

Attention-Deficit/Hyperactivity Disorder

Can It be Recognized and Treated in Children Younger Than 5 Years?

Mark L. Wolraich, MD

The article describes the history of attention-deficit/hyperactivity disorder (ADHD) from when it was described in characters in a children's book to the current definition and diagnostic criteria. Furthermore, it describes the history of therapeutic interventions including psychosocial interventions, medications and school interventions, and the evolution of thinking of the ADHD as a neurobiological condition. The information specific to children younger than 5 years, as well as the implications of the history of the condition on this age group, is discussed. **Key words:** *history of attention-deficit/hyperactivity disorder, preschoolers*

ATENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD) has the distinction of being both the most extensively studied child mental disorder, and yet the most controversial. In recent years, interest in the condition has been extended to all age groups with an understanding that the disorder is life long. This understanding has led to an expansion of the age boundaries both above and below the prior considered school-age children so that there is an interest in pursuing diagnostic and treatment issues in adults and in children younger than 5 years. To understand its place with these children, it is important to understand the history and current state of the art of the ADHD.

Although the diagnosis of the ADHD has seemed to be a new condition, particularly because of the changes in its name over time, the ADHD actually has a long history. In the mid-19th century, the characteristics of the ADHD were described by Heinrich Hoffman, a German physician, and represented by 2 of

his characters—Fidgety Phil and Harry Who Looks in the Air—who appear in his children's book (Hoffman, 1848). In 1902, at a meeting of the Royal College of Physicians, George Still described a disease he characterized as resulting from a defect in moral character (Still, 1902). He noted that the problem resulted in a child's inability to internalize rules and limits, and in addition manifested itself in patterns of restless, inattentive, and overaroused behaviors. He suggested that the children had likely experienced brain damage but that the behavior could also arise from hereditary and environmental factors.

The belief in the association with brain damage increased in 1917-1918 following a worldwide epidemic of influenza with encephalitis, which in some recovering children resulted in symptoms of restlessness, inattention, impulsivity, easy arousability, and hyperactivity (Ebaugh, 1923; Hohman, 1922). When many cases were seen with similar behavioral manifestations, but no clear evidence of brain damage, the name of the disorder was changed to minimal cerebral/brain dysfunction/damage (MBD; Clements, 1966).

As the association with brain damage became less certain, the name was changed to be more behaviorally descriptive. The change is reflected in the psychiatric classification

From the OU Child Study Center, Oklahoma City, Okla.

Corresponding author: Mark L. Wolraich, MD, OU Child Study Center, 1100 NE 13th St, Oklahoma City, OK 73117 (e-mail: mark-wolraich@oubsc.edu).

system, where in the *Diagnostic and Statistical Manual of Mental Disorders, Second Edition (DSM-II)*, it was called hyperkinetic reaction of childhood disorder (American Psychiatric Association, APA, 1967). In 1980, because of the studies of Virginia Douglas and others (Douglas, 1974; Douglas & Peters, 1979), the focus again shifted from considering the primary problem to be hyperactivity to considering inattention as the primary deficit as reflected in the shift of the diagnostic label to attention-deficit disorder in *DSM-III* (APA, 1980), and, more recently, to attention-deficit/hyperactivity disorder in *DSM-III-R* (APA, 1987) and *DSM-IV* (APA, 1994). Recent hypotheses, such as that of Barkley (1997), have proposed further changes focusing on impulse control as to the primary deficit of the disorder, but have not yet resulted in any changes in its characterization or name.

Diagnostic criteria

While the basic core symptoms of inattention, hyperactivity, and impulsivity have remained consistent over time, the specific diagnostic criteria have changed to conform to the conceptual changes. This has had an impact on the prevalence rates that range from 1% to 14% (Brown et al., 2001; Szatmari, Offord, & Boyle, 1989), although are usually quoted as 3% to 5% (APA, 1994). With the recent changes in diagnostic criteria, there may be a further increase. Within the same samples, the prevalence rates of the ADHD increased from 2.6% for *DSM-III* to 6.1% for *DSM-III-R* (Lindgren et al., 1990), and from 9.6% to 17.8% (Baumgaertel, Wolraich, & Dietrich, 1995) and 7.2% to 11.4% (Wolraich, Hannah, Pinnock, Baumgaertel, & Brown, 1996) from *DSM-III-R* to *DSM-IV* just by changes in criteria. (Caution must be taken regarding the last 2 studies because the new criteria require a degree of pervasiveness and impairment not determined in these studies.)

