

# the ADHD

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## ADHD Symptoms vs. Impairment: Revisited

**Russell A. Barkley, Ph.D., Charles E. Cunningham, Ph.D., Michael Gordon, Ph.D., Stephen V. Faraone, Ph.D., Larry Lewandowski, Ph.D., and Kevin R. Murphy, Ph.D.**

This article takes up where our previous article left off (Gordon et al., 2005, *The ADHD Report*, 13(4), p. 1–9) concerning the relationship of severity of ADHD symptoms to degree of impairment in major life activities. It expands upon and extends our earlier work while also qualifying some of our previous conclusions. It examines this relationship and the determination of impairment from several additional methods and perspectives and using several additional large databases in addition to re-analyzing data from two of those used in the earlier paper. Our earlier article examined the relationship of severity of ADHD symptoms, variously measured, to each of a number of specific and discrete measures of impairment. It found that ADHD symptoms showed low to moderate relationships (correlations) with each of those specific measures of impairment. The correlations ranged in magnitude from .01 to .65, but mostly fell in the .10 to .30 range. At most, the overlapping variance between symptoms and any specific measure of impairment was around 42% ( $r = .65$ ), most falling at or below 10% ( $r < .32$ ). Inattention symptoms were most strongly related to specific measures of educational impairment.

We concluded that symptoms and impairment were somewhat distinct dimensions that should be considered as such in the diagnostic process. We further concluded that there appeared to be a weak relationship between symptoms and impairment such that clinical cases of ADHD could display the full range of ADHD-type symptoms without necessarily displaying significant impairment. The prior article also highlighted limitations in current approaches to the assessment of impairment and statistical methods used to evaluate its relationship to symptom severity.

The present article illustrates this issue by examining the relationship of ADHD symptom severity to impairment using different means of defining impairment

and of analyzing the risk for impairment in major life activities. Specifically, we report on the relationship of ADHD symptoms to several investigator-created omnibus impairment indexes. These are largely drawn from the types of specific measures of impairment used in our earlier paper. In this case, however, we convert these largely dimensional measures into discrete dichotomous categories (being impaired or not) on each specific measure. The omnibus index is then created by summing across these discrete measures to achieve a count of the total number of different measures on which impairment could be said to exist. We also examine self, other, employer, and clinician ratings of impairment across a number of domains of major life activities (work, school, family, social, driving,

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**Russell A. Barkley, Ph.D.**  
Department of Psychiatry  
SUNY Upstate Medical University  
Send correspondence to:  
1752 Greenspoint Ct.  
Mount Pleasant, SC 29466  
E-mail: russellbarkley@earthlink.net  
www.russellbarkley.org

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etc.). In contrast to our earlier paper that focused on impairment in very specific measures of functioning, this paper focuses on impairment as a broader, multi-dimensional concept. We also report on the probability of being impaired in at least one domain given clinical levels of ADHD symptoms.

Before proceeding further, we wish to make clear the difference between symptoms and impairments. To us, *the symptoms of ADHD are the behavioral expressions associated with this disorder*—they are the actions demonstrated by those having the disorder that are believed to reflect that disorder (i.e., inattention, distractibility, impulsive responding, hyperactivity, etc.). *Impairments are the consequences that ensue for the individual as a result of these behaviors.* In short, symptoms are actions (behavior) and impairments are consequences (outcomes or social costs). For instance, distractibility while performing school work is a symptom because it represents a behavior of the individual. Getting a low grade point average, being retained in grade, not completing high school, getting less education more generally, and even losing friends may be consequences of such perennial distractibility in school. They represent the types of educational impairment that may ensue from that distractibility. The terms are easily confused and often are so in discussions of ADHD. Even within the symptom list in the DSM, some symptoms may overlap with impairment, such as avoiding tasks that require sustained mental effort (one symptom) could be a consequence of another symptom (being distractible). Yet both are behaviors and by the definitions offered here, both would be treated as symptoms for our purposes.

#### REANALYSIS OF MILWAUKEE STUDY DATABASE

We begin by re-analyzing one of the four datasets used in the previous paper, the Milwaukee longitudinal study of Barkley, Fischer, and colleagues

(2002). The Milwaukee study has followed a sample of 158 hyperactive and 81 control children for more than 13 years into their young adulthood (19 to 25 years of age). We previously reported the correlations between ADHD symptoms at young adulthood as reported by parents of these youths and each of 17 different outcomes as noted above (years of education, grade point average, employment history, arrest rates, driving violations and crashes, etc.). The groups were collapsed together for their earlier analyses. The correlations reported earlier ranged in magnitude from .04 to .51 but most were in the .10 to .30 range.

