Major Life Activity and Health Outcomes Associated With Attention-Deficit/Hyperactivity Disorder

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People with attention-deficit/hyperactivity disorder (ADHD) are affected by the disorder throughout their lifetimes. Children with ADHD often have comorbid oppositional defiant disorder and conduct disorder in addition to having developmental and social problems. The persistence of ADHD into adolescence and young adulthood varies according to who is being interviewed and the criteria used to define the disorder. For those adolescents and adults in whom ADHD does persist, educational difficulties continue, and problems in the areas of employment, driving, and sexual relationships emerge. ADHD is also associated with increased health care costs even when controlled for psychiatric treatment. Because most ADHD research has been conducted with male children and adolescents with ADHD, combined type, most outcomes for ADHD should be thought of as male outcomes for this subtype. In the future, ADHD researchers should study outcomes for girls and women and for people with ADHD, predominately inattentive type. *(J Clin Psychiatry 2002;63[suppl 12]:10–15)*

To date, much of the research on attention-deficit/hyperactivity disorder (ADHD) has been limited to children, adolescents, and adults younger than 30 years, with most studies focusing on boys with ADHD, combined type. Despite these limitations, a trajectory about ADHD has emerged: children with ADHD face developmental and social difficulties, and when these children become adults, they face employment, driving, and relationship difficulties. In short, ADHD causes impairments that span the lifetime of people with the disorder. Herein, major life activity and health outcomes adversely affected by ADHD across the lifetime are discussed, as are outcomes that should be more thoroughly investigated in future ADHD studies.

QUALIFYING ISSUES IN ADHD RESEARCH

Most studies have focused on ADHD, combined type and/or predominately hyperactive-impulsive type; consequently, these studies' results reflect what is known about only these subtypes. The predominately inattentive type of ADHD remains to be studied for major life activity and health outcomes. A recent article by Milich et al.[1] reviewed the world literature on the inattentive subtype and concluded that there is a subset of the predominately inattentive type that is a unique disorder and should no longer be lumped with ADHD. The results discussed herein pertain to traditional ADHD, which is now known as the combined type.

Additionally, few studies of girls with ADHD have been conducted. Although the disorder is qualitatively the same in girls and boys, some outcomes may differ. Since females are grossly underrepresented in follow-up studies, the outcomes discussed here should be thought of as male outcomes.

Because ADHD has not been studied in patients past 26 to 32 years of age, little is known about the disorder in midlife to late life. Disparities exist between children with ADHD who are followed into adulthood and adults who refer themselves to clinics. Although both groups have the same disorder, the comorbid disorders vary markedly between the groups. Children followed to adulthood have more antisocial behavior and seek help less than self-referred adults. Self-referred adults tend to have higher levels of anxiety and depression than adults diagnosed as children. Therefore, outcomes for adults may differ depending on the demographics of the samples and the methodology of the study.

COMORBID DSM-IV DISORDERS IN CHILDHOOD

ADHD without comorbid disorders is rare even in general population samples.[2] The difficulties caused by

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Table 1. Academic Impairments in Children With Attention-Deficit/Hyperactivity Disorder (ADHD)[a]

Perform poorly in school at a rate of over 90%
Score 10 to 15 points lower than their peers on standardized achievement tests
Score 7 to 15 points lower than their peers on standardized intelligence tests
Have learning disabilities in areas such as reading (21%), spelling (26%), math (28%), and handwriting (% not specified)

[a]Data from Barkley.[3]

these disorders may include behavioral, developmental, academic, and social problems. Disorders comorbid with ADHD are assessed through structured interviews, such as the Kiddie Schedule for Affective Disorders and the Schizophrenia for Children and Diagnostic Interview Schedule for Children.

The behavior of children with ADHD may be more defiant and oppositional than the behavior of children without the disorder. Children with ADHD often have aggression and conduct problems. Unsurprisingly, oppositional defiant disorder occurs at a rate of 40% to 65% in young patients with ADHD.[3] The high comorbidity of ADHD with oppositional defiant disorder may be explained by the impairment in the ability to self-regulate mood states like anger and hostility caused by ADHD. Patients with ADHD and oppositional defiant disorder also have or develop the more serious conduct disorder, the prevalence of which is 21% to 45% in children with ADHD.[3] Approximately 25% to 35% of children who have these comorbid disorders become adolescents who participate in delinquent or antisocial activities.[3]

ADHD has also been associated with anxiety disorders. However, the anxiety seen in children with ADHD seems to be related more to poor emotion regulation than to fear and panic. In a review on the comorbidity of common childhood and adolescent psychiatric disorders, Angold et al.[4] reported 1.3 as the median odds ratio for comorbid ADHD and anxiety. Clinic-referred populations appear to have a high percentage of ADHD and anxiety, so the association between these disorders could be due to a referral bias.