An important factor contributing to the controversial nature of the ADHD is that the symptoms are not distinctly different behaviors such as delusions manifested in

individuals with psychotic disorders, but are appropriately occurring behaviors that occur inappropriately more frequently than the behaviors occur in most people and occur to the extent that they cause significant dysfunction in the individual. With such criteria, developmental and normative behaviors become much more prominent issues, and environmental contexts such as home or school have a major influence on the deliberations. The added criteria of "Some impairment from the symptoms is present in 2 or more settings," in the *DSM-IV* criteria of the ADHD (APA, 2000), was added to achieve compatibility between *DSM-IV* and the *ICD-10 Classification of Mental and Behavioural Disorders* of the World Health Organization (World Health Organization, 1992). Operationally, defining this criterion has been challenging in school-age children, and it is likely to be even more difficult in pre-school-aged children where environmental conditions vary to a greater extent.

Characterizing the heterogeneity of the disorder began with the change in focus to inattention as the primary deficit (APA, 1980). Under this definition, 2 subtypes were defined, *attention-deficit disorder with and without hyperactivity*. However, at the time that the *DSM* classification was revised (*DSM-III-R*), the impression was that there was not enough evidence to support the subtypes (APA, 1987). Subsequently, further research (Lahey & Carlson, 1991, 1994) provided evidence so that the revision to *DSM-IV* (APA, 1994) included 3 subtypes. There has also been some concern that the differences between inattention and hyperactivity define separate disorders rather than subtypes of the same disorder (Loney & Milich, 1982). The argument is that inattention is more of a cognitive or learning deficit while hyperactivity is more of a behavioral disorder.

Interventions

The benefits of stimulant medication were first reported in 1937 (Bradley, 1937), starting with benzedrine and focusing on children in inpatient residential care. There was

little activity subsequent to Bradley's work until the 1950s when clinicians rediscovered his work and methylphenidate was released for commercial use in 1957. Early studies set the guidelines for controlled studies to determine efficacy (Conners, 1966). By 1977, 62 double-blind placebo-controlled studies had been reported in the literature (Wolraich, 1977). Since that time, the number of controlled studies has increased, so that a review, utilizing rigorous research criteria and only including studies from 1981, found 123 studies (Miller et al., 1998) and by 1993 a "Review of reviews" reported more than 3000 citations and 250 reviews (Swanson et al., 1993). The initial interest was in dextroamphetamine. However, adverse publicity from its use, as a treatment for weight reduction and its addictive properties when used in that context, diminished its popularity about the time that methylphenidate became commercially available and known to clinicians. Only a small number (10) of studies have been completed in pre-school-aged children and these are reviewed in the article by Kollins and Greenhill in this special issue of the *Infants & Young Children (IYC)* (Kollins & Greenhill, 2006).

The psychological literature abounds with research pertaining to psychosocial interventions and behavior modification techniques for the children with ADHD (Pelham, Wheeler, & Chronis, 1998). Debate has existed over when to apply stimulant medication and/or psychosocial interventions. The uses of these interventions, in what order and to what extent as well as the extent of complimentary effects, remain a source of disagreement. Characteristics of all the interventions for children with ADHD including both stimulant medication and psychosocial interventions are that they are nonspecific in that while the treatments are efficacious for children with ADHD, children without the diagnosis respond similarly (Rapoport et al., 1978). The effects are symptomatic and not curative. Their effectiveness is mainly demonstrated as long as they are in effect, but have yet to be demonstrated to have any

lasting effects after being terminated. This lack of effect is most clearly demonstrated by the lack of long-term benefits of medication when used alone (Ingram, Hechtman, & Morgenstern, 1999).

Educational interest began in the 1940s and 1950s with the problem of educating children with "organic brain damage." Strauss and their associates started with a series of studies comparing brain-injured and non-brain-injured children with mental retardation (Strauss, 1941, 1944; Strauss & Werner, 1943) and developed educational interventions (Strauss & Kephart, 1955). While they primarily addressed children with brain injury, they included children with similar but milder patterns of deficits who had no definitive evidence of brain injury—children fitting the description of minimal brain damage.