For this article, we recoded data for individuals on each of most of these same measures as either reflecting impairment on that outcome or not. For a few others measures, we substituted a categorical measure for a dimensional one that better reflected impairment in that domain. For instance, for years of education, we substituted whether or not the individuals had ever been retained in grade, whether or not they graduated from high school, and whether or not they had received special education in high school. We converted other dimensional measures, such as arrests, car crashes, etc., into binary categorical ones (being impaired or not) by selecting a cut-point for impairment on the dimension. The cut-point had to be at least 1.5 SDs or more above the mean for the control group and also formed an obvious break-point in the distribution. The resulting cut-points ranged from the 89th to 98th percentile for the control group.

The specific outcome measures (and cut-points) were as follows: (1) ever retained in grade in school; (2) failed to graduate high school; (3) received special education in high school (by self-report); (4) fired from a job (2 or more times; by self-report); (5) few close friends (2 or less; by self-report); (6) trouble keeping friends (by self-report); (7) driver's license ever suspended or revoked (by self-report); (8) excessive self-reported car crashes (3 or more); (9) excessive self-reported speeding cita-

tions (5 or more); (10) excessive citations on official driving record (7 or more); (11) excessive arrest rate (3 or more; self-reported); (12) 1 or more felony arrests recorded on official crime record; (13) 1 or more misdemeanor arrests recorded on official crime record; (14) unusually low grade-point average on high school transcript (1.6 or lower—roughly C– to D+); (15) unusually low class ranking in high school on transcript (89th percentile or higher); [Note: class ranking is usually an inverse of the student's placement in the class distribution and means that this many people in the class did as well or better than the student.] (16) employer-rated work performance of below average or poor (rating of 2 or lower on a 1 to 5 scale); (17) involvement in a teenage pregnancy as the father or mother; (18) sent to jail for any crime.

While other measures could have been added to reflect other domains of functioning, we chose these because the majority had been included in the prior article or, in a few cases, served as more appropriate substitutes for the earlier ones in defining impairment. Each subject was coded as 1 (impaired) or 0 (unimpaired) on each measure. We then summed these impairment categories to create an *omnibus index of impairment* (OII) reflecting the total number of different measures in which the individual was impaired. We then took the same measure of ADHD symptoms used in the prior article (parent-reported DSM-IV symptoms) and correlated it with this investigator-determined impairment score.

The correlation between parent-reported inattention symptoms and this investigator-determined OII was .45 ( $N = 209$ ;  $p < .001$ ), while that between the hyperactive-impulsive symptoms and the OII was .53 ( $N = 205$ ;  $p < .001$ ). Total parent-reported ADHD symptoms correlated with the OII at .53 ( $N = 209$ ;  $p < .001$ ). [Note: As we reported previously, parent reports were used because self-reported ADHD symptoms at follow-up were exceptionally and significantly low and did not correlate with adverse outcomes across many domains of impairment;

parents reported far more symptoms in these youths and parent reports were significantly associated with various adverse outcomes—see Barkley et al., 2002.] Thus, where the typical correlation between ADHD symptoms and any specific measure of a domain of impairment in our prior article was found to range from .10 to .30 (average of .21), the relationship between severity of ADHD and the number of impairments one is likely to have is more than double that average, showing approximately 28% of shared variance between symptoms and impairments. Important to note here is that the measure of ADHD symptoms comes from parent report whereas the indicators of impairment come from self-report, employer reports, or official records (driving, crime, school transcripts). This makes the size of these correlations more impressive because they do not reflect same-source variance that can often increase the size of correlations of this sort when the source of the symptom rating is the same as the source of the impairment rating. Indeed, some of these sources are so disparate one would hardly have expected them to be related at all given no obvious overlap of the content of each (parent reports of symptoms vs. official archival records of crime or driving). Also, we found that the hyperactive sample substantially under reported their symptoms relative to other sources in this study (which is why parent report was used for symptoms) and, by inference, may also have under reported some of the impairment areas we used above based on their self-reports. These circumstances would make these results a lower-bound or more conservative estimate of the relationship between symptoms and likelihood of being impaired. In short, ADHD symptom severity shows at least a moderate association in young adulthood with the number of measures on which one is likely to be impaired as reflected in the OII.

