



RESEARCHERS ON **AD/HD** RESEARCH

Introduction by Anne Teeter Ellison, EdD

DESPITE FREQUENT SENSATIONAL MEDIA PORTRAYALS to the contrary, there is more than a hundred years of research documenting the existence of AD/HD and offering answers as to the best ways to treat the neurobiological disorder. In the 1970s, for example, there were over two thousand studies published on AD/HD. But this was always somehow lost in translation. Despite the incredible gains in our scientific understanding, generations of people were undiagnosed and untreated.

After opening its doors in 1987, CHADD began sharing information from the scientific community with families and individuals affected by AD/HD. Through support groups at the local level, national conferences, parent and teacher training programs, an award-winning magazine, and a widely accessed Web site, CHADD has made a significant impact on public awareness of AD/HD.

The 21st century promises remarkable progress that will no doubt alter the way people view, diagnose, and treat

AD/HD. Our understanding of genetics is growing by leaps and bounds and impressive developments in technology

will produce more discoveries by offering a window into the brain. We are now more likely to discuss and research issues important to Hispanics/Latinos, women, African Americans, and other historically disenfranchised groups (though disparities in research and treatment certainly continue). It's a cliché to say it, but we truly don't know exactly how all of these revolutionary developments will shape the distant future. But we can stop and celebrate scientific findings to this point and contemplate what needs to happen next.

To accomplish that goal, *Attention* asked some of the nation's leading researchers, experts on a variety of topics surrounding AD/HD, to talk about two or three research findings that have improved society's understanding of AD/HD. We also asked them how we could improve on the next stage of

AD/HD research. And then we posed to them the most important question of all: What will these answers mean to people affected by AD/HD? In the end, our social movement is only as strong as the research that is produced. Current research findings tell us about how best to diagnose and treat AD/HD, and in the future may unlock new ways to prevent its occurrence. The future promises innovative approaches that will improve the lives of individuals affected by AD/HD. We must keep asking the right questions and making sure our government is funding research to answer those questions. Here's to more research. Here's to the future. Here's to you!

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Attention editors **Bryan Goodman, MA**, and **Susan Buningh, MRE**, compiled and edited the contributions from leading researchers on AD/HD.



Multimodal Treatment

AMONG THE NUMEROUS FINDINGS from the two major AD/HD multimodal treatment studies—the National Institute of Mental Health Multimodal Treatment Study of Children with AD/HD (MTA) and the NY/Montreal Medication and Psychosocial Treatment (MPT)—there are a few that stand out. First, the intervention associated with the most improvement in AD/HD symptoms is pharmacotherapy. However, the optimal benefits of stimulant treatment are less likely to occur with the use of typical community-based medication management strategies. The MTA and MPT have identified medication management guidelines that increase the likelihood that optimal AD/HD symptom reduction will be achieved and maintained. Notably, once stimulant treatment is no longer provided by research clinicians, the relative benefits of medication compared to behavioral treatment begin to diminish and are no longer present after two years. This finding emphasizes the importance of implementing strategies to sustain clinical gains following the completion of intensive treatment, be it pharmacotherapy or behavior therapy. To this end, research that focuses on the development, evaluation, and comparison of various maintenance strategies is called for. Related to that, generalization of treatment effects across settings remains a primary yet still relatively elusive goal of AD/HD intervention research. Systematic research efforts to improve generalization effects are needed as are investigations of whether individuals with AD/HD have a basic deficit in the ability to generalize. If so, it will be important to ascertain the basic mechanisms associated with a “generalization deficit” and to consider the potential treatment implications of these findings.

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Alternative / Complementary Treatments

ONE MAJOR ADVANCE in AD/HD research in the past decade has been the increased number and quality of studies for most alternative/complementary treatments, and the increased interest and willingness of mainstream respected investigators to examine them. Although many of the studies have flaws, the general quality has improved (albeit in a spotty manner), with features such as double-blinding, random assignment, more valid data analyses, and clinically relevant outcome measures.

There are now at least seven reasonable studies of long-chain

polyunsaturated fatty acids, with several showing modest positive effects. A trend seems to be emerging that a mixture of EPA, DHA, and gamma-linolenic acid may be better than either DHA or GLA alone. The importance of this is that these supplements are reasonably cheap and safe if taken as directed (as long as the fish oil is mercury-free), have known cardiovascular benefits, and are compatible with conventional treatments, so that provisional clinical use while awaiting definite proof for AD/HD seems acceptable. A third advance is the accumulation of controlled studies suggesting sensitivity to food dyes and preservatives (about ten since 1990), capped by three studies in the United Kingdom demonstrating a small but significant deleterious effect for children in general, not just those with AD/HD. Although the effect was modest, the fact that it applies to the whole population gives it enough public health import to justify negotiations to get artificial dyes out of edibles intended for children.

