

## Review Article

# A Review of the Most Recent Longitudinal Studies of ADHD

Robert Eme\*

Department of Psychology, Illinois School of Professional Psychology at Argosy University, USA

## \*Corresponding author

Robert Eme, Department of Psychology, Illinois School of Professional Psychology at Argosy University, Schaumburg Campus, USA, Email: reme@argosy.edu

Submitted: 20 February 2017

Accepted: 18 March 2017

Published: 21 March 2017

## Copyright

© 2017 Eme

OPEN ACCESS

**Abstract**

This review examined the findings from the six most recent longitudinal studies of ADHD with a goal of answering the question of what the future likely holds for an individual with childhood ADHD. When the findings from these studies were combined with those of prior longitudinal studies, the two most important answers to emerge were as follows. First, approximately two-thirds of children with childhood ADHD will continue to be moderately or severely impaired in young adulthood. Second, the two most robust predictors of this outcome are severity of ADHD and co morbid conduct problems.

**INTRODUCTION**

Among the most pressing questions that parents of children with ADHD, and the clinicians involved, have is what the *future* likely holds for the child and what are the factors that influence this future [1]. The answer to these questions is provided by long-term longitudinal studies of individuals who have received a diagnosis of ADHD during childhood and then followed for varying lengths of time. The purpose of this article is to provide answers to these questions by reviewing the most recent longitudinal studies of children with ADHD. The article will begin by providing a digest of the major findings of reviews of the most prominent prior longitudinal studies. It will then proceed to review six of the most recent studies that were not included in the prior reviews with a special focus on how these studies have advanced our knowledge of what the future *likely holds* for the child with ADHD.

**Prior longitudinal studies**

The major findings from the reviews of the most important prior longitudinal studies of ADHD are as follows [2-4]. First, regarding the characteristics of the subjects, most of the children with ADHD were white, middle class boys who were typically identified through referral to psychiatric or mental health facilities rather than being true community samples. In addition to the obvious demographic limitation of the samples, it is also important to note that clinical samples of children with ADHD usually include more severe cases than community samples and thus are more likely to report higher persistence rates as well as increased co morbidity with other disorders [3].

Second, regarding outcome, the major findings were:

- There is a relatively high rate of persistence of ADHD from

childhood to adolescence (50-80%) and into adulthood (35-65%).

- Symptoms of hyperactivity (and perhaps impulsivity) decline more steeply with age than do symptoms of inattention.
- Children with ADHD are at increased risk for virtually every outcome domain that has been studied including, but not limited to
- Mental Disorders such as Oppositional Defiant Disorder, Conduct Disorder, Substance Abuse Disorder.
- Academic impairment, driving problems, social impairment, risky sexual behavior, occupational functioning as adults, criminality.
- ADHD severity and co morbid conduct disorder in childhood are the two most important predictors for persistence into adulthood as well as adverse outcomes in adulthood.
- There were few if any gender differences in outcome.

**Recent longitudinal studies of ADHD**

The review will be roughly ordered in terms of the chronological baseline for the start of the study. Particular attention will be paid to how the studies have added to the knowledge base established by the prior longitudinal studies and thus advance our knowledge on what the *future* likely holds for individuals with a history of childhood ADHD.

**Prediction of adolescent outcomes among children diagnosed with ADHD at 4-6 years of age**

A study by Lahey and colleagues [5] addressed the problem that little is known about the stability and long-term