### ONTARIO SAMPLES OF CHILDREN

In the next analysis, the relationship between ADHD symptoms and likelihood of impairment was examined in large samples of Canadian children. A

sample of 9,935 children was examined for those having  $t$ -scores of 70 (+2  $SD$ s above the mean) or above on the Brief Child and Family Phone Interviews (BCFPI) regulating impulsivity, attention, and activity level subscale, a measure of ADHD symptoms (see our earlier article for details of this study). The percentage of these children having one or more  $t$ -scores above 70 on the five functional impairment scales on the BCFPI was then computed. These scales measure participation in social activities, quality of social relationships, academic performance and attendance, impact on family activities, and impact on family conflict and anxiety. The results indicated that 89.8% of those children who scored high ( $t$ -scores  $\geq 70$ ) on the ADHD-related symptom dimensions evidenced significant impairment (impairment  $t$ -scores of 70 or above) on at least one or more impairment scales. In another sample, the BCFPI ADHD-related symptoms scales above were correlated with the number of domains of functional impairment (1 to 5) using 22,811 children referred to children's mental health services. The result for this investigator-created OII was .42.

This correlation is probably somewhat lower than that found in the Milwaukee study above due to several significant methodological factors. First, the BCFPI does not directly assess clinical ADHD symptoms as they are worded in the *DSM-IV*. The scale used here, however, can serve as a proxy for those ADHD symptoms because they likely would correlate well with a rating scale that contained those *DSM* symptoms. Second, the range of possible impairments was far smaller, just 0 to 5, compared to the 0 to 18 in the Milwaukee study. This smaller, more restricted range would attenuate the correlation between symptoms and risk for impairment. Even so, this correlation is more than double the average correlation reported for these samples in the earlier paper, in keeping with the same finding from the reanalysis of the Milwaukee data. When impairment is studied as a multidimensional, more global concept, symptoms of ADHD show a more sub-

stantial relationship with likelihood of being impaired in at least one or more domains—high levels of ADHD symptoms ( $t$ -scores of 70 or more) are almost universally associated with a high risk of impairment (90%).

### ADULTS WITH ADHD

We now present analyses from a database not previously published that deals with adults with ADHD. It will be the subject of a book by Barkley, Fischer, and Murphy to be published later this year and represents one of the largest and most comprehensive studies of ADHD in adulthood. Barkley and Murphy collected information on 149 adults clinically diagnosed with ADHD, 97 adults referred to the same clinic who did not have ADHD (mainly anxiety and mood disorders), and 109 community control adults who were 17 to 69 years of age (Mean 35) of whom 52% were male and 48% female. For the analyses presented here, the groups were combined. The authors collected multiple measures of *DSM-IV* ADHD symptoms including a clinical interview, self-report rating scales, scales completed by others who knew the participant well, and employer ratings. Also, using some of these same methods, ADHD symptoms were assessed for recall of childhood functioning (ages 5 to 12 years); (self and other reports).

Impairment was also evaluated by a variety of measures. We had available for analysis: (1) self-reported impairment (binary categorical) in 6 different domains of current functioning from the interview (work, home responsibilities, social activities, community activities, educational activities, and dating or marriage); (2) self-rated impairment on a rating scale reflecting 10 domains of impairment, each being rated 0 to 3 (Not At All to Very Often) using the same 6 domains as in the interview as well as money management, driving, leisure activities, and daily responsibilities; (3) other-rated impairment on this same rating scale of 10 domains of current functioning; (4) self-rated impairment on a rating scale of 7 domains of childhood functioning (home activities, social activities, community activities, school, sports, clubs

and organizations, self-care, and daily chores/responsibilities); (5) other-rated impairment on this same rating scale for childhood; (6) a clinician rating on the Social and Occupational Functioning Assessment Scale, or SOFAS; a scale very similar to the Clinical Global Assessment of Functioning Scale (CGAFS) used in *DSM-IV* (Patterson & Lee, 1995); (7) a rating scale completed by others (parents) evaluating 8 domains of school impairment; and (8) employer ratings of impairment (0 to 3) from ADHD symptoms in 10 domains of workplace functioning (relations with coworkers, relations with supervisors, relations with clients or customers, completing assigned work, educational activities, punctuality, meeting deadlines, operating equipment, operating vehicles, managing daily responsibilities).