The education community has continued to contribute significantly to the services provided to children with ADHD. Under the Individuals with Disabilities Education Act (IDEA, 1990) and the Rehabilitation Act (504 Regulations) (1973), school systems have had to provide adaptations in the classroom and special education services if needed for children with ADHD. Though not as extensive as psychopharmacologic or behavioral modification studies, research has been undertaken to address specific school intervention (eg, Shapiro, Dupaul, Bradley, & Bailey, 1996; Zentall & Dwyer, 1988; Zentall & Meyer, 1987). Manifestations before the age of 3 years have not been clearly identified, so that children rarely receive early interventions for a diagnosis of the ADHD without other co-occurring conditions.

Etiology

The ADHD is a heterogeneous disorder, whereby multiple etiologies can manifest similar behavioral symptoms. By far the most common cause has been genetic transmission. This is manifested in twin studies with a heritability of 0.75 (75% of the variance in phenotype can be attributed to genetic factors) (Gillis, Gilger, Pennigton, & DeFries, 1992; Gjone, Steveson, & Sundet, 1996;

Goodman & Stevenson, 1989; Hudziak et al., 1998; Levy, Hay, McStephen, Wood, & Waldman, 1997; Sherman, Iacono, & McGue, 1997). Family studies have also shown that relatives of adoptive children with ADHD are less likely to have the disorder (Alberts-Corush, Firestone, & Goodman, 1986; Morrison & Stewart, 1973), and biologic and first-degree relatives have a greater risk compared with controls (Biederman, Faraone, Keenan, Knee, & Tsuang, 1990; Hudziak et al., 1998; Morrison & Stewart, 1971). Most recently, specific gene associations have been identified in a portion of individuals with ADHD. These include the dopamine transporter gene (*DAT1*), the D4 receptor gene (*DRD4*), and the human thyroid receptor- β gene. (Cook et al., 1995; Gill, Daly, Heron, Hawi, & Fitzgerald, 1997; Hauser et al., 1993; Swanson et al., 1998).

Insults to the brain can also result in the behaviors characteristic of the ADHD. There is a higher incidence of the ADHD as well as learning disabilities among children who are born premature (Saigal, Rosenbaum, Szatmari, & Campbell, 1991). Traumatic injuries to the brain can also result in similar behaviors (Rutter, 1981). Exposures in utero, particularly to alcohol, cause ADHD symptoms, which in its severe form is manifested in fetal alcohol syndrome (Steinhausen, Williams, & Spohr, 1993). Exposures such as lead or infections such as meningitis in young children can also result in similar behavioral symptoms (Tuthill, 1996).

Mechanisms

Further progress has been made in identifying some of the preliminary central nervous system mechanisms. Studies of brain anatomy have demonstrated that, on average, individuals with ADHD have smaller prefrontal cortex, basal ganglia, or cerebellar vermis. Functional studies such as positron emission tomography, single photon emission computed tomography (SPECT), and functional magnetic resonance imaging (fMRI) have shown striatal hypoperfusion in individuals with ADHD compared with control individuals. On a neurotransmitter level, it is

clear that the functions relate to the dopamine and norepinephrine systems in the same areas of the brain identified by anatomical studies (Aylward et al., 1996; Castellanos et al., 1996; Filipek et al., 1997). The neurobiology as it pertains to pre-school-aged children is well described in the article by Valera and Seidman in this issue of the *IYC* (Valera & Seidman, 2006).

It is important to note that while research has progressed significantly in helping to identify possible underlying mechanisms in individuals with ADHD, the sophisticated assessment techniques now available do not help facilitate the clinical diagnosis. There are such wide variations in both individuals with ADHD and control individuals both in size and in activity, with an extensive enough overlap between the 2 groups, that the assessments cannot adequately predict who has the ADHD on an individual basis.

Research supports the premise that the ADHD is present from birth most frequently due to genetic factors or in a few cases due to early brain injury. This premise is reflected in the *DSM-IV* criteria that the symptoms must begin before the age of 7 years (APA, 1994). Despite the likelihood of the ADHD being present from birth, little research has been undertaken in younger children. In fact, almost all the studies to establish diagnostic criteria and almost all the research about the efficacy and safety of medication treatment have occurred in elementary school-age children, mostly boys (Brown et al., 2001).

