

Instability of the *DSM-IV* Subtypes of ADHD From Preschool Through Elementary School

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Context: The *DSM-IV* definition of attention-deficit/hyperactivity disorder (ADHD) distinguished 3 subtypes that had not been extensively studied.

Objective: To determine whether the ADHD subtypes are stable enough over time to be valid.

Design: Longitudinal study with a greater-than 89% retention rate in 7 assessments over 8 years.

Setting: Outpatient clinics.

Participants: Volunteer sample of 118 4- to 6-year-olds who met *DSM-IV* criteria for ADHD, including impairment in 2 settings in at least 1 assessment.

Main Outcome Measure: Meeting *DSM-IV* criteria for the subtypes of ADHD during years 2 through 8.

Results: The number of children who met criteria for ADHD declined over time, but most persisted. Children who met criteria for the combined subtype (CT, $n=83$) met criteria for ADHD in more subsequent assessments than children in the predominantly hyperactive-impulsive subtype (HT, $n=23$). Thirty-one (37%) of 83

CT children and 6 (50%) of 12 children in the predominantly inattentive subtype (IT) met criteria for a different subtype at least twice in the next 6 assessments. Children of the HT subtype were even more likely to shift to a different subtype over time, with HT children who persisted in ADHD mostly shifting to CT in later assessments. The subtypes exhibited consistently different mean levels of hyperactive-impulsive symptoms during years 2 through 8 that corresponded with their initial subtype classifications, but initial subtype differences in inattention symptoms diminished in later years.

Conclusions: In younger children, the CT and IT may be stable enough to segregate groups for research, but they seem too unstable for use in the clinical assessment of individual children. Children rarely remain in the HT classification over time; rather, they sometimes desist from ADHD but mostly shift to CT in later years. Using continuous ratings of hyperactivity-impulsivity symptoms as a diagnostic qualifier should be considered as an alternative to classifying nominal subtypes of ADHD in *DSM-V*.

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THE *DSM-IV* DEFINITION OF attention-deficit/hyperactivity disorder (ADHD) distinguishes 2 dimensions of impairing symptoms, inattention and hyperactivity-impulsivity. Based on these symptom dimensions, 3 subtypes are distinguished. The combined type (CT) exhibits high levels of both inattention and hyperactivity-impulsivity, the predominantly inattentive type (IT) exhibits atypical levels of inattention only, and the predominantly hyperactive-impulsive type (HT) exhibits high levels of hyperactivity-impulsivity only. Because the *DSM-IV* conducts field trials for the disruptive behavior disorders,¹ the internal validity of distinguishing 2 symptom dimensions has been consistently supported by confirmatory factor analyses,²⁻⁴ and the external validity of the 2 dimen-

sions has been supported by studies showing different developmental trajectories⁵ and different correlations of the 2 symptom dimensions with different types of functional impairment and mental health problems.⁶

The hyperactive-impulsive type was added to the *DSM-IV* taxonomy because children who exhibited high levels of only hyperactivity-impulsivity in the *DSM* field trials¹ had levels of impairment that were as high as CT children and were said to exhibit clinically significant ADHD by validation clinicians as often as CT children. Not adopting HT as a subtype would have left many impaired children unclassified because most did not meet criteria for other mental disorders.¹ It was concerning, however, that almost all the cases of HT in the field trials were found in 4- to 6-year-olds.¹ The *DSM-IV* Work Group decided

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that young children who met criteria for HT likely shift to CT as increasing demands of school make their attention problems evident. If so, adding HT to *DSM-IV* would facilitate early identification of ADHD. The need for longitudinal studies of HT children was evident, however, because the alternative explanation was that HT children simply cease to meet criteria for ADHD over time.