### Current Functioning

The relationships that were found between ADHD symptoms and the impairment measures are shown in Table 1. The correlations are substantial and demonstrate that whether measured by clinical interviews or rating scales, the more ADHD symptoms an adult possesses, the greater the number of domains of major life activities they will report as being impaired by those symptoms. This applies whether symptoms and impairment are determined from self, other, clinician, or employer reports. In some cases the measures share more than 77% of their variance. In separate analyses not shown here, inattention symptoms showed a slightly stronger relationship with impairment than hyperactive symptoms—a pattern found across all subsequent measures. Consequently, we did not report the correlations for the two individual symptom dimensions of ADHD separately but just report those for the total number of ADHD symptoms.

Prior research has indicated that 4 or more symptoms of ADHD in adults reflects significant deviancy in the population (93rd percentile) and could serve as a clinical cutoff score instead of the 6

symptoms recommended in the *DSM* (see Murphy & Barkley, 1996). When using this threshold, we found that 100% of those reporting 4 or more ADHD symptoms on the interview reported being impaired in at least one domain of major life activity. As in the Cunningham results described above, such a finding suggests that high levels of ADHD symptoms for one's age group are nearly universally associated with risk of being impaired in at least one or more domains of major life activities.

When ADHD symptoms and impairment were assessed by rating scale, both self-rated symptoms and other-rated symptoms correlated even more highly with self-rated and other-rated impairment, respectively, than it did using the interview data. The higher correlation may reflect the fact that the rating scales permit a much finer-grain rating of both each symptom's severity, rated as 0 to 3, and degree of each impairment, also rated as 0 to 3, compared to a binary categorical encoding of these symptoms and impairments on the interview (symptom present or not; impairment present or not). If we use a different source of information for symptoms (self-rated) and another for impairment (other ratings), or vice versa, the correlations are reduced somewhat but are still very high, being more than double what was observed in our prior article. One measure of the validity of the self-impairment ratings is the extent of the relationship between self and other sources. Self-rated impairment from the rating scale correlated .68 with other rated impairment on that same scale ( $N = 184, p < .001$ ), a moderate to large relationship. Consider, in comparison, that the relationship between parent and teacher ratings of child behavior typically averages .30 (Achenbach, McConaughy, & Howell, 1987).

Such a decline in the relationship from self-ratings using the same source to using different sources for symptoms vs. impairments would be expected across different sources of infor-

**Table 1. Relationships between ADHD Symptoms and Impairment Scores from Barkley & Murphy Study of Adults**

Current Functioning Measures	<i>r</i>	<i>N</i>	<i>p</i>
Number of ADHD symptoms with # of impaired domains (interview)	.84	351	< .001
Number of ADHD symptoms (interview) with SOFAS clinician rating	-.80	335	< .001
Self-rated ADHD symptoms with self-rated impairment	.88	272	< .001
Other-rated ADHD symptoms with other-rated impairment	.88	199	< .001
Self-rated ADHD symptoms with other-rated impairment	.69	199	< .001
Other-rated ADHD symptoms with self-rated impairment	.65	227	< .001
Employer-rated ADHD symptoms with employer-rated impairment at work	.83	95	< .001
Childhood Functioning Measures			
Self-rated ADHD symptoms with self-rated impairment	.86	276	< .001
Other-rated ADHD symptoms with other-rated impairment	.85	139	< .001
Other-rated ADHD school symptoms with other-rated school impairment	.88	160	< .001
Self-rated ADHD symptoms with other-rated impairment	.61	164	< .001
Other-rated ADHD symptoms with self-rated impairment	.68	136	< .001

mation particularly when they are rating different aspects of functioning (symptoms vs. impairment), as was found in the Milwaukee results discussed above.

In an effort to replicate the OII approach to defining impairment used in the Milwaukee study, we also computed an investigator-determined OII from these adult data. We did so by the summation of the following 18 specific measures of outcomes. Again where the measures were initially dimensional in nature, we chose as the demarcation for impairment on that measure a score that was at least +1.5 SDs above the mean for the community control group (percentiles ranged from 92 to 99%) and where an obvious break-point occurred in the distribution. The specific domains were all determined from self-reported information in this case. The domains (and cut-points) were: (1) ever retained in grade in school; (2) failed to graduate high school; (3) ever received special education; (4) fired from a job (2 or more times); (5) unemployed at least a month or more (3+ times); (6) quality of work below average or worse; (7)

driver's license suspended or revoked (2+); (8) excessive car crashes (7+); (9) excessive speeding citations (9+); (10) ever ticketed for driving while intoxicated; (11) excessive arrest rate (2 or more); (12) ever sent to jail for any crime; (13) ever divorced; (14) ever treated for alcoholism; (15) ever treated for drug abuse; (16) have trouble managing money; (17) ever gone bankrupt; and (18) have a poor credit rating.