The Angold et al. review[4] also found the median odds ratio to be 5.5 for comorbid ADHD and depression. Researchers from Massachusetts General Hospital[5] documented that the lifetime diagnosis rate of major depressive disorder in children with ADHD was 49% at a 4-year follow-up. In the Milwaukee follow-up study conducted by my colleagues and me, the percentage with major depression was 27%.[6]

Bipolar disorder remains a controversial comorbidity with ADHD because the overlapping symptoms of the disorders make differential diagnosis difficult. However, depending upon the particular study, its methodology, and correction for the overlapping symptoms, the comorbidity rate for bipolar disorder and ADHD may be from around 6% to 10%.[3]

CHILDHOOD OUTCOMES WITH ADHD

Developmental Risks

ADHD is associated with many developmental risks. Among these risks, learning disabilities and/or language disorders affect children with ADHD most often. The academic impairments associated with ADHD are well known (Table 1). Many children with ADHD perform poorly in school, with reduced productivity being the greatest problem. Learning disabilities in reading, spelling, and math are common in this group. Children with ADHD also often have difficulty with expressive language and what is known as the pragmatics of language or language as a social tool for communicating with others. Ten percent to 54% of these children have speech problems, and these problems appear to be less the result of difficulties with speech and language and more the result of difficulties with executive processing.[3] Patients with ADHD may also be at risk for central auditory processing disorder, which is a deficit in receptive language processing. However, despite the popularity of central auditory processing disorder, this disorder has not yet been established as valid apart from receptive language disorders.

Kadesjo and Gillberg,[7] in a study of 409 Swedish 7-year-olds, found considerable overlap between developmental coordination disorder and ADHD. Half of the children diagnosed with developmental coordination disorder also met criteria for ADHD and vice versa. Motor systems are involved in both disorders, which may explain the high rate of comorbidity. Harvey and Reid[8] have demonstrated that children with ADHD also have reduced stamina and strength in physical fitness tests. A misconception is that since these children move around a lot and tend to be very active, they are physically fit. These study results negate that expectation. Children with ADHD have a high predisposition for accidental injury, particularly if they also have oppositional defiant disorder.[9] Aggression, not hyperactivity, appears to increase accident proneness. These children have a 1.5% to 4% increased risk for non–head injuries.[9] (The risk for head injuries appears to be the same in children with ADHD and controls.) However, children with ADHD have 3 times the risk for accidental poisonings when compared with community samples.[3]

Social-Emotional Impairments

The social-emotional impairments associated with ADHD have been assessed through parent ratings, peer sociometrics, and videotaped interactions of children with ADHD and other people. The relationship between parents and children with ADHD is often more conflicted and stressful than the parent-child relationship in families where no one has ADHD.[3] Over half of children with

ADHD have serious peer relationship problems.[3] These problems stem from the children's inability to participate in social exchanges like sharing, cooperation, and turn taking. Consequently, children with ADHD often interact with their peers through commanding, intrusive, hostile, and self-centered behavior. The social difficulties of children with ADHD are even more serious if the children have comorbid oppositional defiant disorder and/or conduct disorder. Further impacting the social relationships of children with ADHD are the problems these children have with self-regulating emotional states.

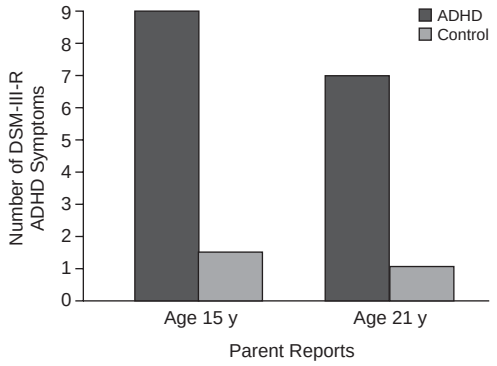
PERSISTENCE OF ADHD FROM CHILDHOOD INTO ADOLESCENCE AND YOUNG ADULTHOOD

The persistence of ADHD into adolescence and young adulthood varies according to who is being interviewed and the criteria used to define the disorder. For example, if DSM-III-R criteria are used, the persistence of the disorder into adulthood by self-reports is 5%, but that number increases to 46% with parent reports.[10] Switching from parent reports to self-reports has caused problems in follow-up studies of ADHD, with the switch from parent report to self-report dropping the persistence of the disorder as much as 95%.