Two kinds of developmental change were expected in the *DSM-IV* subtyping schema.⁶ First, some children who meet criteria for CT would be expected to meet criteria for IT in later childhood or adolescence as hyperactivity-impulsivity symptoms decline more than inattention symptoms over time.⁶ Second, young children who meet criteria for HT may shift to CT over time as their attentional capacity is increasingly challenged in school.¹

However, except for such predicted age-related changes, the subtypes were expected to be temporally stable, reflecting traitlike differences among the subtypes. If subtype classifications are not stable over time, they cannot validly segregate homogeneous subgroups within the disorder with different etiologies or neurophysiological mechanisms.⁷

METHODS

SUBJECTS

Two cohorts of preschool and primary school children were recruited in consecutive years in Chicago, Ill, and Pittsburgh, Pa. Participants were required to live with their biological mothers and to be enrolled in structured educational preschool or school. Their demographic characteristics are presented in **Table 1**. In Chicago, all ADHD probands were recruited from an urban or a suburban child psychiatry clinic. In Pittsburgh, 26 (42%) of 62 probands were recruited from an urban child psychiatry clinic, with the rest recruited through advertisements. Probands recruited from clinics or advertisements did not differ significantly on demographic or impairment measures.⁸ Five potential participants were excluded because they had received clinical diagnoses of pervasive developmental disorder, mental retardation, or seizure disorder. Parents of participants gave written informed consent and children gave oral assent.

ASSESSMENTS

Measures

Child intelligence was estimated by averaging Stanford-Binet Intelligence Scale Short Form⁹ scores from the first 2 annual assessments. Four children were excluded from analyses because their average intelligence scores were less than 70. Attention-deficit/hyperactivity disorder was assessed annually using the same measures, except that the fifth annual assessment was omitted because of funding limitations. The Diagnostic Interview Schedule for Children¹⁰ was administered to the parent (almost always the mother) in each assessment to query *DSM-III-R* diagnostic criteria for ADHD and other mental disorders during the last 6 months. In addition, we asked questions used in the *DSM-IV* field trials¹ to assess *DSM-IV* symptoms not in *DSM-III-R*. Information on symptoms of the disruptive behavior disorders was obtained from teachers by mail using the *DSM-IV* version of the Disruptive Behavior Disorders Rating Scale.¹¹ We used the standard method^{11,12} of con-

Table 1. Demographic Characteristics of the 2 Cohorts of the Sample in Year 1*

| Characteristic | Cohort 1 | Cohort 2 |
|--|---------------------|---------------------|
| Age, y | | |
| 3.8-4.11 | 6 | 13 |
| 5.0-5.11 | 24 | 30 |
| 6.0-7.0 | 21 | 24 |
| Grade in school | | |
| Structured preschool | 18 | 18 |
| Kindergarten | 17 | 34 |
| First | 16 | 14 |
| Second | 0 | 1 |
| Sex | | |
| Male | 41 | 57 |
| Female | 10 | 10 |
| Race/ethnicity | | |
| Non-Hispanic white | 38 | 36 |
| African American | 11 | 25 |
| Other | 2 | 6 |
| Total family income, mean \pm SD, \$ | 40 333 \pm 34 752 | 39 425 \pm 36 072 |

*Values are numbers unless otherwise indicated.

sidering symptoms rated “pretty much” or “very much” as present for teacher reports. As in the *DSM-IV* field trials, symptoms were considered present if reported by either parent or teacher.¹²

In each assessment, impairment was assessed in 2 ways for the diagnosis of ADHD. First, the parent was asked in the Diagnostic Interview Schedule for Children if the child’s ADHD symptoms had caused problems (1) at home or with friends or (2) at school. Second, parents and teachers completed the Impairment Rating Scale (Fabiano, unpublished data, 2005), in which the child’s need for treatment in multiple areas was rated using 7-point scales ranging from “No problem; definitely does not need treatment” (0) to “Extreme problem; definitely needs treatment” (6). In the Parent Impairment Rating Scale, the child was rated on problems in relations with peers, siblings, and parents; academic progress at school; self-esteem; and impact on the family. Teachers used the Impairment Rating Scale to rate problems in relations with classmates and teachers, academic progress, classroom disruption, and self-esteem. Both respondents rated the child’s overall need for treatment. Based on previous studies, children were said to be impaired according to the parent and teacher using the Impairment Rating Scale if they received a rating of 3 or greater on at least 1 scale (Fabiano, unpublished data, 2005).