The correlation between number of ADHD symptoms from the interview and this investigator-created OII was .46 ( $p < .001$ )—very similar to that found above for the OII derived in the Milwaukee study (.53) and the Cunningham study of Canadian children (.42).

### Childhood Functioning

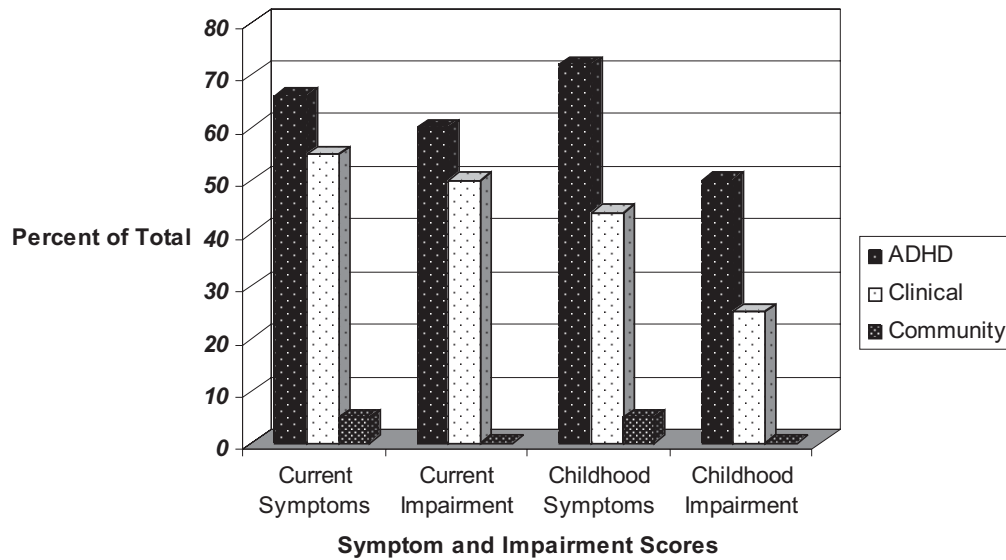
This study also collected information from participants about their retrospective recall of their childhood functioning along with reports of others (usually parents) about that same time period in development. These are also shown in Table 1. The pattern of results

is virtually identical to those found for current functioning. The correlations ranged from .61 to .88. The substantial size of these correlations is surprising in view of the time period over which these symptoms and impairments are being retrospectively recalled by participants and by others who knew them well (typically parents). Again, as a sign of validity, we correlated self-rated childhood impairment with ratings by others of that same childhood impairment. The resulting correlation was .55 ( $N = 160, p < .001$ ), implying some validity of the self-ratings of impairment for this developmental period.

### Summary

This study of adults with ADHD finds a substantial relationship between symptom severity and extent of impairment, variously assessed (self, others, clinician, employer), both for current functioning and for recall of childhood functioning. The greater the severity of ADHD symptoms, the more domains of impairment an individual is likely to be experiencing and the more severe that impairment will be. Indeed, the interview results (.84), clinician results (.80), rating scale results (.88), and employer results (.83) are so high as to share 64 to 77% of the variance between symptoms and impairment. While same source ratings for symptoms vs. impairment, whether by self or other reports, may set upper bounds for such relationships because of shared method variance, crossing sources of information, as we did here (self-rated symptoms vs. other-rated impairment) may set the lower bound of agreement by removing that shared variance. Even when we crossed such sources, the relationships remained large: .80 for self-report on interview vs. clinician SOFAS, and .69 for self-ratings of symptoms vs. other-rated impairment. The relationships between symptoms and impairment for recall of childhood symptoms were only slightly smaller but just as impressive (.61 to .88), especially considering the length of time over which such

## Symptoms vs. Impairment



**FIGURE 1.** Percentage of possible ADHD symptoms (out of 18 in DSM-IV) and percentage of possible impaired domains (out of 10 for current and 8 for childhood) for each group for current and childhood functioning. Graph visually illustrates the relationship of symptoms to impairments. Groups are ADHD adults, Clinical control adults, and Community control adults

retrospective recollections occurred (an average of 25 to 30 years).