consequence of ADHD when it is diagnosed in early childhood. Participants were 125 children (107 boys) recruited from various mental health settings who were diagnosed with ADHD at 4-6 years and followed prospectively through age 18 years. The major findings were as follows. First, on average, although the children improved over time, they still continued to exhibit more symptoms, functional impairment, and risky behavior through adolescence than demographically matched healthy comparison children. Indeed, only approximately 10% of the children could be classified as functioning in the normal range on multiple measures during the 15-18 years. This finding is especially significant as it supports the predictive validity of the diagnosis of ADHD in early childhood, thereby validating the recommendation of professional groups such as the American Academy of Pediatrics who are calling for recognition and treatment of ADHD as early as age 4. Second, the study confirmed the results of prior longitudinal studies by finding that higher numbers of inattention and hyperactivity-impulsivity symptoms and higher number of concurrent symptoms (oppositional, conduct disorder, anxiety, and depression) measured at baseline predicted higher future levels of the same dimension of symptoms. In addition, higher baseline levels of inattention, oppositional, conduct disorder, and anxiety symptoms predicted greater future functional impairment. Lastly, the authors concluded that although the study demonstrated that future outcomes in general could be predicted, the predictors were not accurate enough to allow prediction on an individual basis of which children would or would not improve.

### Early development of co morbidity between ADHD and oppositional defiant disorder

A study by Harvey, Breaux, and Lugo-Candelas [6] sought to advance the understanding of how to explain the substantial co morbidity between ADHD and Oppositional Defiant Disorder (ODD) that develops during the preschool years such that between one third and one half of children who are diagnosed with one disorder are also co morbid for the other disorder. Participants were 199 children (107 boys) who were recruited from the community for a longitudinal study of preschoolers with behavior problems. Parental reports of ADHD and ODD symptoms were collected annually from ages 3 to 6 and a family history interview was administered at age 3. The results provided strong support for a developmental precursor's model to explain the co morbidity. Namely, ADHD was a strong predictor for the development of the argumentative/defiant symptoms of ODD. This progression from ADHD to ODD is best explained by the ADHD symptoms of behavioral and emotional impulsivity which greatly increase the risk for coercive, oppositional interchanges with significant others in the child's life [7-9]. Indeed, it is estimated that a typical child with ADHD has an astonishing half a million of these negative interchanges each year [10].

### Developmental trajectories of ADHD symptoms from grade 3 through 12

Developmental trajectories of clinically significant ADHD symptoms were explored in a sample of 413 children (66% male) who were recruited from the community, having been identified as high risk because of elevated kindergarten conduct problems

[11]. Symptoms of inattention and hyperactivity-impulsivity were modeled using parent reports collected in Grades 3, 6, 9, and 12. Three developmental trajectories emerged: (1) low levels of inattention and hyperactivity (71% of sample), (2) initially high but then declining symptoms (16% of sample), and (3) continuously high symptoms that featured hyperactivity in childhood and early adolescence and inattention in adolescence (13% of sample). By late adolescence, children in the high class were significantly more antisocial than those in the low class, with higher rates of arrests, school dropout, and unemployment, whereas children in the declining class did not differ from those in the low trajectory class. This study supports the notion that clinically significant ADHD symptoms persist into adolescence for some children, but not for others. Children who are more hyperactive or aggressive, or whose parents are inconsistent or ineffective with discipline, are more likely to have clinically significant and stable ADHD symptoms and show more antisocial activities and worse graduation and employment rates in late adolescence. In conclusion, the most important contribution of this study was that it provided additional support for the finding from prior studies that severity of ADHD in childhood predicts persistence of ADHD into adolescence as well as increased risk for adverse outcomes in multiple domains.

### Adult outcomes 16 years after childhood ADHD: MTA results

The Multimodal Treat Study (MTA) which has conducted several follow-ups of 579 children (465 males) diagnosed with combined type ADHD at ages 7-9 is the largest study to date with the most representative, generalizable clinical sample of children with ADHD [1]. In the most recent follow-up study, Roy and colleagues [12], examined rates and predictors of ADHD persistence versus desistence in 453 of the participants from the MTA trial based on a 16-year follow up at a mean age of 25 years. Regarding persistence, 50% of the participants had persistent ADHD based upon *DSM-5* criteria. Regarding predictors, the study found that the most important predictors of adult ADHD persistence were initial severity of ADHD symptoms, increasing but not initial co morbidities (after controlling ADHD severity), and parental mental health problems. Childhood IQ, socioeconomic status, parent education, and parent-child relationships showed no association with adult ADHD symptom persistence. In comparing these findings to those of prior studies, Roy and colleagues [12] reported that their negative findings on initial (baseline) co morbidity, IQ, socioeconomic status and parental income are discrepant from prior studies and require further study. Lastly, the negative findings on the association between parent-child relationships and persistence are congruent with the generally weak findings in this area. A second study by Hechtman and colleagues [13] was built on the findings of Roy and colleagues [12], by further assessing outcome differences between those with persistent versus desistent ADHD and a local normative comparison group (LNCG). Three patterns of functional outcomes were identified. First, the symptom-persistent ADHD group fared the worst on functional outcomes in post-secondary education, times fired/quit a job, current income, receiving public assistance, and risky sexual behavior compared to the LNCG. Second, the desistent group had outcomes