Diagnosis of ADHD

Children were said to exhibit ADHD if they met *DSM-IV* symptom criteria and age-at-onset criterion. Because of the young age of the children in the first year and the focus of the study, the *DSM-IV* cross-situational impairment criterion was implemented as follows: impairment as defined earlier was required in 1 or more settings in the initial assessment. In addition, impairment in both home and school was required in at least 1 of the 7 annual assessments. Of 125 children who met criteria for ADHD and were reported to be impaired in 1 or more settings in year 1, 118 (94.4%) exhibited cross-situational impairment in at least 1 assessment (91.5% in more than 1 assessment).

Children were allowed to exhibit cross-situational impairment after the initial assessment for 2 reasons. First, because 87 (74%) of 118 children were in preschool or kindergarten in year 1, their school impairment may not yet be evident. Sec-

Table 2. Children Who Met Criteria for Each Subtype of ADHD, Took Psychoactive Medication or Received Psychosocial Treatment, and Had Assessments by Parents and Teachers in Each Year*

| Characteristic | Year of Assessment | | | | | | | |
|---|--------------------|-----|-----|-----|----|------|-------|-------|
| | 1 | 2 | 3 | 4 | 5† | 6 | 7 | 8 |
| Ages in each assessment, y | 4-6 | 5-7 | 6-8 | 7-9 | | 9-11 | 10-12 | 11-13 |
| Combined type | 83 | 63 | 59 | 62 | | 57 | 48 | 36 |
| Hyperactive-impulsive type | 23 | 21 | 15 | 16 | | 10 | 4 | 2 |
| Inattentive type | 12 | 15 | 21 | 20 | | 22 | 19 | 32 |
| Not ADHD | 0 | 15 | 16 | 14 | | 23 | 35 | 38 |
| Informants participating in each assessment | | | | | | | | |
| Parent | 118 | 114 | 111 | 112 | | 109 | 102 | 106 |
| Teacher | 117 | 104 | 95 | 101 | | 102 | 85 | 87 |
| Psychoactive medication | 24 | 59 | 58 | 64 | | 61 | 59 | 58 |
| Psychosocial treatment | 62 | 71 | 65 | 66 | | 67 | 60 | 60 |

Abbreviation: ADHD, attention-deficit/hyperactivity disorder.

*Except for ages, all values are numbers.

†The fifth annual assessment was omitted because of funding limitations.

ond, any study of the subtypes of ADHD would be biased by requiring cross-situational impairment in every assessment. This is because the 2 dimensions of ADHD symptoms are associated with different types of impairment, with inattention being more strongly associated with school problems and hyperactivity-impulsivity being more associated with home problems.¹ As a result, more children in this sample who exhibited high levels of both kinds of symptoms at baseline (ie, CT) exhibited impairment in 2 settings at baseline than children who exhibited high levels of only 1 symptom dimension (ie, HT and IT; $n = 129$, $\chi^2 = 14.99$, $P < .001$). Thus, excluding children who did not always show impairment in both settings would differentially eliminate many children who were impaired in the single setting most associated with their symptoms during that assessment.

Moreover, it is not clear why significant impairment in 1 setting (eg, social relationships or classroom performance) is not sufficient to justify the diagnosis and treatment of ADHD in any case. No other DSM-IV disorder requires impairment in multiple settings. Consistent with this view, children with impairment in only 1 setting according to our operational definition exhibited greater impairment across time than demographically matched nonreferred comparison children on several other measures of impairment in an earlier report based on the first 4 annual assessments of the present sample.¹³ Nonetheless, because cross-situational impairment is required by DSM-IV, all children in the present analyses met this criterion in at least 1 assessment.

STATISTICAL ANALYSIS

Contrasts among the subtypes on dichotomous outcomes across years 2 through 8, such as meeting criteria for ADHD, were conducted using binomial regression in general estimating equations. Contrasts on counts of symptoms over time used Poisson regression in general estimating equations. Both analyses used autoregressive correlation structures and robust variance estimates. These longitudinal analyses allow the multiple observations on each participant to contribute to the precision of estimates.

