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Lifetime criminality among boys with ADHD: a prospective follow-up study into adulthood using official arrest records

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Abstract

This study investigates the relationship between childhood attention deficit hyperactivity disorder (ADHD) and later criminality. White boys (n = 207, ages 6–12) with ADHD, free of conduct disorder, were assessed at ages 18 and 25 by clinicians who were blind to childhood status. A non-ADHD group served as comparisons. Lifetime arrest records were obtained when subjects were 38 years old for subjects who resided in New York State throughout the follow-up interval (93 probands, 93 comparisons). Significantly more ADHD probands than comparisons had been arrested (47% vs. 24%), convicted (42% vs. 14%), and incarcerated (15% vs. 1%). Rates of felonies and aggressive offenses also were significantly higher among probands. Importantly, the development of an antisocial or substance use disorder in adolescence completely explained the increased risk for subsequent criminality. Results suggest that even in the absence of comorbid conduct disorder in childhood, ADHD increases the risk for developing antisocial and substance use disorders in adolescence, which, in turn, increases the risk for criminal behavior in adolescence and adulthood.

Keywords

prospective; outcome; course; judicial; crime; delinquent

1. Introduction

Attention deficit hyperactivity disorder (ADHD) in childhood has been identified as a significant liability for later criminality. Clinical studies were the first to suggest this link. Satterfield et al. (1982) conducted an 8-year follow-up of clinic-referred boys with ADHD and normal comparisons. Official County records at age 17 showed significantly higher rates of arrests and incarcerations for the patient group. In a later follow-up (mean age, 22), ADHD probands, compared to controls, continued to show significantly higher arrest rates as adults (Satterfield and Schell, 1997). Based on official State arrest records of clinic-referred children with ADHD at mean age 21, Barkley et al. (2004) also found significantly more arrests and felonies in probands than in normal comparisons. In another follow-up study of clinic-referred children, Hechtman et al. (1984) reported that, at age 19, ADHD probands tended to report more court referrals during the preceding five years than controls.

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Community studies have yielded similar findings. Farrington et al. (1990) followed 8- to 9-year-old boys in London, classified as having hyperactivity-impulsivity-attention deficit (HIA), conduct problems, neither, or both. Official arrest records obtained at ages 10–16 and 17–25, revealed that children with HIA, with or without conduct problems, had significantly increased juvenile and adult criminality than children without HIA. In a prospective study of a New Zealand birth cohort, Moffitt and Silva (1988) reported that, at age 11, 18 % of delinquents vs. 2% of non-delinquents had a history of ADHD ($P < 0.001$). Stated differently, 58% of children with ADHD vs. 13% of those without ADHD were delinquents. In a Swedish community study, Rasmussen and Gillberg (2000) followed 6 year olds with and without ADHD. At age 22, 19% of probands vs. none of the comparisons reported having committed criminal offenses ($P < 0.01$). A prospective population study of elementary school children in San Francisco obtained self-reports of criminality and official State arrest records when subjects reached age 26 (Babinski et al., 1999). Childhood hyperactivity-impulsivity and conduct problems in males independently predicted officially recorded criminality. These childhood variables did not, however, predict self-reported crime. No childhood predictors of crime were identified for females.

Developmental theories suggest that minor problem behaviors such as stubbornness, are more likely to occur at younger ages, and these progress to more serious transgressions by adolescence (Loeber et al., 1993). Some theories suggest that oppositional defiant disorder, not ADHD, is a developmental precursor to conduct disorder (Lahey et al., 2000). However, support for this association has not been universal (Biederman et al., 1996; Mannuzza et al., 2004).

Although a relationship between ADHD and criminality has been documented consistently, its exact nature remains ambiguous. Longitudinal studies of clinical samples of children with ADHD included substantial proportions of cases with comorbid conduct disorder (Satterfield et al., 1982; Hechtman et al., 1984; Barkley et al., 2004). For example, Satterfield et al. (1987) estimated that 75% of their children with ADHD would have been diagnosed with CD, had the diagnosis existed at the time; and Weiss and Hechtman estimated that 25% of their subjects would have. Since children with conduct disorder are at greatly increased risk for adult antisocial personality disorder and criminality (e.g., Robins, 1974), it is not clear whether elevated rates of criminality in children with ADHD reflect the effect of ADHD per se, or that of comorbid CD.