that were in between the persistent group and the LNCG. Third, on emotional outcomes (emotional lability, neuroticism, anxiety disorder, mood disorder) and substance use outcomes, the LNCG group and the symptom-desistent group did not differ, but both fared better than the symptom-persistent group. Fourth, there were no significant differences between the groups in jail time or alcohol use disorder. In sum, although degrees of impairment varied by domain, persistent ADHD was associated with the greatest functional problems.

### **Prediction of young adult outcome for women with childhood ADHD**

A study by Owens and Hinshaw [4] investigated whether earlier conduct problems, operationalized as symptoms of ODD and conduct disorder (CD), which predict adult outcomes for males with childhood ADHD also predict adult outcomes for females with childhood ADHD. Participants were 140 females in the Berkeley Girls with ADHD Longitudinal Study who were recruited from various community and mental health settings. Data was collected at three time points when the females were on average aged 9.6 years, 14.3 years, and 19.6 years. The study found that among girls with ADHD, after controlling for severity of childhood ADHD, IQ, and demographic factors, childhood and adolescent conduct problems predicted overall functioning, internalizing problems, and externalizing problems during young adulthood. Two major pathways were identified as mechanisms for explaining how these early conduct problems predicted adult outcome. In the first pathway early conduct problems increased risk for school failure and disciplinary problems during adolescence which in turn increased risk of failure to adapt to the demands of young adulthood. In the second pathway early conduct problems increased risk for internalizing problems and peer rejection during adolescence which in turn predicted internalizing problems in young adulthood.

In conclusion, this was the first study to document that earlier conduct problems are as robust a predictor of young adult outcomes for females as they are for males. It also adds to the overall finding in the literature that there are few, if any gender differences in either the *future* for children with childhood ADHD or predictors of that future, with the possible exception that females may be a higher risk for internalizing disorders and males at higher risk for externalizing disorders [4].

### **Progression in impairment in adolescents with ADHD though the transition out of high school**

Despite declining symptoms levels, children with ADHD show increasingly impaired functioning as they transition into high school most probably because of increased academic workloads and greater demands for independent and organized work [14]. A study by Howard and colleagues [14] using the previously discussed MTA sample [13] sought to extend the investigation of impairments increasing with age to adolescents through and after leaving high school as they transitioned to adulthood. The study found that on average the impairments of adolescents with childhood ADHD increased through high school and after the transition out of high school in contrast to those of LNCG adolescents for whom impairments stabilized or declined after high school. However, these impairments were stabilized after

leaving high school for those adolescents with ADHD who attended college. Also, adolescents with childhood ADHD who had more involved parenting had less impairment overall, and those with both histories of involved parenting and who attended college were least impaired overall as young adults. In sum, on average adolescents with childhood ADHD became slightly more impaired through high school, and impairments continued to increase but at a slower rate after the transition out of high school. The progression in impairments was mitigated by involved parenting and college attendance.

### **CONCLUSION**

First, as a bit of an aside, it should be noted that contrary to the continuing erroneous opinion of some, the reviewed studies served to further establish the validity of ADHD as a real disorder, "as if 20,000 or more earlier studies had not" [2].