The ADHD and pre-school-aged children

The problem is reflected in the diagnostic criteria defined by the *DSM* system—the current diagnostic standard—that does not provide for any variations in diagnostic criteria based on age or developmental level (APA, 2000). The same criteria derived from elementary school-age children studies are required for individuals whether they are of preschool age or even adults. Egger et al. have reviewed the applicability of the diagnostic criteria for pre-school-aged children and provided

some interesting new results (Egger, Kondo, & Angold, 2006), and Bussing et al. have drawn the distinctions between the ADHD and the temperament (Bussing, Lehninger, & Eyberg, 2006).

The expanding number of children participating in preschool programs and moving some of the school readiness curricula to those programs have likely increased the expectations for sustained attention and behavioral control at a younger age. At least anecdotally, it results in an increased number of preschool children with ADHD who become dysfunctional. Parents also have the increased pressure to have their children conform to the expectations of the preschool programs for fear that their children will be less ready for school if they do not receive the experience and because of the increasing need for childcare in 2-working-parent or single-parent families.

The preliminary studies as reviewed in the article by Kollins and Greenhill in this issue of the *IYC* suggest that stimulant medications are efficacious and safe for pre-school-aged children, but the evidence is limited (Kollins & Greenhill, 2006). The Federal Drug Administration has not revised its recommendations about the medications so that methylphenidate—the most studied and used in pre-school-aged children with ADHD—of the stimulant medications is only approved for those 6 years and older while dextroamphetamine—an earlier approved medication when requirements were less stringent—is approved down to those for age 3 years, despite that it has been less-well studied in pre-school-aged children and likely has a similar profile to methylphenidate. None of the new formulations or new medications appears to be under study for their safety and efficacy with pre-school-aged children forcing physicians and families to not to use them or to use them without the approval of the Food and Drug Administration (referred to as off-label use). The study reported by Kollins and Greenhill in this issue is the first of its kind multisite study of a psychotropic medication used to treat pre-school-aged

children with ADHD (Kollins & Greenhill, 2006).

It is clear from the article by Rappley in this issue that despite the limitations of current studies or the Food and Drug Administration recommendations, physicians are using the stimulant medications to treat preschool children with ADHD in what is referred to as off-label use, and their practices do not always even follow guidelines recommended to treat children with ADHD (Rappley, 2006). In addition, to better defining the safety and efficacy of medication for pre-school-aged children with ADHD, it will be important to have clearer guidelines for both the diagnosis and the treatment of pre-school-aged children with ADHD and to develop methods to help clinicians implement their practice procedures much as has been accomplished for elementary school-age children with ADHD.

Behavioral interventions are usually the first intervention employed with preschool children with behavior problems. A review of the evidence for their use is provided in this issue by Sonuga-Bark et al. (Sonuga-Bark, Thompson, Abikoff, Klein, & Brotman, 2006). Most of the previous studies have not specifically targeted pre-school-aged children with ADHD because of the difficulties of making the diagnosis in that age group. Dr Sonuga and his colleagues have identified the important issues when behaviors specific to the ADHD are not targeted.

The complement of articles in this special issue of the *IYC* would not be complete without including parents perspective. As highlighted in the American Academy of Pediatrics treatment guidelines for the ADHD (Perrin et al., 2001), it needs to be considered as a chronic illness. Although we have efficacious psychosocial and pharmacological treatments, none of the treatments are curative. Children and their families face long-term and changing challenges. It is critical to educate families and include them as partners in the therapeutic process. Therefore, it is essential to understand their perspective on identifying the ADHD as early as possible including when the children are of preschool age.

By compiling all the information about the current state of the art of diagnosing and treating children younger than 5 years who have the ADHD, the intent of this special issue is to provide the reader with the most comprehensive and current information to date on this topic. It is hoped that this in-

formation will help to improve the identification and treatment of young children with ADHD when the symptoms manifest themselves, and that it will encourage further research to improve how we appropriately identify and treat the ADHD in pre-school-aged children.