Epidemiologic and clinic studies have found that 30–50% of children with ADHD have comorbid conduct disorder (Biederman et al., 1991). If so, 50–70% of them do not. Therefore, studying children with ADHD without comorbid conduct disorder informs on the specific contribution of ADHD to later criminality among the majority of children with the syndrome.

We report on the criminal records of a clinical cohort of children with ADHD who were followed into adulthood. Importantly, conduct disorder was screened out systematically in childhood. We previously reported on the judicial history of part of the current sample at mean age 22 (SD, 1.6; range, 17–26). Significantly more ADHD probands than comparisons had been arrested (39% vs. 20%, $p < 0.01$), convicted (28% vs. 11%, $P < 0.01$), and incarcerated (9% vs. 1%, $P < 0.05$). In addition, the relationship between childhood ADHD and later criminality was significantly associated with the development of an antisocial disorder in adolescence (Mannuzza et al., 1989). The present study extends the previous report which examined criminality at a relatively early age. In the current study, official records were obtained later in life, at mean age 38 (SD, 2.7; range, 32–44), when the likelihood of future criminal events is minimal, thereby providing a comprehensive picture of lifetime criminality in adults with a childhood history of ADHD.

The present investigation tests the hypotheses that children with ADHD without conduct disorder, compared to persons without ADHD in childhood, are at significantly increased risk for criminality in adolescence and adulthood, and that, as suggested by our previous report (Mannuzza et al., 1989), the relationship between childhood ADHD and criminality is mediated by the development of antisocial disorder in adolescence. We also examine the relationship between ADHD, substance use disorder, and criminality since SUD and antisocial disorder often overlap.

2. Methods

2.1. Participants

Subjects consist of two groups, adults who as children had ADHD (probands), and adults whose behavior in childhood was unremarkable (comparisons).

2.1.1. ADHD Probands—From 1970 to 1977, over 1,000 children were assessed at a no-cost child psychiatric research clinic in New York (Gittelman-Klein et al., 1976; Gittelman et al., 1980). Of these, 207 cross-situationally hyperactive white boys [mean age, 8.3; SD, 1.6] from lower- to middle-class homes [mean, 3.1; SD, 1.0 (Hollingshead and Redlich, 1958)] met the following criteria: (1) ages 6–12 and attending school; (2) referred by teachers because of excessive activity; (3) rated by teachers ≥ 1.8 on the Hyperactivity factor of the Conners Teacher Rating Scale (CTRS: Conners, 1969); (4) rated 2, Pretty Much, or 3, Very Much, on the “restless, overactive” item of the CTRS; (5) rated at least 28 out of a possible 44 on 11 items (scored 0–4) of the Parent Home Hyperactivity Scale, a modification of the Werry-Weiss-Peters Activity Scale (Werry and Sprague, 1970) which excluded school behavior items; (6) diagnosed as having DSM-II (American Psychiatric Association, 1968) hyperkinetic reaction based on a systematic clinical psychiatric evaluation by a child psychiatrist, conducted with parent and child; (7) WISC/WISC-R Full Scale IQ ≥ 85 (Wechsler, 1949, 1974); (8) no psychosis or neurological disorder; and (9) English-speaking parents and a home phone.

None of the subjects was placed within, or outside the home of origin, and all were required to be medically healthy as a condition of study entry. Learning disorders were uncommon (2–10%, depending on diagnostic criteria).

Children were excluded if the referral involved aggressive or other serious antisocial behaviors (e.g., vandalism, fighting), or if the psychiatric assessment with parent and child revealed a pattern of antisocial activities. This exclusion was implemented to rule out children with conduct disorders (CD). To determine whether these clinical criteria were successful, we examined the ratings on the Conners Teacher Rating Scale (CTRS: Conners, 1969) and the Conners Parent Rating Scale (CPRS: Conners, 1973), each includes six items corresponding to DSM-IV (American Psychiatric Association, 1994) conduct disorder criteria: bullying, fire-setting, destructive, lies, steals, and truancy. Items ranged from 0, Not at All, to 3, Very Much. As expected, the overall mean of parent and teacher ratings on these six items was very low (mean, 0.7; SD, 0.4).

Although children with CD were excluded, those with oppositional defiant disorder (ODD) were not. Of the eight behaviors listed in DSM-IV ODD criteria, six are included in the CTRS and CPRS: temper outbursts, quarrelsome, defiant/uncooperative, disturbs other children, blames others for his mistakes, and carries a chip on his shoulder. Overall mean of parent and teacher ratings on the six ODD items was not elevated (mean, 1.6; SD, 0.6) but higher than the average for CD ratings (mean, 0.7; SD, 0.4) [0–3 possible].