If a developmental disability view of ADHD is utilized for diagnosis, which means that the disorder is defined by how people with ADHD compare with their peer group, discrepancies remain between self-reports and parent reports on the persistence of ADHD into adulthood. With this criteria, the 98th percentile is used as the cutoff point because it is consistent with the same threshold being used for mental retardation (defined as being 2 standard deviations from the mean on general cognitive ability) and because the 98th percentile is the widely recommended cutoff for interpreting rating scales. Sixty-six percent of adults with ADHD continued to meet criteria for the disorder when the 98th percentile cutoff and parent reports were used.[10] However, only 12% of this group met the criteria when they reported about themselves.

The question then is whose reports are the most valid: the people who actually have ADHD or their parents? To answer this question, my colleagues and I[10] examined both self-reports and parent reports of people with ADHD and controls without ADHD to determine whose reports predicted impairment. We chose 8 domains of impairment—such as employer ratings of job performance, arrest records, high school standing, and grade point average—that had been documented in the official records of people with ADHD or derived from self-reports and not parent reports. Next, we correlated both the self-reports and parent reports with the domains of impairment. Parent reports proved to be most predictive of impairment. The only impairment predicted by self-reports was employer ratings of job performance. Figure 1 demonstrates the decline in ADHD symptoms from adolescence to adulthood as reported by parents in this study.[10] The decline is enough to put some adults at or below the threshold that the DSM defines for the disorder. Although this may mean that some people outgrow the DSM diagnosis, the fact that the control mean declines and the discrepancy between the groups remains similar also implies that a child with ADHD may outgrow the DSM criteria but not necessarily outgrow the disorder.

Figure 1. Decline in DSM-III-R Attention-Deficit Hyperactivity Disorder (ADHD) Symptoms From Adolescence to Adulthood as Reported by Parents[a]



[a]Data from Barkley et al.[10]

COMORBID DSM-IV DISORDERS IN ADOLESCENCE AND ADULTHOOD

The adolescent outcomes for children with hyperactivity were assessed by my colleagues and me in an 8-year prospective follow-up study.[11] Over 80% of the hyperactive group had ADHD and 60% also had either oppositional defiant disorder and/or conduct disorder. By age 15, the hyperactive group was more likely than controls to have lied, stolen, deliberately destroyed property, been cruel to animals, been in fights, and set fires. Breaking and entering was the only antisocial act in which no strong differences existed between teenagers with hyperactivity and controls. As mentioned earlier, many children with ADHD and oppositional defiant disorder and/or conduct disorder become adolescents with antisocial behavior, whereas ADHD alone appears to create only a slight predisposition to antisocial activity.

Self-reports for lifetime occurrences of antisocial activities among adolescents with ADHD who were followed into adulthood have also been collected. In adolescence, 28% of these people reported setting fires, but as adults only 15% reported doing so.[3,11] Thus, it appears as if these people forgot what they said about themselves as adolescents, which illustrates the problems self-reporting can create.

The psychiatric disorders comorbid with ADHD are similar in childhood and adulthood. However, in adulthood, individuals begin to meet criteria for substance use and abuse disorders, and personality disorders, such as antisocial and passive-aggressive, emerge. A longitudinal study by my colleagues and me, the Milwaukee Young Adult Outcome Study, showed that oppositional defiant disorder by self-report is not significantly different between adults with ADHD and controls.[6] However, the prevalence of both conduct disorder and depression is higher in adults with ADHD than in controls. Interestingly, the Milwaukee study was unable to document an increased rate of substance abuse in the ADHD group relative to the control group. People with ADHD are continuing to abuse substances, but, in the last decade in the United States, people in general have begun to abuse more substances. Consequently, no differences for substance abuse emerged between the ADHD group and the control group, particularly for alcohol, tobacco, and marijuana.

ADOLESCENCE AND ADULTHOOD OUTCOMES WITH ADHD

Educational Outcomes

Educational outcomes may be the area in which ADHD has the greatest impact. Data from the Milwaukee Young Adult Outcome Study (R.A.B.; M. Fischer, Ph.D.; L. Smallish, M.A.; et al., manuscript submitted), which were assessed by self-report and high school transcript, corroborated the educational outcomes from other follow-up studies. Young people with ADHD are more likely than controls to be held back (42% versus 13%), be suspended (60% versus 19%), and be expelled (14% versus 6%). While in school, many young people with ADHD have low grade point averages (C– to D+ range). In the Milwaukee study, high school dropout rates increased 4-fold among the ADHD group despite the availability of special educational services in the state of Wisconsin. Approximately 32% to 38% of adolescents with ADHD never complete their high school education, whereas the national average for adolescents who drop out of high school is 5%.[12] Not surprisingly, few people with ADHD enter college (22% in the Milwaukee study), and of those who do, only 5% actually graduate. The educational outcomes for people with ADHD negatively impact both the individual with ADHD as well as the whole of society.