The next steps in studying alternative and complementary treatments should be (a) large multisite trials for those that have promising controlled pilot data; (b) randomized pilot trials (double-blind where possible) of treatments that don't already have such; and (c) comparisons not only to placebo, but also to standard treatment and the combination of standard treatment and the complementary treatment.

Unanswered major questions include: How much quality control is needed for treatments with a generous safety margin? What nutritional support is needed with medications that decrease appetite and might have unknown effects on nutrient metabolism? What treatments or combinations of treatment can be devised for the small percent who are unresponsive to current established treatments?

L. Eugene Arnold, MD, MEd, professor emeritus of psychiatry at Ohio State University, currently serves as chair of the steering committee for the NIMH Multimodal Treatment Study of Children with AD/HD. Arnold is a member of CHADD's professional advisory board and the editorial advisory board of *Attention* magazine.



AD/HD Through The Lifespan

UNDOUBTEDLY, the three research findings that have improved our understanding of AD/HD have been (1) *the advances in understanding the nature and cause of AD/HD*. For instance, among the fastest growing areas of research has been the genetic contribution to AD/HD and specifically identifying candidate genes and their interactions with environmental factors (biohazards) that affect the inherited variant of AD/HD. Related to these advances have been those in the neuroimaging of AD/HD and the networks that mediate the expression of the disorder. And with these advances have come those in the neuropsychology of AD/HD broadening our understanding to include the executive functions, such as working memory, and the self-regulation that they provide to human behavior. (2) *The development of new medication delivery systems and new medicines for AD/HD*. The science and technology behind these advances have been nothing short of amazing as we now have the five P delivery systems—pills, pellets (time release), pumps, patches, and prodrugs—along with the new drug, atomoxetine. And (3) *the rapid development of knowledge about the adult outcomes of children with AD/HD combined with that on clinic-referred adults with AD/HD*.

We should broaden the array of accommodations and nonmedical treatments for AD/HD beyond the traditional behavioral ones by

- › conducting further research on new promising psychosocial treatments for AD/HD, such as training working memory, time management training of children through teachers and parents, cognitive behavioral training for adults with AD/HD, after-school supplemental services for teens with AD/HD, etc.
- › targeting the problems associated with compliance with or adherence to treatments during the crucial transitional years of adolescence into adulthood.
- › evaluating the impact of AD/HD in adults in the workplace, marriage, child-rearing, and other important major life activities that remain understudied.
- › exploring in far more detail the link recently identified between AD/HD and risk for cardiovascular disease specifically and general health maintenance in adulthood more generally.

Future research may provide answers to the following important questions: What are the genes for AD/HD and how do they function to alter behavior and produce the symptoms of the disorder? Once identified, can these be translated into genetic testing in clinics for aid with diagnosis, subtyping, selection of medications, and understanding and preventing life-course risks? Will these mechanisms lead to safer and more effective medications and

even nonmedical treatments given that genes have recently been found that appear to mediate response to behavioral interventions? Can we reduce the portion of

AD/HD prevalence that arises from nongenetic sources, such as maternal smoking and drinking, prematurity, maternal infections, etc.? Just how is AD/HD related to the brain's executive functions, and does this mean that AD/HD is EFDD (executive function deficit disorder) or a developmental disorder of self-regulation (DDSR)? Can alternative pathways to successful occupational and social functioning be identified and implemented during adolescence that do not rely so heavily on general academic performance for the college-bound individual (i.e., vocational-technical training, training for entrepreneurial enterprises, opportunities in self-employment, etc.)? How can family members be empowered to assist patients with AD/HD who are uncooperative with traditional AD/HD interventions?

Russell A. Barkley, PhD, is research professor of psychiatry at the State University of New York Upstate Medical University at Syracuse.



AD/HD in Spanish-Speaking Communities

OVER THE PAST FEW YEARS, researchers have refuted a monolithic characterization of AD/HD and have sought to conceptualize it as a highly genetic disorder with diverse causes, heterogeneous symptoms, and persistent yet differing manifestations across development. Mounting genetic and behavioral research suggests that AD/HD interferes with self-regulation, affects cognitive development, and impairs effective adaptation to the social environment. However, limited research has explored how culture and the social context may trigger the genetic expression of AD/HD and shape the diagnosis and treatment of AD/HD symptoms within Spanish-speaking communities, as well as others. This omission needs to be addressed in future studies. Research in this area will help us to identify differences across cultural groups in the expression of AD/HD symptoms, as well as the risk and protective factors associated with optimal psychosocial functioning.