The clinical criteria are consistent with a DSM-IV diagnosis of ADHD since: (1) cross-situationality was required; (2) all subjects were clinically impaired by ADHD; (3) relatively

severe hyperactivity was required; (4) mean ratings on the CTRS items of restless/overactive, inattentive/distractible, and excitable/impulsive [rated 0–3] were 2.8, 2.6, and 2.4, respectively, and; (5) classroom observation ratings made by blind observers showed highly significant differences between index and "normal" children on items related to hyperactivity ("out of chair"), inattention ("off task"), and impulsivity ("interference") (Abikoff et al., 1980). As for type of DSM-IV ADHD, judging from the teacher ratings and blind classroom observations, all children would have fulfilled criteria for the Combined type.

2.1.2. Comparisons—A non-ADHD white male comparison group matched for age, social class, and geographic residence was recruited at adolescent follow-up. Comparisons were identified from non-psychiatric departments within the same medical center. All were required to be medically healthy as a condition of study entry. They were seen at the medical center for minor acute ailments (e.g., influenza) or routine physical examinations required by their schools. Based on chart review and parent reports, males without behavior problems in elementary school were recruited. These methods are detailed in Gittelman et al. (1985).

2.2. Overview of prospective follow-ups

ADHD probands were followed-up in adolescence (94%; mean age, 18) and adulthood (85%; mean age, 25). Probands and non-ADHD comparisons were systematically interviewed by blind clinicians at both follow-ups [details in Gittelman et al. (1985) and Mannuzza et al. (1991) regarding adolescent follow-up, and in Mannuzza et al. (1993, 1998) regarding adult follow-up]. At adolescent follow-up, subjects were administered a modification of the Diagnostic Interview Schedule (Robins et al., 1981), the Teenager or Young Adult Schedule (TOYS), which includes DSM-III (American Psychiatric Association, 1980) attention deficit, conduct, substance use, mood, anxiety, and psychotic disorders. Parents were administered the Parent Interview (Gittelman et al., 1985). Interrater reliability for conduct disorder and substance use disorder was excellent for both self and informant assessments (kappas: CD = 0.93 and 0.75; SUD = 0.81 and 0.88, respectively, Mannuzza et al., 1991). At adult follow-up, subjects were administered the Schedule for the Assessment of Conduct, Hyperactivity, Anxiety, Mood, and Psychoactive Substances (CHAMPS: Mannuzza and Klein, 1987), which includes DSM-III-R (American Psychiatric Association, 1987) antisocial personality disorder (APD), as well as substance use, mood, anxiety, and psychotic disorders. Interrater reliability for APD and SUD was good to excellent (kappas = 0.69 and 0.80, respectively, Mannuzza et al., 1993).

2.3. Subject inclusion

This report focuses on subjects who lived in New York State throughout the follow-up interval. Since judicial records are in the public domain, we considered conducting online nationwide searches for criminal records on all subjects, regardless of state of residence. We entered the name and birth date of an individual who was known to have numerous arrests and incarcerations for drug-related crimes, assaults, and other serious acts into two compensated, online search services. One service did not identify any arrests for this subject, and the other identified two misdemeanors. Based on the lack of accuracy, we limited searches to official records from the New York State Division of Criminal Justice Services, which had been found to be comprehensive and accurate when parent and subject reports served as accuracy indicators (Mannuzza et al., 1989).

Residential status was confirmed within 1 year of obtaining the criminal records. We examined whether there were systematic differences between out of state vs. NYS residents, and subjects with known vs. unknown residence. Roughly the same proportion of probands and comparisons were known to have lived out of state at some time in their adult lives (30% probands, 21% comparisons). For both groups, the ages of NYS and out of state residents were nearly identical

(probands: 38.2 vs. 38.7; comparisons: 39.0 vs. 38.5, respectively). Similarly, for both groups, the socioeconomic status of NYS and out of state residents was highly comparable (probands: 3.2 vs. 3.3; comparisons: 2.7 vs. 2.6, respectively). Residential status was known for about two-thirds of probands (64%) and comparisons (66%). For both groups, the difference in age between knowns and unknowns was not significant (probands: 38.3 ± 2.7 vs. 37.7 ± 2.6; comparisons: 38.9 ± 3.2 vs. 37.0 ± 3.3, respectively). Also, for both groups, the difference in social class ranking between knowns and unknowns was not significant (probands: 3.2 ± 0.8 vs. 3.3 ± 0.9; comparisons: 2.7 ± 0.9 vs. 2.9 ± 0.8, respectively). Despite these similarities in demographics, there still might be unidentified differences in the arrest histories of subjects who had moved out of state. Therefore, in common with our previous report and those of other investigators (Satterfield et al., 1982; Mannuzza et al., 1989), we restricted analyses to the subset of subjects known to have lived in New York State throughout the follow-up interval (93 probands, 93 comparisons). However, it should be noted that including data from all 207 probands and 178 comparisons did not alter findings (data available upon request).