Two fixed (site and cohort) and 2 time-varying methodologic covariates (number of parent or teacher respondents and blindness of the interviewer of the parent to information from previous assessments) and 4 demographic covariates measured in year 1 (age, sex, race/ethnicity, and logged total fam-

ily income) were tested to determine whether they should be controlled in each analysis. It was necessary to control for the number of informants participating in each assessment because children were reported to exhibit fewer total ADHD symptoms when only 1 informant participated in the assessment than when both the parent and teacher reported symptoms (**Table 2**). Covariates significant at $P < .10$ were retained in the final model for each outcome variable.

Parents were asked to discontinue medications on the day of the assessment if approved by the child's physician, but no measures used in the present analyses were obtained from the children during the assessment sessions. Parents and teachers were asked to rate children who took medication as they are off medication, but to ensure that treatment was not associated with the outcomes of ADHD, we included psychoactive medication and psychosocial treatment in the last 12 months as time-varying covariates. The numbers of children receiving these treatments are shown in Table 2. When treatment variables were significant, they were associated with less shifting of subtypes and less desistance. We interpret this as indicating that children with more persistent ADHD received more treatment and did not include treatment in final models.

To empirically evaluate the decision to allow cross-situational impairment to be reported after the initial assessment, and to learn more about the validity of this diagnostic criterion, we added a dummy variable to each model to determine whether the stability of ADHD or its subtypes across years 2-8 was predicted by the child first exhibiting cross-situational impairment in the initial assessment ($n = 96$) or in a later assessment ($n = 22$). This variable was not significant at the $P < .05$ level in any model, however, and was not retained in final models. The total number of symptoms of oppositional defiant disorder and conduct disorder reported by parents and teachers was added to the model predicting shifts to a different subtype, but it did not predict shifts at the $P < .05$ level.

RESULTS

RETENTION

The numbers of ADHD children who participated in each assessment after year 1 was 114 (96.6%), 111 (94.1%), 112 (94.9%), 112 (94.9%), 106 (89.8%), and 108 (91.5%),

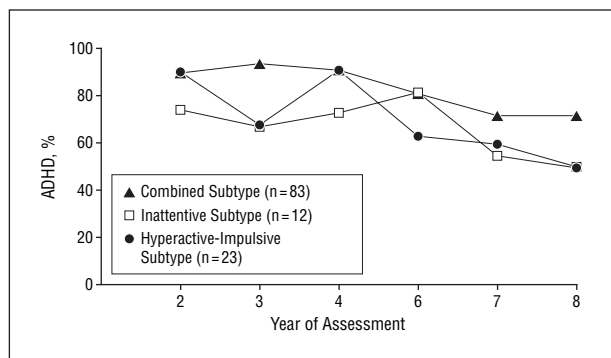


Figure 1. Percentage of children who met criteria for each subtype at baseline who met criteria for any subtype of attention-deficit/hyperactivity disorder (ADHD) in each assessment over the next 7 years, adjusted for the number of informants in each assessment.

respectively. Families who did not participate in 1 assessment often participated in the next assessment, however. For example, 114 (96.6%) of 118 subjects participated in either year 7 or 8. Thus, there was little opportunity for bias due to attrition.

STABILITY OF ADHD

To provide a context for assessing the stability of the subtypes of ADHD, it is necessary to describe the extent to which ADHD children continued to meet criteria for any subtype of ADHD over time. **Figure 1** shows the percentage of children who met criteria for each subtype at baseline who subsequently met criteria for any subtype of ADHD in each follow-up assessment. Controlling for time, site, blindness of interviewers, number of informants in each assessment, family income, and race/ethnicity, the log odds of meeting criteria for ADHD declined over years 2-8 ($\beta = -0.22$, $z = -3.72$, $P < .001$). Children in the HT group were less likely than CT children to continue to meet criteria for any subtype of ADHD ($\beta = -0.98$, $z = -2.89$, $P < .005$), and IT children were less likely than CT children to meet criteria for ADHD ($\beta = -0.78$, $z = -2.02$, $P < .04$), but the HT and IT groups did not differ ($\beta = 0.20$, $z = 0.44$, $P = .66$).