Among the numerous research questions that remain unanswered, the most pressing is an understanding of how genetic and contextual factors are interrelated in the onset and development of AD/HD; in other words, which genes and environmental factors interact to increase the risk of developing AD/HD and its associated impairments, and how. Answers to this complex question will help to prevent

AD/HD and guide development of tailor-made treatment programs for those living with this condition and their families, as well as how to integrate culturally specific treatment strategies for multiple populations.

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Executive Functions

OVER THE PAST DECADE, research findings have provided impressive evidence of the fact that AD/HD is a developmental disorder that powerfully impacts a large number of adolescents and adults, as well as young boys and girls, around the world. Studies have also shed helpful light on how medication treatments often can alleviate AD/HD symptoms. New imaging techniques are beginning to offer clues about the many interacting aspects of the brain implicated in this disorder.

Gradually, many are recognizing that AD/HD is not a simple behavior disorder but a developmental impairment of the brain's executive functions, its self-management systems. Many with AD/HD have never had any significant behavioral problems; attentional problems are far more impairing and persistent for most. Much remains to be learned about the complexities of cognitive management functions that underlie the multiple impairments of AD/HD in daily life.

Current diagnostic criteria for AD/HD include nothing about problems with management of emotion, yet most clinicians recognize that impairments in motivation and emotional regulation are a major burden for most patients with AD/HD across the lifespan. We need research to develop a clearer understanding of how to sort out and treat problems of motivation and emotional regulation characteristic of most persons with AD/HD.

An even larger problem is to gain a clearer understanding of how impairments of AD/HD are related to other disorders. Some researchers are beginning to recognize the role of attentional problems in reading disorders and other specific learning disorders; they can see that treatment of associated attentional problems may be necessary, though not sufficient, to alleviate dyslexia and other learning disorders. Other researchers are struggling to sort out questions about how to identify, understand, and treat mood disorders, autistic spectrum disorders, anxiety disorders, and other syndromes that often overlap and/or are comorbid



with AD/HD. Hopefully such studies will eventually guide us to develop more effective assessments and treatments for the many children, adolescents, and adults who continue to suffer from complicated versions of AD/HD.

Thomas E. Brown, PhD, is assistant clinical professor of psychiatry at the Yale University School of Medicine and associate director of the Yale Clinic for Attention and Related Disorders.

African Americans and AD/HD

AFRICAN-AMERICAN CHILDREN have rates of AD/HD comparable to their Caucasian peers, yet they are less likely to receive treatment. This is particularly concerning because African-American children appear to be at higher risk for adverse social consequences of AD/HD, such as school disciplinary referrals and poor educational outcomes. Lower access to AD/HD treatment for African-American children may in part reflect cultural differences in such domains as parental explanatory models of AD/HD, mental disorder stigma perceptions, and acceptability of empirically supported AD/HD treatments (medications and behavioral interventions).

Against this background, the 2003 study by Gene Arnold et al. provides us with important information about the effects of ethnicity on treatment attendance and 14-month outcomes in the Multimodal Treatment Study of Children with AD/HD. Their analysis showed that African-American and Latino children responded equally well to treatment as matched Caucasian peers, and that ethnic minority families cooperated with and benefited significantly from combination treatment. This incremental benefit from behavior management was still significant after controlling for potentially confounding sociodemographic factors such as mother's education, single-parent status, and poverty.

Given that empirically supported AD/HD treatments work as well for African-American children as for their Caucasian counterparts, the next important research question is how we can improve access to these treatments and which factors should we target

(e.g., AD/HD knowledge and beliefs, stigma perceptions, perceived acceptability and effectiveness of interventions) and at what level (e.g., individual parent, child, or adolescent; community; faith-based groups; school-based), to reduce disparities. For this work to succeed, community-based participatory research designs are particularly promising.

Regina Bussing, MD, professor of psychiatry at the University of Florida, is a member of CHADD's professional advisory board. She worked with CHADD and experts from across the country on a consensus statement on AD/HD in the African-American community.