2.4. Arrest records

Approval for this study was obtained from the NYU School of Medicine's Institutional Review Board. The study was conducted with a waiver of consent since signing a consent would require maintaining a written record of being part of a study on criminal behavior, with the potential for adverse consequences should their participation be revealed. Thus, the study was conducted anonymously, with rigorous procedures to ensure subject anonymity.

Complete arrest records (including adult records, as well as juvenile detentions, arrests, and adjudications) were obtained from the New York State Division of Criminal Justice Services (DCJS), Albany, NY. A detailed description of our follow-up studies (including methods, sample characteristics, goals, and significance) was submitted to the DCJS for review. On approval, a nondisclosure agreement was signed by the principal investigator (RGK). The agreement stipulated that the DCJS would conduct a search of their database for criminal records on the participants, and that records would be matched by DCJS to our data, and then made anonymous by stripping all identifiers that could be linked to an individual. The anonymous data set was then provided by the DCJS in electronic format and protected by password.

The nondisclosure agreement also required that access to the data be restricted to those individuals directly concerned with the study, and it prohibited any secondary dissemination of the anonymized data set. The DCJS further required that the data be destroyed following the completion of the study, or by 8-21-06, whichever occurred first. The data have been destroyed.

2.5. Data analyses

Dichotomous dependent variables (arrested vs. not arrested, etc.) were analyzed using logistic regression analyses (Fleiss et al., 1986). This statistical procedure allows for covariates, such as age, socioeconomic status, and IQ. Continuous dependent variables such as number of arrests and convictions were subjected to analyses of covariance.

Socioeconomic status was measured with the Hollingshead and Redlich 2-factor scale (Hollingshead and Redlich, 1958), which is based on education (highest grade completed) and occupational rank. The scale ranges from 1 (highest SES) to 5 (lowest SES). Intellectual aptitude was indexed with the Wechsler Adult Intelligence Scale (WAIS, Wechsler, 1955) or WAIS-R (Wechsler, 1981) Full Scale IQ.

Logistic regression was also used to examine whether antisocial disorders (i.e., antisocial personality and conduct disorder) and substance use disorder (alcohol or non-alcohol substance abuse or dependence) that were identified at either the adolescent or the adult follow-up, were significantly associated with criminality in ADHD probands. These analyses excluded arrests that had occurred after the last adult follow-up interview (mean age, 25) to equate the interval covered by mental status assessment and criminal history.

At the time of our previous follow-up, the parents of probands had significantly lower socioeconomic status than parents of comparisons (SES: 3.0 ± 1.0 vs. 2.5 ± 1.0, $p < 0.001$) (Mannuzza et al., 1991). In addition, probands had significantly lower IQs than comparisons (see below). Therefore, these factors were covaried in all proband-comparison contrasts. The parents', rather than the subjects' SES was covaried, since the latter might be influenced by the presence of antisocial personality disorder (APD) or substance use disorder (SUD). For example, subjects with APD or SUD (compared to those without these disorders) would likely have completed less formal schooling (as a result of truancy or expulsion due to substance use), and they might hold lower-ranking occupational positions (as a result of poor job stability due to arguments with co-workers or intoxication). Both of these factors would contribute to low SES, which would be confounded by the subject's mental status.

Significance was stipulated as $P \leq 0.05$, 2-tailed. However, $0.05 < \underline{P} \leq 0.10$ are noted as trends and are enclosed in square brackets in the tables.

3. Results

3.1. Sample characteristics

Official judicial records were obtained when probands and comparisons were on average 38 years old (38.2 ± 2.6 vs. 39.0 ± 3.3, ns). At mean age 25, when last interviewed, probands' social class rankings and Full Scale IQs were significantly lower than comparisons' [Subjects' SES: 3.2 ± 0.9 vs. 2.7 ± 0.9, $P < 0.001$; IQ: 102.6 ± 12.7 (75-140) vs. 113.6 ± 13.6 (76–140), $P < 0.001$].