REFERENCES

- Alberts-Corush, J., Firestone, P., & Goodman, J. T. (1986). Attention and impulsivity characteristics of the biological and adoptive parents of hyperactive and normal control children. *American Journal of Orthopsychiatry*, 56, 413-423.
- American Psychiatric Association. (1967). *Diagnostic and statistical manual for mental disorders* (2nd ed.). Washington, DC: Author.
- American Psychiatric Association. (1980). *Diagnostic and statistical manual for mental disorders* (3rd ed.). Washington, DC: Author.
- American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed. Rev.). Washington, DC: Author.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- Aylward, E. H., Reiss, A. L., Reader, M. J., Singer, H. S., Brown, J. E., & Denckla, M. B. (1996). Basal ganglia volumes in children with attention deficit-hyperactivity disorder with normal controls. *Journal of Child Neurology*, 11, 112-115.
- Barkley, R. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin*, 121, 65-94.
- Baumgaertel, A., Wolraich, M. L., & Dietrich, M. (1995). Comparison of diagnostic criteria for attention deficit disorders in a German elementary school sample. *Journal of the American Academy of Child & Adolescent Psychiatry*, 34, 629-638.
- Biederman, J., Faraone, S. V., Keenan, K., Knee, D., & Tsuang, M. T. (1990). Family-genetic and psychosocial risk factors in DSM-III attention deficit disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, 29, 526-533.
- Bradley, C. (1937). The behavior of children receiving benzedrine. *American Journal of Psychiatry*, 94, 577-585.
- Brown, R. T., Freeman, W. S., Perrin, J. M., Stein, M. T., Amler, R. W., Feldman, H. M., et al. (2001). Prevalence and assessment of attention-deficit/hyperactivity disorder in primary care settings. *Pediatrics*, 107, e43.
- Bussing, R., Lehninger, F., & Eyberg, S. (2006). Difficult child temperament and attention-deficit/hyperactivity disorder in preschool children. *Infants & Young Children*, 19(2), 123-131.
- Castellanos, F. X., Giedd, J. N., Marsh, W. L., Hamburger, S. D., Vaituzis, A. C., Dickstein, D. P., et al. (1996). Quantitative brain magnetic resonance imaging in attention deficit-hyperactivity disorder. *Archives of General Psychiatry*, 53, 607-616.
- Clements, S. D. (1966). *Minimal brain dysfunction in children: Terminology and identification*. Washington, DC: US Department of Health, Education and Welfare.
- Conners, C. K. (1966). The effects of dexedrine on rapid discrimination and motor control of hyperkinetic children under mild stress. *Journal of Nervous and Mental Disease*, 142, 420-433.
- Cook, E. H., Jr., Stein, M. A., Krasowski, M. D., Cox, N. J., Olkon, D. M., Kieffer, J. E., et al. (1995). Association of attention deficit disorder and the dopamine transporter gene. *American Journal of Human Genetics*, 56, 993-998.
- Douglas, V. I. (1974). Differences between normal and hyperkinetic children. In C. Conners (Ed.), *Clinical use of stimulant drugs in children* (pp. 12-23). Amsterdam: Excerpta Medica.
- Douglas, V. I., & Peters, K. G. (1979). Toward a clearer definition of the attention deficit of hyperactive children. In G. Hale & M. Lewis (Eds.), *Attention and the development of cognitive skills*. New York: Plenum.
- Ebaugh, F. G. (1923). Neuropsychiatric sequelae of acute epidemic encephalitis in children. *American Journal of Diseases of Children*, 25, 89-97.
- Egger, H. L., Kondo, D., & Angold, A. (2006). The epidemiology and diagnostic issues in preschool ADHD: A review. *Infants & Young Children*, 19(2), 109-122.
- Filipek, P. A., Semrud-Clikeman, M., Steingard, R. J., Renshaw, P. F., Kennedy, D. N., & Biederman, J. (1997). Volumetric MRI analysis comparing subjects having attention deficit-hyperactivity disorder with normal controls. *Neurology*, 48, 589-601.
- Gill, M., Daly, G., Heron, S., Hawi, Z., & Fitzgerald, M. (1997). Confirmation of an association between attention deficit-hyperactivity disorder and a dopamine