Employment Outcomes

Individuals with ADHD are 3 times more likely to be fired from a job than individuals without ADHD (R.A.B.; M. Fischer, Ph.D.; L. Smallish, M.A.; et al., manuscript submitted). People with ADHD also change jobs at a rate of 2 to 3 times within a 10-year period. In the Milwaukee Young Adult Outcome Study (R.A.B.; M. Fischer, Ph.D.; L. Smallish, M.A.; et al., manuscript submitted), with participant permission, employers were interviewed about the presence of ADHD and oppositional defiant disorder in employees while at work. The employers reported increased rates of disorder symptoms on the job. Employers also provided overall work performance evaluations that reported employees with ADHD as having lower work performance ratings than employees without ADHD. By their 30s, 35% of people with ADHD are self-employed.[13]

Driving Outcomes

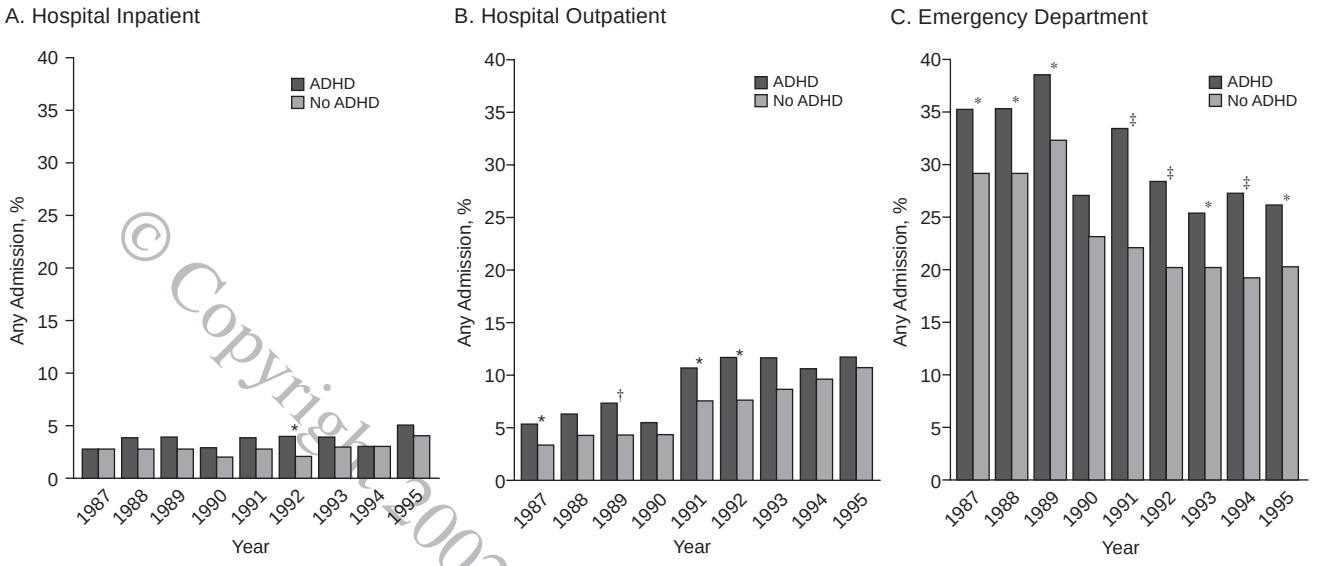
My colleagues and I[14] conducted a study to evaluate the driving outcomes for teenagers and young adults with ADHD. Twenty-five subjects had ADHD and 23 did not have the disorder; the age range for the groups was 17 to 30 years. Driving outcomes were assessed through structured interviews, self- and passenger reports, video tests of driving knowledge, computer-simulated driving tests, and driving records. We found that drivers with ADHD, as compared with drivers without ADHD, were more likely to be cited for speeding, have licenses suspended, be involved in crashes in general but also crashes that caused bodily injury, and be rated by themselves and passengers as having unsafe driving habits, such as erratic steering, false breaking, and slow reaction times.