Another way of demonstrating the relationship of symptoms to impairment is to examine the number of domains reported as impaired in each of the three clinical groups. The ADHD group displayed more symptoms than did the Clinical control group and both of these showed more symptoms than the Community control group. Figure 1 shows the percentage of domains of major life activity self-reported “Often” or “Very Often” impaired for both current and childhood functioning juxtaposed against the number of ADHD symptoms. To make the comparison clearer, each measure is expressed as a percentage of the maximum possible score. It clearly shows that the higher the percentage of possible ADHD symptoms across the groups, the greater the percentage of domains rated as impaired.

These relationships between symptoms and impairment are certainly higher than those found in the Milwau-

kee study, though even the latter found a moderate relationship and double that found in our earlier paper. Yet we also replicated the Milwaukee study results by defining degree of impairment using the OII approach as in the Milwaukee database. The relationship of symptoms to this investigator-created impairment score was .46, again being approximately twice the average level found in the earlier article. Most likely this difference between the high correlations found for ratings of impairment and these more moderate correlations found for an investigator-created OII is due to differences in their methodology. When impairment is specifically questioned in an interview or on a rating scale, its relationship to ADHD symptoms is higher than if impairment is defined by the investigator as a summation of a number of very specific and discrete outcome measures. As occurred in the Milwaukee study, the use of differing sources of reporting for symptoms (parents) versus the specific measures of outcomes comprising the OII (self and official archives) would at-

tenuate the relationship. The archives in particular suffer from incompleteness in assessing that outcome relative to self-report (e.g., crime records do not reflect all criminal activity, nor do driving records reflect all crashes and citations, etc.).

One could also argue that two of the three groups in this study of adults were clinic-referred patients and thus highly likely to be impaired if only by virtue of having been diagnosed by DSM criteria that requires impairment. This might inflate the observed relationship. But this problem also existed in the earlier paper where low correlations were found. But Figure 1 argues against this limitation because the differences between the ADHD and Clinical group cannot be an artifact of clinical referral status. Also, in the context of the other two studies that did not necessarily involve clinic-referred samples at the time of their current assessments, our findings still hold—the relationship of symptoms to impairment is more than twice that found in our earlier paper,

which contained some of these same methodological limitations.

## CONCLUSIONS

The results of the present analyses extend and expand upon the earlier evidence in our prior article on the relationship of ADHD symptoms to risk of impairment. There we showed that ADHD symptoms may have only a modest relationship with *any single* measure of *any single* outcome. Here we have shown that the severity of those same symptoms may show a moderate or greater relationship with severity of impairment (number of measures impaired) as measured by omnibus indexes (OIs). We also showed an even higher relationship with severity of impairment across domains as rated by self, others, clinicians, and even employers. In other words, when impairment is represented by a single specific measure of a life activity, ADHD shows a low (but still often significant) relationship to that specific measure. But if the concept of impairment is broadened to include multiple measures and domains of major life activities, then ADHD symptoms show a stronger relationship to risk of any impairment and to the number of different measures in which impairment is likely to be found. Whereas the range of relationships in our previous study was between .01 and .65, and typically between .10 and .30, when examining each specific measure of impairment separately, the range found here is between .43 and .88, and typically between .60 and .80, when examining impairment globally or multidimensionally.

This leads us to qualify some of our earlier conclusions. The modest relationship we found earlier between symptoms and impairment such that they may be only loosely coupled appears to apply only when examining any single measure of a specific outcome for its relationship with ADHD. When examining impairment across multiple measures and domains, the relationship is more than twice that found earlier, being of at least a moderate to large magnitude. If impairment is

specifically evaluated in interviews and rating scales its relationship to ADHD symptoms in some instances shares nearly 80% of the variance. Previously, we speculated that in view of the earlier modest relationships, no small proportion of clinical samples would be unimpaired. Yet here we found just the opposite—high levels of ADHD symptoms may be nearly universally associated with impairment. We found that 90 to 100% of those cases experiencing high symptom levels were impaired in at least one or more domains of daily life activity. Such results resemble those found by Biederman, Mick, and Faraone (1998) in their follow-up study in which 80% of ADHD boys were impaired in at least one or more (of three) domains of major life activities at follow-up with just 20% showing normalization in all three domains (school, social, and emotional functioning).

