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Short Communication

## Longitudinal Studies of Antisocial Outcome in Individuals with Childhood Attention Deficit Hyperactivity Disorder

Robert Eme\*

Illinois School of Professional Psychology at Argosy University, Schaumburg Campus, Chicago, USA

\*Corresponding Author: Robert Eme, Illinois School of Professional Psychology at Argosy University, Schaumburg Campus, Chicago, USA, Tel: 8479694949; E-mail: [reme@argosy.edu](mailto:reme@argosy.edu)

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### 1. Introduction

Voluminous research has established that impaired self-regulation/self-control is not only of almost unparalleled importance to mental health, but may be the single most important variable in explaining developmental origins of antisocial behavior [1-3]. Similarly, self-control theory has been proclaimed as the Tyrannosaurus rex of criminology that is poised to devour criminal justice theorizing [4]. Attention-Deficit/Hyperactivity Disorder (ADHD) is widely conceptualized as a disorder of self-control [1, 5-8] Indeed, Nigg has declared ADHD to be “paradigmatic of problems in the domain of self-regulation [5]. Therefore, in view of this conceptualization of ADHD, it follows that ADHD should be a very important risk factor for the development of antisocial/criminal behavior. Evidence supporting this inference comes from two domains. The first domain consists of studies that have examined the prevalence of ADHD in incarcerated populations. A recent meta-analysis of 42 studies conducted

in 15 countries reported an estimated prevalence of 25% [9]. There were no significant differences by gender (although most studies included only males) or age. As this prevalence estimate greatly exceeds the commonly accepted general worldwide population prevalence estimate of 5-7% for juveniles and 3-5% for adults, it provides robust support for ADHD being a very important risk factor for criminality [10, 11].

The second domain consists of long-term prospective longitudinal studies that have followed-up individuals with childhood ADHD into adolescence and adulthood and which have examined criminal behavior as an outcome. To the author's knowledge, no publication has brought together in one place a review of each of the major studies with the goal of examining the extent to which childhood ADHD predicted the development of antisocial/criminal behavior. Because such studies are expensive and difficult to execute, they are relatively few in number compared to the studies of the prevalence of ADHD in incarcerated populations. This article will provide a concise overview of the major studies that have been identified as having the soundest methodological designs [12-14]. The studies will be reviewed chronologically and the effect of treatment of ADHD as a moderator of outcome will also be reported.

Although the diagnosis of ADHD in all the reviewed studies antedated the 5<sup>th</sup> edition of the Diagnostic and Statistical Manual of Mental Disorder (DSM-5) published in 2013, an examination of the criteria used for the diagnosis indicates that most of the children could have been diagnosed with a DSM-5 diagnosis of ADHD-combined presentation [1]. Thus, while the original terminology of the studies in describing the subjects will be retained (e.g., hyperactivity), the reader should make the appropriate translation.

## **2. Los Angeles Study**

Beginning in the early 1970's James Satterfield and his colleagues began recruiting white boys (aged 6-12) from consecutive referrals to a psychiatric outpatient clinic in Los Angeles, California (USA) specializing in the treatment of hyperactive children for a study of delinquent outcomes and preventative measures [15]. At a 30-year follow-up (average age 18 to 38 years), the study compared the official arrest records of the hyperactive boys (N=179) with control boys (N=75). After controlling for intelligence (IQ) and socioeconomic status (SES), the hyperactive boys had a higher rate of adult felony arrests (37%), convictions (28%), and incarcerations (25%) than the control group whose rates were 9% (felony arrests), 6% (convictions), and 6% (incarcerations). The best predictor of criminal outcome was comorbid conduct problems (CP). Hyperactive boys without comorbid CP were not at increased risk

for later criminality. Three years of intensive individualized multimodal treatment had no effect on preventing future criminality which Satterfield suggests might have been due to the intervention having begun too late in the boy's development.

### **3. New York Study**

From 1970 to 1977 a sample of 207 white, middle class hyperactive 6 to 12 year old children was ascertained from over 1000 children who were referred to a psychiatric clinic in New York City [16, 17]. Children who had a diagnosis of conduct disorder (CD) were excluded as the goal of research was to study pure hyperactivity. At age 38 the study focused on the subjects who had lived in New York state throughout the follow-up as their official criminal records were judged to be comprehensive and accurate. Life time criminality was assessed for the 93 male ADHD subjects and a comparison group of 93. Significantly more ADHD subjects than comparisons had been arrested (47% vs 24%), convicted (42% vs. 14%), incarcerated (15% vs 1%), and diagnosed with antisocial personality disorder (ASPD) (23% vs 2%) The increased risk for criminal behavior was completely explained by the development of antisocial or substance use disorder in adolescence. Thus, even in the absence of clinically diagnosed comorbid conduct disorder (although some CD symptoms were present) in childhood, ADHD was found to increase the risk for antisocial and substance use disorders in adolescence, which, in turn, increased the risk for criminal behavior in adolescence and adulthood. Treatment of the ADHD group as a moderator of outcome was not examined.