Given these results, drivers with ADHD are likely to be at fault in the car accidents in which they are involved. Forty percent of drivers with ADHD have had at least 2 accidents by young adulthood compared with only 6% of drivers without ADHD.[15] The dollar damage amount for accidents involving drivers with ADHD is almost 3 times that of other drivers. Additionally, 60% of drivers with ADHD have had an accident with injuries, while 17% of other drivers have had accidents with injuries. Drivers with ADHD lose their licenses at a rate 3 times that of other drivers, and although most suspensions are the result of their poor driving records, drivers with ADHD may also lose their licenses because they cannot negotiate the judicial system as well as others. People with ADHD may not show up for their court appointment or they may not hire a lawyer. In short, they may be so disorganized that they do not attempt to defend themselves. When they fail to appear in court, their licenses are revoked. Thus, disorganization and an inability to deal effectively with the court system on the part of people with ADHD may account for the loss of some licenses.

Sexual and Reproductive Outcomes

Adolescents with ADHD begin having sexual intercourse early—at approximately 15 years.[3] They tend to have more sexual partners because they do not stay in relationships for long. This group is less likely than their peers to use contraception, which, of course, leads to a high rate of teen pregnancy and sexually transmitted disease. In the Milwaukee Young Adult Outcome Study, the ratio of the

Figure 2. Percentage of Children and Adolescents With and Without Attention-Deficit/Hyperactivity Disorder (ADHD) With 1 or More Hospital Admissions Per Year[a]



[a]Reprinted with permission from Leibson et al.[17] Asterisk indicates that differences between groups were statistically significant at $p < .05$; dagger, $p < .01$; and double dagger, $p < .001$.

number of births for the ADHD group to the control group was 42:1 by age 20 years. Less than half of those individuals with children had custody, with most of the children being raised by the mother's parents or being put up for adoption or sent to foster care. The rate for sexually transmitted disease was 4 times higher among the ADHD group compared with the control group.

HEALTH CARE OUTCOMES

ADHD is associated with increased health care costs even when controlled for psychiatric treatment. Kelleher et al.[16] compared the health care costs of children with ADHD with those of children with asthma. The difference between the total costs for each group was not significant, but the group with ADHD did have statistically significant higher drug costs and outpatient visits. Leibson et al.[17] compared the health care use and costs for children and adolescents (boys and girls) with and without ADHD. Children born from 1976 to 1982 were followed up through 1995; children with ADHD were identified as such through school and medical records. Cohorts with ADHD were more likely to have major injuries or asthma than cohorts without ADHD. Further, the ADHD group had more inpatient and outpatient hospital and emergency department admissions (Figure 2). The health care costs for children and adolescents with ADHD were double those of children and adolescents without the disorder. More research is needed on the health care outcomes for adults with ADHD.

FUTURE RESEARCH AND CONCLUSIONS

Future ADHD research should concentrate on areas and issues for which currently there are deficits in the literature. Research needs to be conducted to determine the outcomes for people with the predominately inattentive type of ADHD. Currently, the life course of this group is unknown, and, given that this disorder may be unique, more information on the inattentive subtype is necessary. The outcomes discussed in this article cannot be applied to that subtype.

As I mentioned earlier, most of the research discussed in this article has been concerned with boys and young men. The sex differences in ADHD need to be studied. The follow-up studies do not represent outcomes for girls and women as well as they should, so outcomes for women should be looked at more closely. The outcome findings for both men and women should be extended past the age of 30 years. No studies to date examine the impact of ADHD on child rearing or marital functioning. Another area that should be studied is the accident rate for adults with ADHD at home, at work, and in the community.

New research is beginning to determine the occupational costs associated with ADHD. Poor work performance and frequency of disorder symptoms on the job in employees with ADHD have been documented, so now specific measures of job function are being examined—particularly accidents, operation of equipment, sick days, and absenteeism. Occupational costs can be looked at in a variety of ways, and on the basis of what is already known

about people with ADHD and job performance, those costs will likely turn out to be substantial.

The impact of ADHD on life expectancy and risk for medical illness should also be assessed. Evidence in the cardiovascular literature[18] indicates that being in the lowest quartile of the population in impulse control is the single best predictor of death by all causes in the United States. Poor impulse control also predicts cardiovascular disease and cancer, as well as death by various other medical illnesses. Given the association of ADHD with poor impulse control, people with ADHD are probably at high risk for these illnesses and for shorter life expectancy.

Clearly, research on ADHD has not been exhausted. Because ADHD is not a benign disorder that disappears after childhood, people are affected by the disorder in major areas throughout their lives. In order for a more comprehensive understanding of this disorder to exist, groups such as those with the inattentive subtype, girls, and adults in midlife to late life need to be studied.

Disclosure of off-label usage: The author has determined that, to the best of his knowledge, no investigational information about pharmaceutical agents has been presented in this article that is outside U.S. Food and Drug Administration–approved labeling.

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