However, the percentages in Figure 1 underestimate the persistence of ADHD and somewhat exaggerate differences among subtypes in persistence. This is because fluctuations in symptoms over time often resulted in children falling below the diagnostic threshold in one assessment but meeting criteria in a later assessment. When persistence was defined as meeting criteria for any subtype of ADHD in either of the last 2 assessments, the diagnosis was reasonably stable: 64 (81.0%) of 79 CT children, 8 (66.7%) of 12 IT children, and 17 (73.9%) of 23 HT children still met criteria for ADHD. Defined in this way, the 3 subtypes did not differ in persistence at the $P < .05$ level.

STABILITY OF THE SUBTYPES OF ADHD

Although the overall diagnosis of ADHD was reasonably stable over 8 years, shifts from one subtype to another over time were common among children who con-

Table 3. Percentages of Children Who Met Criteria for a Different Subtype in Subsequent Assessments Over the Next 7 Years

| Subtype | 1 or More Times | 2 or More Times | 3 or More Times |
|----------------------------|-----------------|-----------------|-----------------|
| Combined type | 68.7 | 37.4 | 22.9 |
| Hyperactive-impulsive type | 91.3 | 78.3 | 43.5 |
| Inattentive type | 66.7 | 50.0 | 16.7 |

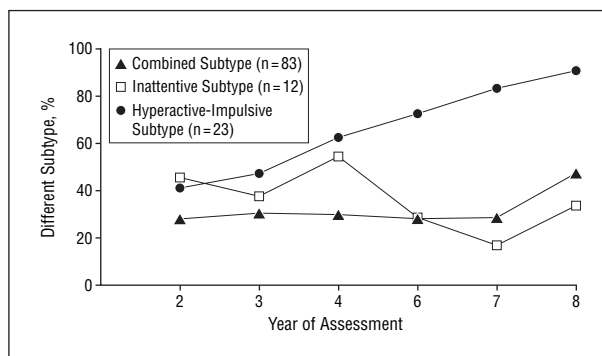


Figure 2. Percentage of children who met criteria for each subtype of attention-deficit/hyperactivity disorder in year 1 who met criteria for a different subtype in each of years 2 through 8.

tinued to meet criteria for ADHD. To provide background for analyses of the stability of the subtypes, the numbers of children who met criteria for each subtype in each of the 7 assessments is presented in Table 2. Controlling all methodologic variables, the prevalence of CT declined over years 1-8 ($\beta = -0.15$, $z = -4.04$, $P < .001$), as did the prevalence of HT ($\beta = -0.30$, $z = -5.46$, $P < .001$). In contrast, the prevalence of IT increased over years 1 through 8 ($\beta = 0.18$, $z = 4.61$, $P < .001$). As a result, although 12 children met criteria for IT in year 1, 42 met criteria for IT at least once over the 7 assessments (32 in year 8 alone).

Table 3 shows the percentage of children who met criteria for each subtype of ADHD in the initial assessment who subsequently met criteria for a different subtype in 1 or more, 2 or more, or 3 or more of the next 6 assessments over 7 years. The majority of children in each subtype met criteria for another subtype at least once, and a substantial minority met criteria for a different subtype 3 or more times. The HT group was more likely than the CT group to meet criteria for another subtype at least once (odds ratio, 4.8; 95% confidence interval, 1.04-22.0), but HT and IT did not differ. There were no significant differences among the subtypes in the proportion who met criteria for another subtype either 2 or more or 3 or more times, however.

