impulsivity item "Has difficulty organizing his work" was more strongly correlated with the Inattention (.35) than with the Impulsivity (.23) or Hyperactivity (.00) subscale scores. The methylphenidate (MPH) dose-performance data of favorable responders and nonresponders on the Continuous Paired Associate Learning Test (CPALT) is shown in Table 7.

The complete data were entered into a 3 (diagnosis) × 4 (dose) mixed-design ANOVA. The main effect of dosage was significant, $F(3,276) = 23.09$, $p < .0001$. Orthogonal trend analysis indicated that the linear trend accounted for 91.25% of the variance. However, there was no interaction with diagnosis. The coefficient of variation data were similarly analyzed. The main effect of dosage was significant, $F(3,186) = 4.73$, $p < .001$. The linear trend accounted for 85.95% of the variance. There was no interaction with diagnosis.

Subjects' medication responder status is presented in Table 8. A χ^2 test was nonsignificant ($\chi^2 = .40$, $p > .05$), indicating comparable proportions across groups. Drug response rate in the I group was 84%, compared to II (71%) and HII (78%). Ninety-two of the 95 children who responded favorably to medication in the laboratory assessment were followed by this unit. Teachers and parents were contacted once every 3 months with inquiries about their academic performance and behavior, both at home and in the classroom. Ninety percent (83 children) showed continued benefit while taking MPH for more than 12 months. Therefore, favorable CPALT response to MPH was generally followed by favorable response in the field. CPALT nonadverse and adverse responders were not medicated. Three subjects abandoned treatment before 6 months for philosophical reasons and because of side effects.

DISCUSSION

Both inattentive plus impulsive (II) and inattentive (I) subjects were well represented within the total sample. This

TABLE 5. Swanson, Nolan and Pelham Rating Scale (SNAP) Means (Range 0–3)[a]

	HII	II	I
Hyperactivity			
1. Excessive running or climbing	1.60	0.35	0.50
2. Difficulty sitting still or excessive fidgeting	2.42	0.89	1.33
3. Difficulty staying seated	2.18	1.04	1.07
4. Motor restlessness during sleep	1.32	0.39	0.43
5. Always on the go or acts as if driven by a motor	1.78	0.58	0.53
Inattention			
1. Often fails to finish things he or she starts	2.17	2.12	2.03
2. Often doesn't seem to listen	2.63	2.54	2.33
3. Easily distracted	2.63	2.50	2.23
4. Difficulty sticking to a play activity	1.55	1.81	0.90
5. Difficulty concentrating on school work or other tasks requiring sustained attention	2.65	2.77	2.50
Impulsivity			
1. Often acts before thinking	2.42	2.23	0.93
2. Excessive shifting from one activity to another	1.78	1.73	0.77
3. Has difficulty organizing work (not due to cognitive impairment)	2.40	2.39	2.17
4. Needs a lot of supervision	2.42	2.42	1.50
5. Frequent calling out in class	1.53	0.85	0.13
6. Difficulty waiting in turn in games or group situations	1.95	1.27	0.43

[a]HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

TABLE 6. Discriminant Analysis: Swanson, Nolan and Pelham Rating Scale (SNAP)[a]

	df	F
HII vs II		
1. Difficulty sitting still or excessive fidgeting	(1,84)	153.91
HII vs I		
1. Often acts before thinking	(1,88)	79.93
6. Difficulty waiting in turn in games or group situations	(1,87)	24.42
4. Needs a lot of supervision	(1,86)	11.42
2. Excessive shifting from one activity to another	(1,85)	6.31
II vs I		
1. Often acts before thinking	(1,54)	38.98
4. Needs a lot of supervision	(1,53)	13.96
2. Excessive shifting from one activity to another	(1,52)	7.71
2. Difficulty sitting still or excessive fidgeting	(1,51)	7.23

[a]HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

TABLE 7. Paired-Associate Learning Test: Performance by Subtype and Response Type[a]

	HII	II	I
Responders mean number of correct responses			
Placebo	33.6	58.2	60.4
5 mg	57.7	74.1	73.8
10 mg	69.4	77.5	93.6
20 mg	71.6	84.6	87.8
Nonresponders mean number of correct responses			
Placebo	88.0	77.8	99.7
5 mg	86.1	81.6	83.7
10 mg	84.5	82.2	96.0
20 mg	90.2	72.8	112.7
Responders coefficient of variation			
Placebo	1.27	0.86	0.65
5 mg	0.81	0.68	0.48
10 mg	0.58	0.57	0.40
20 mg	0.62	0.47	0.40
Nonresponders coefficient of variation			
Placebo	0.39	0.39	0.31
5 mg	0.41	0.44	0.50
10 mg	0.48	0.38	0.34
20 mg	0.31	0.45	0.32