To the question of what does the *future* likely hold for a person with childhood ADHD, the results of recent longitudinal studies in combination with the prior studies suggest the following answers? First, with regard to persistence, a distinction must be made between ADHD symptoms and ADHD-related impairments. With regard to persistence of symptoms, the best answer would appear to be that approximately 50% of children with childhood ADHD will continue to experience significant levels of ADHD symptomatology into young adulthood. With regard to impairment, there are two principal findings. First, overall adult outcomes of children with ADHD fall roughly into three equivalently sized groups – positively adjusted, moderately impaired, and severely impaired [15]. Second, although ADHD symptoms may decline with age, ADHD-related impairments are less likely to do so and indeed may even increase [2]. Two possible reasons have been advanced to explain why decline in symptoms may not be accompanied by decline in impairments. The first is that despite the decline in symptom frequency and severity, the individual with ADHD remains at a relatively high level of deviancy compared to the non-ADHD [2]. Thus, since the individual with ADHD remains at this relatively high level of deviancy, they remain at the same level of risk for impairment or even increased risk of impairment with age because of increasing demands e.g., for independent academic or occupational achievement [14]. The second reason why the decline in symptoms may not be accompanied by decline in impairments is that the decline in symptoms may be illusory. Namely, there is a growing consensus that because the DSM-5 list of 18 symptoms primarily reflects those symptoms that are typical of the preadolescent presentations of ADHD, they are developmentally insensitive to manifestations of ADHD at older ages [7,14,15]. DSM-5 has attempted to address this issue by listing some expressions of the core 18 symptoms that might be more typical beyond preadolescence, but much work remains to be done in this regard. In short then, ADHD-related impairments may continue or even increase because ADHD symptoms, if assessed by developmentally appropriate criteria, are *not* decreasing and thus continue to cause significant interference in functioning. With regard to the predictors of future outcomes in ADHD, the recent studies have provided additional convincing support in establishing *severity* of ADHD and *co morbidity* with other disorders (especially conduct problems) as the most reliable,

robust predictors. In addition, outcome is also determined, as it is for virtually all disorders, by environmental demands, compensatory skills of the individual and environmental supports or lack thereof. Lastly, the omission of treatment of ADHD as a predictor of long term outcome in the reviewed studies needs to be addressed in some detail. This omission is especially surprising since hundreds of controlled studies of stimulant treatment for individuals with ADHD (mostly children) have reported success rates approximating 80% over the short term with rates for placebo being dramatically lower (i.e., 13%) [16-18]. Indeed, "There is no medication for any mental health condition that approaches this differential. Sometimes the effects of stimulants are "night and day" [17]. The most probable reason for this omission is a design problem in longitudinal studies which make the consideration of treatment moot. Research that attempts to study the long term predictive of outcome of treatment for ADHD is faced with an intractable design problem of bias once the randomization trial has ended and individuals in the treatment and control groups self-select into various treatment strategies or not. As Caye and colleagues [3] noted: "Disentangling this bias adequately would require a randomized clinical trial with good adherence and retention for several years...However, maintaining adherences to assigned treatment over long periods of time may not be possible." This bias helps explain the seemingly paradoxical finding in prior longitudinal studies that treatment for ADHD is a predictor of persistence, not desistence [3]! Namely, since it is the most severe cases of ADHD that are selected for treatment [3], treatment is in effect a proxy for severity a robust predictor of persistence. Similarly, although 14 months of state of the art treatment in the MTA study resulted in highly positive short-term outcomes, subsequent self-selected extended use of medication after the trial ended found no effect on outcome in adulthood [3]. Again, this may be because those who elected to continue treatment with medication into adulthood had more severe ADHD than those who chose to discontinue treatment.