Prevention Strategies

RESEARCH OVER THE PAST DECADE has supported the assumption that the combination of stimulant medication and behavioral interventions is optimal for enhancing children's academic and social functioning. In particular, this combination may allow the usage of lower dosages of both treatments than is possible when either medication or behavior therapy is used in isolation. Further, we have learned that stimulant medication is

effective for reducing AD/HD symptoms in preschoolers; however, this treatment approach may lead to greater side effects than among older children, may be less acceptable to parents, and has not been demonstrated to have an impact on functioning outside of symptom reduction. Thus, the next generation of treatment outcome studies needs to emphasize the impact of interventions on critical functional impairments (i.e., beyond symptom reduction) and account for individual variation in response to treatment. Further, we need to identify strategies that can help to prevent functional impairments and comorbid disorders (e.g., conduct disorder) in young children with AD/HD, as well as to develop methods to enhance the likelihood that empirically supported interventions will actually be used in the community, especially in schools and homes.

George J. DuPaul, PhD, is professor of school psychology and coordinator of the school psychology program at Lehigh University.

International Findings

THE INCREASING PUBLISHED LITERATURE over the past decade has contributed to our understanding and appreciation that AD/HD is a condition that transcends not just age, development, race, ethnicity, religion, gender, and socioeconomic status, but also geographic location. In the past ten years studies on the epidemiology, symptom presentation, impairments, and course of AD/HD have been published with data generated from six continents. The current challenge is to generate more and better research exemplifying the course of AD/HD through the lifespan. In particular, we need to better understand the protective factors within the person, environment, and culture able to reduce the adverse risks and impairments many individuals with AD/HD experience. This research will lead to better treatments as well as to a much better understanding of how to improve the quality of life and happiness for individuals with AD/HD.

Sam Goldstein, PhD, a member of the faculties of the University of Utah and George Mason University, is clinical director of the Neurology, Learning, and Behavior Center in Salt Lake City, and editor of the Journal of Attention Disorders. Goldstein is a contributing editor to Attention magazine and a member of its editorial advisory board.

Translating Research Into Practice

OVER THE LAST DECADE we have made three very important advances in our understanding of AD/HD. Appropriately understood, these advances offer enormous hope and help for parents of children affected by AD/HD. First, as shown in the NIMH Multimodal Treatment Study of Children with AD/HD (MTA), we now have a good handle on which of the



available treatments work best for children with AD/HD. Thus, the MTA study essentially showed that carefully managed medication was superior to hundreds of hours of psychosocial interventions delivered at home and school, using the leading alternative treatment, behavior therapy. Second, through the MTA we also learned that many children, especially those with the most severe, complex, and/or comorbid forms of AD/HD, benefited most by medication plus behavior therapy, essentially restating the adage coined by Gabriele Weiss, “pills do not create skills.” With both treatments together—the multimodal approach—children with social skills deficits, family conflict, and/or learning difficulties received even greater benefit than with medication alone. The third major finding emerging from the MTA study is that these treatments, while powerful and helpful in their own right, must be continued for many children, rather than stopped after 14 months, as was done in the MTA study.

Together, these three findings lead us to areas where additional research is needed: Why do some children show substantial and sustained benefit from 14 months of treatment, essentially allowing them to lead relatively normal lives from that point forward, while others slip back into many of the difficulties that initially brought them to treatment? Here again, findings from the MTA are illuminating: The data indicate that in some instances, parents and children are able to

create a successful path forward, finding hope and success in working around the child’s difficulties. But in other instances, perhaps where families are under severe stresses, the child’s difficulties pose a severe threat to both the child’s and parents’ views and hopes about the child’s future. Despair and defeat appear to settle in for the long run, as the child’s future seems to be guided by self-fulfilling prophecies of future failure.

Future research on AD/HD outcomes will need to tackle this thorny problem: How do we create hope and healing in highly stressed, overwhelmed families? What is the role of community supports or other, yet-to-be-discovered treatments in helping the whole family overcome cycles of parental depression and despair, and persistent youth beliefs that they cannot succeed? It is now clear that

AD/HD does not mean an inevitable prediction of poor outcomes. Many, perhaps even most children, will do reasonably well and go on to lead successful lives. But for some children the effects of AD/HD appear to lead to lifelong scars. Learning how to intervene more effectively for these children constitutes our greatest challenge for the future.

Peter Jensen, MD, is the director and CEO of the REACH Institute (Resources for Advancing Children’s Healthcare). He was associate director of child and adolescent research at NIMH and lead investigator on the MTA study.