[a]HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

is at variance with the claim in DSM-III-R that the attention-deficit without hyperactivity (inattentive + impulsive) (ADDW) "diagnosis is hardly ever made."[8] The latter statement may reflect a bias toward behavioral presentations in samples seen in psychiatric facilities. The majority of referrals in the present sample were for classroom inattention. Parents' ratings correlated well[40] and were generally able to discriminate between groups both on the Conners rating scale and the Swanson, Nolan and Pelham Rating Scale (SNAP).

Teachers' Abbreviated Conners Questionnaire (ACQ) ratings discriminated the I from the HII (inattentive, impulsive, and hyperactive) and II groups but correlated poorly with the parents' ACQ ratings. Previous studies have already shown that parents' and teachers' ratings frequently do not agree.[39–43] A reason might be that parents and teachers observe behaviors in different settings. Stevens et al[44] showed that parents' ratings better reflect children's behavior in unstructured than in structured settings.

TABLE 8. Response to Methylphenidate[a]

	HII (n = 26)	II (n = 60)	I (n = 30)
Response	87	77	84
Nonresponse	13	23	16

[a]Values are percentages. HII, hyperactive, impulsive, inattentive; II, impulsive, inattentive; I, inattentive.

In the discriminant analysis (based on the SNAP questionnaire), as expected, a hyperactivity-related item accounted for most of the variance between HII and II groups. Impulsivity items differentiated the I from both the HII and II groups.

At the level of specific items, "has difficulty organizing work" is misplaced among impulsivity descriptors. The three groups yielded comparable mean scores on this item, and the correlational analysis suggests that it reflects the inattentiveness they have in common.

The Hyperactivity Index criterial score of 1.5, which largely reflects "hyperkinesis," generally was exceeded by HII but not by II or I subjects. Research samples that use this as a cutoff score would be likely to exclude the nonhyperactive subgroups, and thus offer a grossly incomplete perspective on the range of expression of attention deficit.

Almost all children in our clinic-based sample were readily classifiable into one of the three patterns: I, II, and HII. A classroom population study based on teacher ratings yielded additional patterns; notably, inattention and hyperactivity (23%) and impulsivity and hyperactivity (19%)[45] (see also Lahey and Carlson[46]). It remains to be seen whether these teacher impressions, which in themselves do not necessarily indicate psychopathology, will be paralleled in future clinical samples.

The analysis of additional dependent variables yielded the following results:

1. Family psychopathology was equally prevalent in all three groups. Our findings not only confirm previous reports of increased incidence of psychiatric illness in the families of hyperactive children,[3] but extend these findings to the II and I groups.
2. Our findings confirm the relationship of attention deficits to learning disabilities. As reported by Barnes and Forness[47] and Gillberg et al,[48] reading disabilities were the most prevalent. Language disorders were relatively uncommon (cf. Szatmari et al[49]). There were no significant differences among groups in IQ, or overall incidence of learning disabilities. All three groups showed a similar pattern of deficits, i.e., more frequent impairment in reading and spelling than in mathematics. A higher percentage of HII children, however, presented learning problems in every academic area. These results confirm

the previously reported association of hyperactivity and learning disabilities[24–29] and extend it to the nonhyperactive subgroups. They do not support the claim that children with ADDW (II and I) are more prone to academic underachievement, or that a specific set of learning disorders distinguishes them from the attention-deficit disorder with hyperactivity (ADDH) (HII) group.[14,15,22] Unlike Rosenberger,[50] we did not find that mathematics deficiency was concentrated among children who are inattentive, but not impulsive or hyperactive. The findings do not indicate how much of the learning difficulty was secondary to attention deficit symptomatology and how much due to comorbid selective learning disability.