### **4. Denmark Study**

Dalsgaard, Mortensen, Frydenberg, and Thomsen identified the case records of 206 children aged 4-15 (181 boys) referred to a psychiatric clinic in Denmark between 1968 and 1989 who were diagnosed with ADHD [18]. Official criminal conviction data was collected on all of them at the average age of 31 and compared with the conviction rates of an age-matched general population sample. Children with ADHD had a 47% (50.3% male, 24% female) conviction rate compared to 7.5% (6.2% male, 1.3% female) in the general population. Comorbid childhood CD doubled the risk for later criminality. Also, similar to the findings in the New York study, ADHD was found to increase the risk for criminal behavior even in the absence of any CD symptoms, as 26% of these children had a criminal conviction. Treatment of the ADHD group as a moderator of outcome was not examined.

## 5. Milwaukee Study

Between 1979 and 1980 Russell Barkley and his colleagues recruited and enrolled 158 hyperactive children, mostly white males ages 4-12, who were referred to a university medical clinic in Milwaukee, Wisconsin (USA) along with a community control group (N=81) [19]. A follow-up which was conducted at the mean age of 27 consisted of 135 of the original hyperactive group and 75 of the controls. The hyperactive group was subdivided into those who retained a diagnosis of ADHD (H+) and those who had either remitted or had borderline cases of ADHD (H-). Both hyperactive groups were more likely to have been arrested (H+ 73%, H- 52%) or jailed (H+58%, H-46%) than the control group (20% arrested, 16% jailed). Also, both the H+ and H- groups had higher rates of ASPD than the comparison group, 39%, 17%, 8% respectively. The best childhood predictors of criminal behavior were the pervasiveness of ADHD symptoms and CP. Treatment of the ADHD group had no effect in preventing future criminality.

## 6. Massachusetts Study

In the 1980's Joseph Biederman and his colleagues recruited and enrolled 140 white males and 140 white females (aged 6-17) with ADHD from a pediatric psychopharmacology clinic and from primary care pediatrics practices in the state of Massachusetts [20]. The subjects were matched to 120 male and 122 female control children. At a 10-year follow-up (mean age 22), 208 of the ADHD subjects (112 boys, 96 girls) and 196 controls (105 boys, 91 girls) were evaluated for a life-time prevalence of antisocial personality disorder (ASPD). The ADHD subjects were far more likely than the controls (39% vs. 8%) to have developed the disorder. Gender did not differentially influence any of the outcomes studies in the research, including ASPD, except perhaps a delay in the onset of disruptive behavior which occurred later in girls than in boys. Treatment in childhood with stimulants was associated a more positive outcome in many domains (e.g., disruptive behavior), but there was no such effect on ASPD. However, because the study did not manipulate stimulant treatment as an independent variable, the correlation between stimulant treatment and more successful outcomes (other than ASPD) cannot be interpreted causally. This very important point will be discussed in greater depth at the conclusion of the review.

## 7. Pittsburg Study

The Pittsburg Longitudinal study recruited a sample of 288 mostly white males who had received a diagnosis of ADHD between 1987 and 1996 (ages 5-13, mean=9 years) at a psychiatric clinic in Pittsburgh, Pennsylvania [21].

They were followed-up until all the subjects were at least 18 years of age so that a cumulative record of delinquency could be obtained. A comparison group of 209 demographically matched males was also recruited. Delinquency information (severity, variety, and age of initiation) was gathered on the basis of self and parent report. At follow-up, four childhood diagnostic groups [ADHD-only], [ADHD+ODD], [ADHD+CD], and the comparison group were formed to examine group differences on three delinquency outcomes: severity, age of initiation, and variety. The findings indicated that regardless of comorbidity, all children with ADHD were at some type of risk for delinquency. The clearest finding of the study was that children with ADHD+CD displayed the worst delinquency outcomes compared to the other three groups, across almost all indices. For example, 45% of the boys with ADHD+CD had engaged in at least one episode of severe delinquency compared to 5% of the comparison group, accounting for half of the severe offenders. The elevated risk for delinquency in the ADHD group occurred despite the fact that they had received an average of 6 years of pharmacological treatment in addition to an 8-week intensive summer treatment program, with their parents receiving a course in behavioral parent training.