The instability of the subtypes also was compared in more sensitive longitudinal analyses. **Figure 2** presents the proportion of children who met criteria for each subtype of ADHD in year 1 who met criteria for a different subtype in each of years 2 through 8. When we controlled for time, number of informants, and family income, HT children were more likely than CT children

COUNTS OF SYMPTOMS OVER TIME AMONG THE SUBTYPES

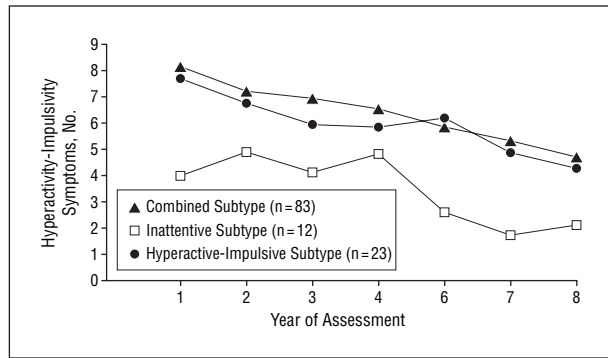


Figure 3. Average number of hyperactivity-impulsivity symptoms during years 1 through 8 of children who met criteria for each subtype of attention-deficit/hyperactivity disorder in year 1.

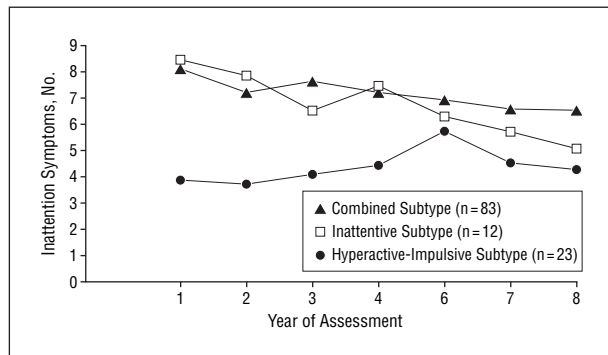


Figure 4. Average number of inattention symptoms during years 1 through 8 of children who met criteria for each subtype of attention-deficit/hyperactivity disorder in year 1.

to meet criteria for a different subtype of ADHD across years 2-8 ($\beta = 1.23$, $z = 4.03$, $P < .001$). Children in the IT group did not differ significantly from CT or HT children in meeting criteria for a different subtype, however. When we added subtype \times time interactions to this model, the HT \times time interaction was significant ($\beta = 0.34$, $z = 2.68$, $P < .008$), reflecting a greater increase in shifting to a different subtype over time in the HT group than the CT group. Indeed, only 3 (17.7%) of the 17 HT children who still met criteria for any subtype of ADHD in either year 7 or 8 still met criteria for HT in either assessment. Instead, 13 (76.5%) of the 17 HT children who still met criteria for ADHD in years 7 or 8 met criteria for CT in at least 1 of these assessments.

Although Figure 2 suggests that CT is reasonably stable over time, these percentages are somewhat misleading. Although 48 (75.0%) of the 64 CT children who still met criteria for ADHD in years 7 or 8 still met criteria for CT at least once during years 7 or 8, 33 (51.6%) of the same children met criteria for IT at least once during years 7 or 8. These percentages sum to more than 100% because 26.4% of children who were classified as CT in year 1 met criteria for both CT and IT in years 7 and 8. When viewed in this way, IT was the most stable subtype, with 6 (75.0%) of 8 IT children who still met criteria for ADHD still meeting criteria for IT at least once during year 7 or year 8, and only 1 (12.5%) each meeting criteria for CT or HT at least once.

Although the subtypes of ADHD are temporally unstable when treated as discrete categories, it is possible that children who displayed large enough differences in their numbers of the 2 dimensions of ADHD symptoms at baseline to be classified in different subtypes may still continue to exhibit the same distinct patterns of symptoms over time. As shown in **Figure 3**, Poisson regression revealed that mean numbers of hyperactivity-impulsivity symptoms declined overall across years 2-8 ($\beta = -0.07$, $z = -7.28$, $P < .001$), controlling time, cohort, number of informants, age in year 1, family income, and race/ethnicity. Nonetheless, as predicted by their subtype classifications in year 1, IT children exhibited fewer hyperactivity-impulsivity symptoms across years 2 through 8 than CT children ($\beta = -0.49$, $z = -3.93$, $P < .001$) and HT children ($\beta = -0.43$, $z = 3.19$, $P < .002$). The HT and CT groups did not differ in their mean levels of hyperactivity-impulsivity symptoms during years 2-8 ($\beta = -0.06$, $z = -0.99$, $P = .32$).