- transporter polymorphism. *Molecular Psychiatry*, 2, 311-313.
- Gillis, J. J., Gilger, J. W., Pennigton, B. F., & DeFries, J. C. (1992). Attention deficit disorder in reading-disabled twins: Evidence for a genetic etiology. *Journal of Abnormal Child Psychology*, 20, 303-315.
- Gjone, H., Steveson, J., & Sundet, J. M. (1996). Genetic influence on parent-reported attention-related problems in a Norwegian general population twin sample. *Journal of the American Academy of Child & Adolescent Psychiatry*, 35, 588-596.
- Goodman, R., & Stevenson, J. A. (1989). A twin study of hyperactivity-II. The aetiological role of genes, family relationships and perinatal adversity. *Journal of Child Psychology and Psychiatry*, 30, 691-709.
- Hauser, P., Zimetkin, A. J., Martinez, P., Vitiello, B., Matochik, J. A., Mixson, J. A., et al. (1993). Attention deficit-hyperactivity disorder in people with generalized resistance to thyroid hormone. *New England Journal of Medicine*, 328, 997-1001.
- Hoffman, H. (1848). *Der Struwwelpeter*. Leipzig, Germany: Imself Verlag.
- Hohman, L. B. (1922). Post-encephalitic behavior disorder in children. *Johns Hopkins Hospital Bulletin*, 33, 372-375.
- Hudziak, J. J., Heath, A. C., Madden, P. F., Reich, W., Bucholz, K. K., Slutske, W., et al. (1998). Latent class and factor analysis of DSM-IV ADHD: A twin study of female adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, 37, 848-857.
- Individuals with Disability Education Act of 1990, 20 U.S.C. 1400 *et seq.*
- Ingram, S., Hechtman, L., & Morgenstern, G. (1999). Outcome issues in ADHD: Adolescent and adult long-term outcome. *Mental Retardation and Developmental Disabilities Research Reviews*, 5, 243-250.
- Kollins, S. H., & Greenhill, L. (2006). Evidence base for the use of stimulant medication in preschool children with ADHD. *Infants & Young Children*, 19(2), 132-141.
- Lahey, B. B., & Carlson, C. L. (1991). Validity of the diagnostic category of attention deficit disorder without hyperactivity: A review of the literature. *Journal of Learning Disabilities*, 24, 110-120.
- Lahey, B. B., & Carlson, C. L. (1997). Attention deficit disorder without hyperactivity: A review of research relevant to DSM-IV. In T. A. Widiger, A. J. Frances, H. A. Pincus, W. Davis, & M. First (Eds.), *DSM-IV sourcebook* (Vol. 1, pp. 163-188). Washington, DC: American Psychiatric Press.
- Levy, F., Hay, D. A., McStephen, M., Wood, C., & Waldman, I. (1997). Attention deficit-hyperactivity disorder: A category or a continuum? Genetic analysis of a large-scale twin study. *Journal of the American Academy of Child & Adolescent Psychiatry*, 36, 737-744.
- Lindgren, S., Wolraich, M. L., Stromquist, A., Davis, C., Milich, R., & Watson, D. (1990). *Diagnostic heterogeneity in attention deficit hyperactivity disorder*. Paper presented at the Fourth Annual NIMH International Research Conference on the Classification and Treatment of Mental Disorders in General Medical Settings, Bethesda, MD.
- Loney, J., & Milich, R. (1982). Hyperactivity, inattention, and aggression in clinical practice. *Advances in Developmental and Behavioral Pediatrics*, 3, 113-147.
- Miller, A., Lee, S. K., Raina, P., Klassen, A., Zupanich, J., & Olsen, L. (1998). *A review of therapies for attention deficit/hyperactivity disorder*. Vancouver, BC, Canada: Research Institute for Children's and Women's Health and University of British Columbia.
- Morrison, J. R., & Stewart, M. A. (1971). A family study of the hyperactive child syndrome. *Biological Psychiatry*, 3, 189-195.
- Morrison, J. R., & Stewart, M. A. (1973). The psychiatric status of the legal families of adopted hyperactive children. *Archives of General Psychiatry*, 28, 888-891.
- Pelham, W. E. J., Wheeler, T., & Chronis, A. (1998). Empirically supported psycho-social treatments for attention deficit hyperactivity disorder. *Journal of Clinical Child Psychology*, 27, 190-205.
- Perrin, J. M., Stein, M. T., Amler, R. W., Blondis, T. B., Feldman, H. M., Meyer, B. P., et al. (2001). Clinical practice guideline: Treatment of the school-aged child with attention-deficit/hyperactivity disorder. *Pediatrics*, 108, 1033-1044.
- Rapoport, J. L., Buchsbaum, M. S., Zahn, T. P., Weingartner, H., Ludlow, C., & Mikkelsen, E. J. (1978). Dextroamphetamine: Cognitive and behavioral effects in normal prepubertal boys. *Science*, 199, 560-563.
- Rappley, M. D. (2006). Actual psychotropic medication use in preschool children. *Infants & Young Children*, 19(2), 154-163.
- Rehabilitation Act of 1973, 29 U.S.C. 701 *et seq.*
- Rutter, M. (1981). Psychological sequelae of brain damage in children. *American Journal of Psychiatry*, 138, 1533-1544.
- Saigal, S., Rosenbaum P, Szatmari P, & Campbell D. (1991). Learning disabilities and school problems in a regional cohort of extremely low birth weight (<1000 g) children: A comparison with term controls. *Journal of Developmental and Behavioral Pediatrics*, 12, 294-299.
- Shapiro, E. S., Dupaul, G. J., Bradley, K. L., & Bailey, L. T. (1996). A school-based consultation program for service delivery to middle school students with attention-deficit/hyperactivity disorder. *Journal of Emotional and Behavioral Disorders*, 4, 73-81.
- Sherman, D. K., Iacono, W. G., & McGue, M. K. (1997). Attention deficit-hyperactivity disorder: A twin study of inattention and impulsivity-hyperactivity. *Journal of the American Academy of Child & Adolescent Psychiatry*, 36, 745-753.