3. No significant interaction was found between group and medication response on the Continuous Paired Associate Learning Test (CPALT). The I group showed as high a favorable stimulant response rate as the HII and II groups. This extends the finding of Ackerman et al[51] and Barkley et al[52] that ADDW children respond to stimulant therapy to the nonimpulsive undifferentiated attention deficit disorder (UADD) group, which had not previously been studied in its own right. It contradicts the claim that nonhyperactive attention deficit disorder (ADD) children are less likely to respond to stimulant therapy.[53] Sporadic earlier reports came to a similar conclusion about children described as "hypoactive hyperactives."[54–57] However, these reports do not make it clear that not only hyperactivity but also impulsivity may be absent in attention-deficient children who respond to stimulant therapy. Indeed, as Cantwell and Baker[58] pointed out, the DSM-III-R itself treats this point ambiguously. It defines UADD without invoking impulsivity, but then suggests that some children who could have been classified as ADDW by DSM-III might be included in the UADD category. By definition these children would have had to be impulsive as well as inattentive, and this would qualify them for the attention-deficit hyperactivity disorder (ADHD) category.
4. The HII and the II groups that behaved in an externalizing (impulsive, overactive) manner showed a significantly higher proportion of comorbid externalizing psychopathology than the internalizing I children.[59] This was the only variable on which the groups were found to differ. The relative prevalence of externalizing psychopathology did not differ between HII and II. The finding suggests that not hyperactivity, but deficient impulse control, as found in *both* HII and II groups, is associated with aggressive-defiant conduct.[60] There was no significant interaction between externalizing and internalizing codiagnoses with respect to stimulant response. Overanxious disorder, which perhaps accounts for the tendency of an internalizing codiagnosis to indicate stimulant nonresponse,[61–63] was present in only four of our cases.

It is important to recognize the I diagnostic category, because this is new and little publicized. It comprises children who had previously been excluded from classification altogether, because of an arbitrary requirement that impulsivity coexist (in ADDW). They remain excluded from the ADHD category. Nevertheless, our findings show that attention-deficient children may be inattentive without being impulsive. Although inattention is recognized to be a frequent nonspecific concomitant of childhood psychopathology,[64] it is not confined to children who bear other psychiatric diagnoses. Inattention as a behavioral dimension is distinct from hyperactivity,[65,66] and our findings show that it can exist independently of impulsivity also.

Based on the subject variables studied, should ADD be regarded as divisible into two different syndromes,[15–17] or even three? Or should inattention, impulsivity, and hyperactivity be considered separate disorders that are often comorbid? Given the great similarity between the groups other than on their defining characteristics, probably not. In our sample, mean age, gender ratio, prevalence of coexisting learning disability, and probability of a favorable methylphenidate response did not differ significantly among groups. The only significant difference was that comorbid externalizing psychopathology was more common among the impulsive subgroups; there was a trend toward more frequent internalizing comorbidity among I. This overriding pattern of similarity argues against inferring independent but frequently comorbid conditions (according to the reasoning of Caron and Rutter[67]). The proposed dichotomy in DSM-IV is open to the same critique.

Whether externalizing (HII, II) and internalizing (I) phenotypes of ADD are distinct subtypes or whether a unitary attention deficit is qualified by an orthogonal variable that determines whether it will exhibit one or the other phenotype[68] is a matter for future research.

However that might be, an insistence on restlessness and even on impulsive behavior unduly restricts the range of children properly viewed as subject to ADD. Those who are not restless, and certainly those who are not impulsive either, would run the risk of being ignored and denied potentially beneficial treatment. In fact, clinicians find that inattentive children who do not meet either DSM-III (ADDH, ADDW) or DSM-III-R (ADHD) criteria receive substantial benefit from stimulant therapy.[23] It also seems inappropriate to use a classification as in DSM-III-R, in which a nonhyperactive child has to be more impulsive and/or inattentive to meet the 8-item criterion than one who is rated highly on hyperactivity items. The DSM-IV draft criteria do include a subtype category for inattentive children who are both nonhyperactive and nonimpulsive (314.00).[69] These criteria also fail to recognize that some children are inattentive and impulsive although not hyperactive. Because DSM-IV will have only three impulsivity questions, nonhyperactive impulsives are likely to add unrecognized diversity to the inattentive subtype.

Current recognition of the diversity in attention deficit phenotypes is somewhat confused by an undue insistence on just two phenotypes, the one without hyperactivity (ADDW) being variously conceptualized as including or not including behavioral impulsivity. Our findings show that both alternatives occur. The proposed subtype 314.01 in draft DSM-IV, hyperactive-impulsive but not inattentive, was not represented in our sample. However, this category was based on the results of a factor analysis, and therefore need not correspond to an actual patient group.

ADD is properly viewed as one disorder, albeit with several distinctive patterns of clinical presentations, and by no means merely a nonspecific concomitant of diverse childhood psychopathologies[70,71]. A logical conclusion would be to establish diagnostic criteria based on inattention items, and then to subdivide based on the concurrent presence or absence of evidence of impulsivity, and given the latter, further subdivide with respect to hyperactivity.

Acknowledgment. This work was supported by the National Institutes of Mental Health Grant RO1 MH 37578 to M.K.

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