AD/HD in Women and Girls

UNTIL THE LAST DECADE, issues pertaining to gender differences in AD/HD were largely ignored. The majority of girls and women with AD/HD remained undiagnosed or misdiagnosed, and coexisting conditions were seen as primary rather than secondary or coexisting with AD/HD. Recent research looking more closely at AD/HD in females has uncovered some very interesting and unexpected findings.

A 2006 study confirms that girls with AD/HD are 5.4 times more likely to be diagnosed with a major depression and three times more likely to be treated for depression prior to their AD/HD diagnosis. Coexisting conditions in women with AD/HD are often different from those seen in men. Results from two recent clinical trials in adults with AD/HD have helped to shed additional light on gender differences. In these studies, women were found to have significantly more affective symptoms with higher scores on rating scales for both anxiety and depression. In addition, they were found to have more sleep disorders. In a completely different area, two recent studies of adolescent girls previously diagnosed with AD/HD found a significant incidence of eating disorders at follow-up. A large prospective study of adolescent girls with and without AD/HD (controls) found that those with

AD/HD were 3.6 times more likely to develop an eating disorder, defined as either anorexia or bulimia nervosa. In a second study, 93 adolescent girls seen at a five-year follow-up were assessed for eating disorders. In this study, baseline impulsivity symptoms best predicted adolescent eating pathology, as did the diagnosis of

AD/HD-combined type. In addition, peer rejection and parent-child relationship patterns were seen as predictive of eating disorders in these girls with AD/HD.

This emerging picture of higher rates of comorbidities associated with AD/HD in females, particularly depression and eating disorders, only underscores the psychological suffering females with AD/HD experience as they struggle to meet gender role norms and to deal with their AD/HD on a daily basis. The interplay of these conditions needs to be more closely examined in order to accurately paint the clinical picture of AD/HD in females.

Patricia O. Quinn, MD, a developmental pediatrician and clinical assistant professor of pediatrics at Georgetown University Medical Center, is cofounder and director of the National Center for Girls and Women with ADHD.

Adults with AD/HD

ALTHOUGH PUBLISHED STUDIES documenting that AD/HD persists into adulthood can be traced back to 1967, adult AD/HD has only been widely researched in the past decade or so. Two research tracks that have been instrumental in establishing the validity of the clinical syndrome in adults are those that have documented both the prevalence and life impairments associated with adult AD/HD. Recent research indicates that 4.4 percent of the adult population in the United States and 3.4 percent of a diverse international sample fulfill diagnostic criteria for AD/HD. More relevant for the day-to-day lives of these adults are numerous studies shedding light on the profound difficulties and impairments associated with adult AD/HD, such as increased risk for depression, anxiety, and substance abuse, difficulties functioning in school or at work, relationship and parenting problems, as well as wide ranging problems with money management, disorganization, and managing personal affairs.

Being a clinician-researcher, it is of particular interest that adult AD/HD research suggests that very few adults with AD/HD receive specialized treatment, numbering as low as one in ten adults with AD/HD. This is discouraging because there have been promising results obtained in clinical outcome studies of treatments for adult AD/HD. Medications have emerged as a highly effective treatment option. However, because of the pervasive negative effects of AD/HD on adult life, medications alone may be insufficient treatment for many individuals. Consequently, there has been growing interest in the development and research of non-medication treatments that focus on reducing impairments in daily life. Psycho-social treatments, namely both group and individual cognitive-





behavioral therapy, have produced consistently positive results. An emerging learning strategy and instructional approach for college students with AD/HD has yielded positive initial results, and a variety of other adjunct treatments have produced a range of outcomes from promising to disappointing.

A criticism of past research on AD/HD in children was that it was conducted predominantly with Caucasian boys. It is encouraging that adult studies, particularly psychosocial treatment studies, have included a large number of women with AD/HD. However, extant studies have not reflected the range of diversity of adults with AD/HD in terms of ethnicity, income status, education, and impairment. For example, psychosocial outcomes studies have generally been conducted at clinics specializing in the assessment and treatment of adult AD/HD. However, virtually all of these studies have been conducted without external research funding, which means that the participants were those adult AD/HD patients who could find and afford specialized treatment. Consequently, while the positive outcomes are encouraging, we do not have data on the effectiveness of these treatments for the most severely impaired adults with AD/HD, who might be unemployed, not have insurance, etc. Thus, it will be important to conduct clinical outcome studies that can reach the estimated 90 percent of adults with AD/HD who do not receive specialized treatment.