As shown in **Figure 4**, there was not a significant overall decline over time in inattention symptoms ($\beta = -0.01$, $z = -1.22$, $P = .22$), controlling time, site, number of informants, blind interviewers, and income. Consistent with year 1 subtype classifications, HT children exhibited fewer inattention symptoms during years 2-8 than CT children ($\beta = -0.46$, $z = -5.51$, $P < .001$) and fewer than IT children ($\beta = -0.37$, $z = -3.40$, $P < .001$). Children in the CT and IT groups did not differ in inattention symptoms ($\beta = -0.10$, $z = -1.32$, $P = .19$). There were significant subtype \times time interactions, however. The slope of the HT group differed from those of the CT ($\beta = 0.06$, $z = 2.23$, $P < .03$) and IT groups ($\beta = 0.10$, $z = 2.76$, $P < .006$), reflecting a small increase in inattention symptoms in the HT group over time but substantial decreases among the CT and IT groups over time. By year 6, there were only modest differences among the subtypes in inattention symptoms.

COMMENT

As in studies of older children,^{14,15} the proportion of children in the present sample who continued to meet criteria for ADHD declined over 8 years. This varied somewhat by subtype, however, with children who met criteria for HT and IT in year 1 being more likely than CT children not to meet criteria for ADHD during each of years 2 through 8 (Figure 1). Among children who continued to meet criteria for ADHD, the DSM-IV subtypes of ADHD were far less stable over time than anticipated, however (Figure 2). Indeed, 31 (37%) of 83 CT children and 6 (50%) of 12 IT children met criteria for a different subtype at least twice during years 2 through 8 (Table 3), and nearly all HT children either remitted or shifted to another subtype by year 8 (Figure 2).

In retrospect, the high levels of instability of the subtypes should have been predicted because there are many reasons to expect instability of subtype classifications. First, measurement error, both in the sense of random

variations in scores and regression to the mean, would be expected to create changes among the subtypes. Second, true variation in symptoms due to changes in situations or having different teachers each year probably contributes to the instability of the subtypes. Third, different rates of true developmental changes in the 2 dimensions of symptoms lead to shifts among subtypes.

What is the developmental fate of HT in this study to date? Was HT “outgrown,” suggesting that it is only a transient problem that may not require treatment, or did HT children shift to CT? The answer is *both* but with qualifications. Children who met criteria for HT at baseline were less likely than CT children to continue to meet criteria for ADHD, but 17 (74%) of 23 HT children still met criteria for some subtype of ADHD during year 7 or 8. Few HT children who met criteria for ADHD in either year 7 or 8 still met criteria for HT in either assessment, however (18%). Rather, 13 (76%) of 17 HT children who still met criteria for ADHD in year 7 or 8 met criteria for CT in at least 1 of these assessments. Thus, the prediction that HT in young children presages CT in later childhood¹ was partially supported. As such, the HT subtype is so unstable over time that it is a special case. It may be best to view HT as a milder form of CT that sometimes remits but often exhibits serious enough attention problems later in elementary school to meet criteria for CT.

Given the present findings, are the *DSM-IV* subtypes of ADHD too unreliable to be useful? The present findings clearly show that the subtypes cannot be viewed as discrete (nominal) categories that are permanent over time. In this taxonomy, “apples” often become “oranges” over time. Nonetheless, the marked differences among the subtypes in mean levels of the 2 symptom dimensions over years 2 through 8 shown in Figure 3 are supportive of the validity of at least 1 subtype distinction. Consistent with the definitions of the 3 subtypes, children who met criteria for IT in year 1 continued to exhibit consistently fewer numbers of hyperactivity-impulsivity symptoms across years 2 through 8 than CT and IT children. Thus, the distinction between IT and the other subtypes reflects a traitlike difference in the level of hyperactivity-impulsivity symptoms. In contrast, the initial difference in inattention symptoms between HT and the other subtypes remained over years 2 through 8 but decreased considerably by year 6. Thus, consistent with the frequently observed shifts from HT to CT over time, the distinction between HT and CT in terms of inattention symptoms is less enduring than differences between IT vs CT and HT in terms of hyperactivity-impulsivity.