As we noted previously (and above), there are methodological and statistical limitations involved in any single approach to examining impairment or in measuring symptoms. One problem is the issue involved in both our papers and that is whether or not clinical and control groups should be combined to evaluate this relationship. By their very selection procedures, clinical groups have to be impaired to get the ADHD diagnosis and control groups are usually not general population samples but often healthier than normal. This might inflate the magnitude of any correlation. Yet this problem also existed in our earlier paper in which low-order correlations were the norm. General population samples would certainly provide a better test of the issue. But Figure 1 presents the relationship of symptom severity to impairment as a function of clinical or control-group membership. The fact that the ADHD group was still more impaired than the Clinical control group argues against this problem of clinical referral being the sole explanation of our findings. The figure clearly shows that the more severe are a group's ADHD symptoms, the more domains of impairment they

will experience—currently or as children.

Using the same source (e.g., self, others) and the same method (interview, rating scale, clinician judgment) can result in higher relationships being found than if different sources and methods are used for one (symptoms) than the other (impairment) side of this relationship. Crossing sources and methods does lower the observed relationship more than when same sources are used. Neither is a gold standard for this analysis as each suffers from its own set of limitations. Individuals having just rated their symptoms highly may, on the same scale, inflate their ratings of impairment accordingly. That sword cuts both ways, however, in view of findings that children and adults with ADHD show a positive illusory bias in self-ratings of their competence and task performance, often rating themselves as functioning significantly better than they do in fact when that domain of performance is tested (see Barkley, 2006; Knouse, Bagwell, Barkley, & Murphy, 2006). Such findings would imply that self-ratings of impairment are likely to be an underestimate of their actual functioning in that major life activity.

Using a different source to obtain the impairment rating than the symptom rating is equally problematic. Those other sources may not have as complete a knowledge of the person's daily activities they are rating as does the person him or herself. For instance, only half of the participants in the Milwaukee study were living at home with their parents at follow-up and 26% or fewer of the adults in the Barkley and Murphy study above were doing so. Thus parents are unlikely to be aware of the full range of social, occupational, driving, financial, and other domains of major life activities of their offspring and hence of any impairment within them.

We also found that where impairment is specifically assessed in an interview or rating scale, its relationship to ADHD symptoms is far higher than if the im-

pairment score is determined by the investigator as in the OIIs developed here comprising a simple summation across multiple, highly specific outcome measures. Even then, however, the relationship is much stronger than it is between symptoms and any one of those specific outcome measures. We also found that the relationship of symptoms to impairment seemed to be higher in adult samples than in child samples, perhaps because adults carry more responsibilities across more domains of daily life activity and hence may experience more impairment. But this difference between adult and child datasets could simply be due to their use of different measures.

One should not be surprised that we found such a strong relationship between severity of ADHD and likelihood of impairment in major life activities. After all, many of the thousands of studies comparing ADHD and control groups on various measures of social, educational, adaptive, occupational, and other areas of life functioning found substantial differences between those groups (see [www.russellbarkley.org](http://www.russellbarkley.org) for more than 2,500 such references). More recently, studies have controlled for comorbid disorders and have still found links between being ADHD and being impaired in particular life activities. Those numerous studies provided a different means of addressing the same issue raised here—the relationship of symptoms to impairment. After all, the groups having ADHD were selected for having higher symptoms of ADHD than the control groups and that resulted in subsequent differences being found in major life activities. Studies that examine what factors like ADHD and other characteristics are likely to predict impairment in various major life activities in their samples (especially epidemiologically derived ones) using multivariate approaches such as regression are to be encouraged (Deutscher & Fewell, 2005; Kooij et al., 2005). Those numerous studies provided just as much evidence that ADHD is linked to likelihood of impairment in a variety of major life activities than has our largely correlational approach.

Despite needing to qualify some of our earlier conclusions, others remain salient. Clinicians should still evaluate both symptoms *and* domains of impairment as part of their clinical diagnostic assessment and not automatically assume that assessing the former is sufficient. All evidence points to this need to respect Criterion D in the *DSM-IV* diagnostic criteria for ADHD (impairment) and to assess it specifically apart from just evaluating symptoms. For example, in the Ontario study, although 90% of subjects with high levels of ADHD symptoms showed some significant impairment, the fact that 10% were not impaired shows that misdiagnosis rates would not be negligible if clinicians ignored Criterion D in making diagnoses. Further, in clinical practice there will always be a small subset of patients who for a variety of reasons may endorse large numbers of ADHD symptoms on a rating scale or during an interview. But they do not evidence any significant objective impairment beyond a self-perception that they are not doing as well in life as they believe they should.