There are numerous questions yet to be answered regarding adult AD/HD that span the gamut of research programs, including genetics, neurobiological functioning and neuroimaging, areas of life impairment, and the unique symptoms of adult AD/HD that characterize the syndrome, to name a few. However, an important domain of research with direct relevance to the lives of adults with AD/HD is treatment outcome research. Ongoing pharmacotherapy studies will provide important information on medication treatments, including new agents and combination regimens to address AD/HD and co-existing mood and anxiety issues. There are a wide range of non-medication treatments for adult AD/HD designed to address various areas of impairment that will need to be subjected to well-designed, rigorous research, including psychosocial treatments,

AD/HD coaching, academic interventions, neurofeedback and working memory training, and the assortment of complementary and alternative treatments. Identifying effective treatments and disseminating professional treatment guidelines for adult AD/HD will improve standard clinical services and, in turn, improve the quality of life for adults with AD/HD.

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Neuroimaging

THERE HAVE BEEN TWO MAJOR overall advances in our understanding of AD/HD: first, the biological reality of AD/HD has now been firmly established through a combination of brain imaging and genetic research. Studies looking at brain structure suggest that there is a reduction in the volume of the brain in AD/HD and an overall delay in its development, particularly in the frontal lobes. Studies looking at brain function also suggest that the frontal brain activity differs greatly in AD/HD, and so studies of brain structure and function are pointing to the same brain regions for us to look at in more depth in the future.

As people living with AD/HD will know, the long-term course can be very variable. Some people get better, some remain very symptomatic into adulthood, and some show partial improvement. By understanding the brain basis for this variable outcome we might be able to eventually use brain imaging to help us predict clinical outcome and also to focus treatment on those most likely to struggle with their AD/HD symptoms. Similarly, we need to understand how genetic variations which increase the likelihood of having AD/HD act in the brain. This might help us develop entirely new treatment approaches.

Philip Shaw, MD, PhD, a staff clinician at the National Institute of Mental Health, leads the child psychiatry branch's research into AD/HD. **Jay Giedd, MD**, head of neuroimaging for the NIMH child psychiatry branch, has been the lead investigator on the largest neuroimaging studies exploring the neurobiological basis of AD/HD.

Cognitive Research

FIRST, STUDIES OF TOLERANCE to stimulants have challenged the flat drug delivery profile and led to the first generation of very effective controlled-release medications, which are designed to release the drug in an ascending pattern across the day. Thanks to this development, it is no longer necessary or common to administer medication during the school day, as it was less than a decade ago. This is a major development that affects millions of parents, school officials, and children each day. Secondly, brain imaging studies in adults have challenged the generally accepted assumptions about the high density of dopamine transporters in certain regions of the brain of individuals with AD/HD. This surprising reversal of a fundamental assumption about the brain-basis of AD/HD remains to be confirmed or rejected by additional research, but this research finding could change our understanding of the causes and treatment of AD/HD. Third, a series of publications from the NIMH Multimodal Treatment Study of Children with AD/HD have challenged the general belief of long-term benefits of childhood treatment with stimulants, either for reduction of AD/HD symptoms, since initial relative superiority appears to dissipate over



time, or the predicted protection from later drug use or abuse, which was not documented. This suggests that the rationale for the use of stimulants should be based on the clear short-term relative benefits and not long-term effects.

The next series of studies of AD/HD could be improved by achieving advances in technologies for brain imaging and genetics. Current brain imaging methods are restricted to evaluations of adults, despite the fact that the brains of children are different from the brains of adults. Therefore, brain imaging methods that could be applied in studies of children are needed. Moreover, the efficiency of sequencing the human genome is occurring with breathtaking speed, and when the cost becomes reasonable, it will provide an opportunity to dramatically improve genetic studies of AD/HD.

The National Children's Study, with a prospective birth cohort of 100,000 children, should provide a large, representative sample of children with (around 5,000) and without (100,000) AD/HD by 2015. The NCS will have broad measures of environmental exposures and comprehensive information on genetic and epigenetic factors, so it can be used to evaluate genetic, environmental, and gene by environment interaction effects that probably contribute to the complex clinical condition of AD/HD. If we can use this extraordinary, once-in-a-lifetime study to identify preventable causes of common disorders of childhood that seem to be increasing in modern society, including mental disorders (e.g., AD/HD, autism, etc.) as well as physical disorders (e.g., preterm birth, obesity, etc.), it may be possible to reduce the prevalence and impact of these disorders in the future. This promise might be meaningful to those living with the disorder today because prevention may be possible of some types of AD/HD. ●

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