What are the implications of the present findings for future attempts to reduce the heterogeneity of ADHD through subtyping? In answering this question, it is important to distinguish between applications in research and clinical practice. Because the distinction between IT and the other subtypes appears to reflect enduring differences in levels of hyperactivity-impulsivity symptoms in young children, comparisons of groups of IT and CT children may be useful in research. Although these subtypes are not as stable over time as one could wish, group differences may be large enough to detect meaningful differences in spite of instability in classification.

If the nominal subtypes of ADHD are retained in *DSM-V* for clinical purposes, it would be necessary to qualify them by stating that subtype classifications often change over time. If a child can be said to exhibit one subtype of ADHD at one time but another subtype at later time, it is not clear that the use of nominal subtypes would serve the needs of individual children in clinic settings. Indeed, changes in subtypes over time may be confusing to clinicians and families alike. On the other hand, it should be noted that the temporal instability of the subtypes is not unlike that of some other diagnoses among children. For example, although only about half of children who meet criteria for conduct disorder meet criteria for conduct disorder again the following year, the great majority meet criteria for conduct disorder again at least once during the next 3 years.¹⁶ Fluctuations above and below the boundaries of nominal diagnostic categories over time may be the rule rather than the exception. Thus, nominal categories that are less than perfectly reliable over time might be acceptable if better alternatives are not available.

It is important to note that the present findings only address the reliability of the *DSM-IV* subtypes of ADHD. Before considering changes to the *DSM-IV* subtyping schema, one must also consider the external validity of the subtypes. For example, there is some evidence that CT and HT may have different etiologic influences.¹⁷ In addition, in a separate report from the present study, we found that IT children had markedly lower academic achievement relative to intelligence over 8 years than the other subtypes and non-ADHD comparison children (Masseti, unpublished data, 2005). This could mean that IT is characterized by a form of attention problem that interferes more with academic learning than that of CT children. Alternatively, however, it is possible that difficulties in completing academic tasks lead young IT children to exhibit symptoms of inattention (eg, cease attending to class work). This could even mean that IT in young children is indicative of learning disability rather than ADHD. However, another paper from the present study reported that IT children were observed to exhibit a distinct pattern of inattention in year 1 during a simple task of sorting plastic chips by color that all children could execute perfectly (Loney, unpublished data, 2005). This suggests that young IT children are not inattentive only when given excessively challenging academic tasks. These and other previous findings of differences between CT and IT (Masseti, unpublished data, 2005) suggest that the nature of attention problems in CT and IT children may be sufficiently different to justify a diagnostic distinction between CT and IT.¹⁸

Emerging evidence of the external validity of the subtypes of ADHD justifies attempts to find a more reliable method of defining them. For example, for both research and clinical purposes, it may be more useful to adopt a single diagnostic category of ADHD but to use a qualifier based on the continuous number of hyperactivity-impulsivity symptoms. The number of hyperactivity-impulsivity symptoms varies from assessment to assessment, but the present results suggest that they are quite stable over time on average. This approach would have the advantage of reducing the homogeneity of the diag-

nosis by distinguishing between IT and CT but on a continuous rather than a nominal basis. This would avoid the problem of having children shift from one nominal diagnostic label to another over time.

It would be best if decisions about the subtypes of ADHD were not made until it is determined whether the instability of the nominal categories of CT and IT is equally high in samples that were recruited in late elementary school or middle school. Such samples would be expected to include IT children with later onsets,¹⁹ and possibly a more hypoactive form of IT, that might remain more distinct from CT over time.^{18,20,21} Because the present sample was recruited at 4 to 6 years of age, such later-onset cases of IT were not included. In addition, conclusions based on the present findings could change if the children in this sample were followed up through adolescence. More desistance from ADHD would be expected over time and more CT children would be expected to meet criteria for IT as hyperactivity-impulsivity symptoms decline through adolescence.^{5,22} In particular, it would be important to learn about the long-term outcomes of HT children during adolescence because it is not clear that they will remain stably in CT.

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