## REFERENCES

1. McGough JJ. New Insights From the MTA: Who Outgrows Attention-Deficit/Hyperactivity Disorder and What Becomes of Those Who Don't? *J Am Acad Child Adolesc Psychiatry*. 2016; 55: 925-926.
2. Barkley R. Recent longitudinal studies of childhood Attention-deficit hyperactivity disorder: Important themes and questions for further research. *J Abnorm Psychol*. 2016; 125: 248-255.
3. Caye A, Swanson J, Thapar A, Sibley M, Arseneault L, Hechtman L, et al. Life Span Studies of ADHD-Conceptual Challenges and Predictors of Persistence and Outcome. *Curr Psychiatry Rep*. 2016; 18: 111.
4. Owens EB, Hinshaw SP. Childhood conduct problems and young adult outcomes among women with childhood attention-deficit/hyperactivity disorder (ADHD). *J Abnorm Psychol*. 2016; 125: 220-232.
5. Lahey BB, Lee SS, Sibley MH, Applegate B, Molina BS, Pelham WE. Predictors of adolescent outcomes among 4-6-year-old children with attention-deficit/hyperactivity disorder. *J Abnorm Psychol*. 2016; 125: 168-181.
6. Harvey EA, Breaux RP, Lugo-Candelas CI. Early development of comorbidity between symptoms of attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). *J Abnorm Psychol*. 2016; 125: 154-167.
7. Barkley RA. Attention-deficit hyperactivity disorder: A handbook for diagnosis & treatment. 4<sup>th</sup> edn. New York: Guilford Press. 2015; 81-115.
8. Beauchaine T, Zisner AC, Sauder C. Trait impulsivity and the externalizing spectrum. *Ann Rev Clin Psychol*. 2017; 13: 1-35.
9. Snyder J. Coercive family processes in the development of externalizing behavior: incorporating neurobiology into intervention research. In: Beauchaine T, Hinshaw S, editors. *The Oxford handbook of spectrum disorders* (286-302). New York: Oxford University Press. 2016.
10. Pelham WE Jr, Fabiano GA. Evidence-based psychosocial treatments for attention-deficit/hyperactivity disorder. *J Clin Child Adolesc Psychol*. 2008; 37: 184-214.
11. Sasser TR, Kalvin CB, Bierman KL. Developmental trajectories of clinically significant ADHD symptoms from grade 3 through 12 in a high-risk sample: Predictors and outcomes. *J Abnorm Psychol*. 2016; 125: 207-219.
12. Roy A, Hechtman L, Arnold L, Sibley M, Molina B, Swanson J, et al. Childhood factors affecting persistence and desistence of Attention-Deficit/Hyperactivity Disorder symptoms in adulthood: Results from MTA study. *J Am Acad Child Adolesc Psychiatry*. 2016; 55: 937-945.
13. Hechtman L, Swanson JM, Sibley MH, Stehli A, Owens EB, Mitchell JT, et al. Functional Adult Outcomes 16 Years After Childhood Diagnosis of Attention-Deficit/Hyperactivity Disorder: MTA Results. *J Am Acad Child Adolesc Psychiatry*. 2016; 55: 945-952.
14. Howard AL, Strickland NJ, Murray DW, Tamm L, Swanson JM, Hinshaw SP, et al. Progression of impairment in adolescents with attention-deficit/hyperactivity disorder through the transition out of high school: Contributions of parent involvement and college attendance. *J Abnorm Psychol*. 2016; 125: 233-247.
15. Lee SS, Sibley MH, Epstein JN. Attention-deficit/hyperactivity disorder across development: Predictors, resilience, and future directions. *J Abnorm Psychol*. 2016; 125: 151-153.
16. Connor D. Stimulant and nonstimulant medications for childhood ADHD. In: Barkley RA, editor. *Attention-deficit hyperactivity disorder: a handbook for diagnosis & treatment*, 4<sup>th</sup> Edn. New York: Guilford Press. 2015; 666-685.
17. Hinshaw S, Scheffler R. *The ADHD explosion*. New York: Oxford University Press. 2014.
18. Pliszka S. *Treating ADHD and comorbid disorders: Psychosocial and psychopharmacological interventions*. New York: Guilford Press. 2009.

### Cite this article

Eme R (2017) A Review of the Most Recent Longitudinal Studies of ADHD. *J Mem Disord Rehabil* 2(1): 1004.