- Sonuga-Bark, E., Thompson, M., Abikoff, H., Klein, R., & Brotman, L. M. (2006). Nonpharmaceutical interventions for preschool children with ADHD: The case for specialized parent training. *Infants & Young Children, 19*(2), 142-153.
- Steinhausen, H., Williams J, & Spohr H. L. (1993). Long-term psychopathological and cognitive outcome in children with fetal alcohol syndrome. *Journal of the American Academy of Child & Adolescent Psychiatry, 32*, 990-994.
- Still, G. F. (1902). The Coulstonian lectures on some abnormal physical conditions in children. *Lancet, 1*, 1008-1012.
- Strauss, A. A. (1941). The incidence of central nervous system involvement in higher grade moron children. *American Journal of Mental Deficiency, 45*, 548-554.
- Strauss, A. A. (1944). Ways of thinking in brain-crippled deficient children. *American Journal of Psychiatry, 100*, 639-647.
- Strauss, A. A., & Kephart, N. C. (1955). *Psychopathology and education of the brain-injured child* (Vol. 2). New York: Grune and Stratton.
- Strauss, A. A., & Werner, H. (1943). Comparative psychopathology on the brain-injured child and the traumatic brain-injured adult. *American Journal of Psychiatry, 99*, 835-838.
- Swanson, J. M., McBurnett, K., Wigal, T., Pfiffner, L. J., Lerner, M. A., et al. (1993). Effect of stimulant medication on children with ADD: A "Review of Reviews." *Exceptional Children, 60*, 154-162.
- Swanson, J. M., Sunohara, G. A., Kennedy, J. L., Regino, R., Fineberg, E., Wigal, T., et al. (1998). Association of the dopamine receptor D4 (DRD4) gene with a refined phenotype of attention deficit-hyperactivity disorder (ADHD): A family-based approach. *Molecular Psychiatry, 3*, 38-41.
- Szatmari, P., Offord, D. R., & Boyle, M. H. (1989). Ontario child health study: Prevalence of attention deficit disorder with hyperactivity. *Journal of Child Psychology and Psychiatry, 30*, 219-230.
- Tuthill, R. W. (1996). Hair lead levels related to children's classroom attention-deficit disorder. *Archives of Environmental Health, 51*, 214-220.
- Valera, E. M., & Seidman L. J. (2006). Neurology of ADHD in preschoolers. *Infants & Young Children, 19*(2), 94-108.
- Wolraich, M. L. (1977). Stimulant drug therapy in hyperactive children: Research and clinical implications. *Pediatrics, 60*, 512-518.
- Wolraich, M. L., Hannah, J. N., Pinnock, T. Y., Baumgaertel, A., & Brown, J. (1996). Comparison of diagnostic criteria for attention deficit hyperactivity disorder in a county-wide sample. *Journal of the American Academy of Child & Adolescent Psychiatry, 35*, 319-323.
- World Health Organization. (1992). *The ICD-10 classification of mental and behavioural disorders*. Geneva: Author.
- Zentall, S. S., & Dwyer, A. M. (1988). Color effects on the impulsivity and activity of hyperactive children. *Journal of School Psychology, 27*, 165-174.
- Zentall, S. S., & Meyer, M. J. (1987). Self-regulation of stimulation for ADD-H children during reading and vigilance task performance. *Journal of Abnormal Child Psychology, 15*, 519-536.

Current articles- http://depts.washington.edu/isei/iyc/iyc_comments.html

To view previously posted articles: http://depts.washington.edu/isei/iyc/iyc_previous.html