Research also needs to continue the examination of what other factors are relevant to determining impairment within specific domains and risk across them beyond just level of ADHD symptoms alone (see, for instance, Barkley, Fischer, Smallish, & Fletcher, 2006). There is also no doubt that better methods of assessing impairment, especially in children, are in need of development, validation, and normative data, if they are to provide clinicians with more efficient ways of evaluating impairment in their patients. The impairment scales used here for current, childhood, workplace, and school functioning along with the SOFAS scale seem to be a positive step in that direction. Other approaches such as factor analysis or structural equation modeling may also yield some useful composite approaches to evaluating impairment in various domains of major life activities. That said, the present findings provide some assurance that severity of ADHD symptoms is not merely a meaningless

expression of normal variation in the population devoid of or decoupled from risks for impairment in major life activities. Such severity, especially at clinically elevated levels, is highly likely to be associated with risk of impairment in one or more major life activities. If disorders are conceptualized as deficiencies in, or failures of, human psychological and behavioral adaptations that result in harm (impairment) to those individuals (Wakefield, 1992) then it is clear here that ADHD is just such a disorder with a high risk for associated impairment.

*Russell A. Barkley, Ph.D., is Research Professor of Psychiatry, State University of New York Upstate Medical Center, Syracuse, NY and Clinical Professor, Department of Psychiatry, University of South Carolina, Charleston, SC. Charles E. Cunningham, Ph.D., is Professor, Department of Psychiatry and Behavioural Neurosciences, Jack Laidlaw Chair in Patient-Centred Health Care, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada. Michael Gordon, Ph.D., is Professor and Director of the ADHD Program and Child and Adolescent Psychiatric Services, Department of Psychiatry, Upstate Medical Center, State University of New York, Syracuse, NY. Steve Faraone, Ph.D., is Professor of Psychiatry, State University of New York Upstate Medical Center, Syracuse, NY. Larry Lewandowski, Ph.D., is a Professor of Psychology at Syracuse University.*

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## ADHD and Childhood Obesity

**Barry Panzer, Ph.D., ACSW**

Two recent epidemiologic surveys have found significant correlations between attention deficit hyperactivity disorder (ADHD) and pediatric obesity (Agranat-Meged, Deitcher, Goldzweig, Leiberson, & Stein, 2005; Holtkamp et al., 2004). Both studies noted markedly higher than expected rates of ADHD among obese children (57.7% and 26.8% respectively) leading the researchers to speculate that the child's executive dysregulation may lead to overeating, as well as interfere with sustained weight loss efforts. Surveys of adult ADHD/obese populations have yielded similar findings.

Other connections between the two disorders may involve the presence of obstructive sleep apnea—a negative consequence of obesity—which has been implicated in executive function deficits (Findley et al., 1986; Guillemineault, Eldridge, Simmons, & Dement, 1976; House, 2001; Parkes, 1985) and problematic dopamine or insulin receptor activity possibly underlying both conditions (Altfas, 2002).

Two practice prescriptions were derived from the pediatric studies. All obese children should be screened for ADHD and children with ADHD should be monitored for potential overweight or obesity. While these studies initiate the exploration of connecting these conditions, both the findings and the recommendations are better understood within their broader contexts. The researchers, for example, overlook that there appear to be several trajectories for childhood obesity (Mustillo et al., 2003). Children who are chronically obese since early childhood and whose BMI is elevated several years prior to puberty may be quite different from the adolescence-onset group regarding the role of ADHD for each. Also, the proposed mechanisms of ADHD impulsivity and disorganization, which are presumed to fuel excess caloric intake, are intuitively reasonable, but may be operating in conjunction with other comorbidities which can contribute to the child's weight disorder. Generalized anxiety or depressive syndromes might be manifest in “emotional eating,” oppositional and conduct disorders could involve violat-

ing family dietary rules, and both obsessive-compulsive and developmental disorders could produce faulty eating patterns. Ultimately, it would seem that any condition, physical or psychosocial, which lowers the child's self-esteem should be considered a potential etiologic factor in the development of obesity.

Additional research will hopefully clarify theoretical and conceptual issues of this kind, but the current data suggests that there may be substantial numbers of these dual-diagnosis children who remain untreated for one or both conditions. This lack of intervention increases the likelihood of chronicity as well as comorbid disorders.

Clinicians who are currently treating ADHD children with a weight disorder will first need to become familiar with the nature of the condition, its etiologies, consequences, and epidemiology. A summary of this literature indicates that excess adipose tissue in childhood is due to a variety of biological, psychosocial, and cultural factors and for some of these children the disor-