## **8. Multimodal Treatment Study**

The Multimodal Treatment 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 [22]. The initial purpose of the study, which was designed for a two-year period, was to establish specific treatment strategies and to assess the effectiveness of such strategies [23]. To this end, the participants who were recruited from a variety of sources (e.g., mental health centers, advertisements, pediatric referrals) were randomly assigned to 4 groups: (1) medication management, (2) behavior therapy, (3) medication and behavior therapy, (4) community care, of whom approximately 2/3's were treated with medication. At the study's end, the subjects returned to various forms of community care. It was also decided to extend the study in terms of various follow-ups. In the most recent follow-up (mean age = 25), Hechtman and colleagues assessed the outcomes of 476 of the probands and 241 comparison subjects. No difference was found in either jail time or reported police contact [24]. The finding of no difference in criminality in contrast to all the preceding studies may be due to three of the study's limitations noted by the authors. First, 18% of the ADHD subjects lost to follow-up were characterized by number of risk factors (e.g., lower IQ, more severe ADHD, higher rates of ODD) for poorer outcome. Therefore, it is possible that a significant difference in criminal behavior might have been found had these subjects been retained. Second, self-report by the subjects, which was the principal

measure on all outcome measures, is commonly acknowledged as being subject to bias. Hence, the subjects may have under-reported criminal behavior. Third, the study did not assess for antisocial personality disorder. Lastly, regarding treatment, while medication alone or combined with behavior therapy produced dramatic improvements in both symptoms and functioning at the end of the treatment component of the study, the effects of these treatments wore off such that there were no long term, persisting improvements. This was most likely due to discontinuation of treatment adherence.

## **9. Berkeley Girls Study**

Beginning in 1997, the Berkeley Girls study began recruiting girls from various sources in the San Francisco area (schools, mental health clinics, etc.) [25]. A rigorous evaluation process yielded a group of 140 girls with ADHD and 88 comparison subjects (aged 6-12, 53% white). The subjects were follow-up to a mean age of 20 (range 17 to 24). No differences in antisocial or delinquent behavior (based upon self-report) was found between the groups.

## **10. Prediction of Adolescent Outcomes Among Children Diagnosed with ADHD at 4-6 Years of Age**

A study by Lahey and colleagues 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 130 comparison children [26]. The participants were followed prospectively through age 18 years with good retention for both groups. During 15-18 years of age, more children with ADHD were arrested (based upon adolescent and parent report) at least once (30%) than were comparison children (9%). Higher numbers of concurrent CD symptoms in childhood predicted increased risk for delinquency. Treatment as a moderator of outcome was not studied.

## **11. Conclusion**

The major long-term longitudinal studies of ADHD have clearly established that childhood ADHD is an important risk factor for the development of antisocial/criminal behavior. An estimate of the magnitude of this risk is provided from two sources. First, in her summary of the outcomes of childhood ADHD in the major longitudinal studies, Hechtman estimated that about 10% to 20% individuals with childhood ADHD develop significant antisocial problems [12]. Second, Mohn-Jensen & Steinhausen conducted a systematic review and meta-analysis of the risks of childhood ADHD on long-term outcome of arrests, convictions, and incarceration which included not only some of

the major studies reviewed by Hechtman but an additional number of minor longitudinal studies as well as some retrospective studies [27]. They reported that childhood ADHD was associated with a relative risk of 2.2 for arrests, 3.3 for convictions, and 2.9 for incarceration. In addition, individuals with childhood ADHD had a younger age of onset of antisocial behavior and increased risk of criminal recidivism. The most robust baseline predictors of antisocial outcome were comorbid conduct problems and ADHD severity. Persistence of ADHD was also found to be an important predictor.

These conclusions need to be understood in the context of two major limitations. First, most of the ADHD subjects were drawn from clinical populations who would be more likely than ADHD subjects in the general populations to have more severe ADHD, as well as associated problems. Thus the risk ADHD poses for future antisocial behavior may have been inflated. Second, the vast majority of the subjects were white males, restricting generalization of these findings.

Lastly, the failure of treatment of ADHD to reduce the risk of an antisocial/criminal outcome needs to be addressed. This failure might be seen as 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 (e.g., 2-3 months) with rates for placebo being dramatically lower (i.e., 13%) [28, 29]. Moreover, there is the paradoxical finding that treatment for ADHD is a predictor of persistence rather than desistence of ADHD! [30]. The explanation for these findings is two-fold. First, since ADHD is typically a chronic disorder requiring on-going treatment, and since this rarely occurs (about 10% of time), limited treatment in childhood cannot reasonably be expected to have a long-term positive effect on outcome [12]. Second, since it is the most severe cases of ADHD that are selected for treatment, treatment is in effect a proxy for severity—a robust predictor of persistence [30].

In sum, findings from the major long-term prospective longitudinal studies that have followed-up individuals with childhood ADHD into adolescence and adulthood, supplemented by findings from ancillary studies, and combined with the studies of the disproportionate prevalence of ADHD in incarcerated populations, clearly establish childhood ADHD as an important risk factor for the development of antisocial/criminal behavior. The implication of these findings for the prevention of this dire outcome, as well as the many other negative long-term outcomes associated with ADHD, has been clearly and cogently stated by Hechtman: “Given that ADHD is a chronic condition that

continues into adulthood, treatment (involving both medication and psychosocial treatment) needs to address both ADHD and comorbid conditions and needs to continue ongoingly with varying intensity and careful follow-up. Only with such an approach can we hope to provide better adult outcomes for our patients with ADHD” (italics added) [12].

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