3.2. Rates of arrests, convictions, and incarcerations

Table 1 shows the proportion of ADHD probands and comparisons who had been arrested, convicted, and incarcerated. All categories are significantly more prevalent in disfavor of probands. Significantly more probands than comparisons had been arrested, convicted, and incarcerated. In addition, significantly more probands had felonies and aggressive offenses. Although a majority of individuals arrested in both groups were convicted (39/44 probands, 13/22 comparisons), probands were significantly more likely to be convicted than controls [89% vs. 59%, $\chi^2(1) = 7.66$, $P < 0.006$].

3.3. Number of arrests, convictions, and incarcerations among subjects with a criminal record

Among those who were arrested, ADHD probands had significantly greater number of arrests and convictions, and tended to have a greater number of incarcerations, than comparisons (Table 2). Arrests and convictions for felony offenses also were significantly greater in probands, probably reflecting the more serious nature of committed crimes.

Different from probands, the majority of comparisons had only one arrest (64% vs. 25%, $P = 0.002$). Similarly, different from probands, the majority of comparisons were convicted only once (69% vs. 44%, ns). None of the comparisons vs. 11 of the 44 (25%) arrested probands were arrested more than 6 times. None of the comparisons, but 8 of 39 (21%) convicted probands were convicted more than 6 times.

3.4. Age at judicial event

On average, subjects were first arrested around ages 19–22, although some subjects in both groups were arrested as early as age 16. There were no significant group differences for age at first, or age at most recent arrest or conviction (Table 3). Since only one comparison subject (vs. 14 probands) had been incarcerated, no age contrasts were made for this variable.

3.5. Types of charges of arrested subjects

Theft was the only single offense that was significantly more common among probands than comparisons (Table 4). A full two-thirds of probands vs. one-third of comparisons had been arrested for a theft-related crime ($P < 0.01$). Although not significant, the most serious violent charges, one for murder, two for rape, and one for arson, were among probands exclusively.

3.6. Associations with antisocial and substance use disorders

There were 51 probands and 27 comparisons who were diagnosed as having conduct or antisocial personality disorder in adolescence or adulthood, and 51 probands and 39 comparisons diagnosed as having substance use disorder at some time in their lives. There was substantial comorbidity between these disorders in both groups. Among probands and comparisons with an antisocial disorder, 73% and 78% additionally had lifetime SUD (37/51, 21/27, respectively). Among probands and comparisons with SUD, 73% and 54% additionally had antisocial disorder (37/51, 21/39, respectively).

Multiple arrests, rather than any history of arrest, was selected as an indicator of criminal activity, to report on repeat offenders rather than those with an isolated brush with the legal system. Multiple convictions and incarcerations also were examined.

In univariate analyses, the rate of multiple arrests was nearly five-fold greater in probands with an antisocial disorder than in those without (37% vs. 8%, Table 5). Indeed, when only probands without an antisocial personality disorder are considered, they do not differ from all comparisons in rate of multiple arrests (8% vs. 5%). The same relationship was found for substance use disorder (8% vs. 5%, ns).

To determine the independent contribution of APD and SUD, both variables were entered into the logistic regression. Results indicated that, when controlling for SUD, APD remained a significant predictor of criminality (Wald z-score = 4.09, $P < 0.04$, odds ratio = 4.1, 95% CI = 1.04–16.67). Similarly, when APD was controlled, SUD was a significant predictor (Wald z-score = 4.16, $P < 0.04$, odds ratio = 4.2, 95% CI = 1.06–17.19). The relationship between these disorders and indices of criminality other than arrests could not be examined since no proband without APD, and only one proband without SUD, had multiple convictions or incarcerations (Table 5).

3.7. Developmental sequence of antisocial and substance use disorders and criminality

Twenty-nine probands had all the negative outcomes of interest: antisocial personality disorder (APD) and substance use disorder (SUD) and were arrested. Based on the ages at onset of these disorders, and the age at first arrest, the following sequences were observed: APD preceded SUD, which preceded First Arrest in 20 (69%) cases; APD developed around the same time as SUD, and both preceded First Arrest in 5 (17%) cases; APD preceded SUD, which developed around the same time as First Arrest in 2 (7%) cases; APD preceded First Arrest, which preceded SUD in 2 (7%) cases. For these sequences, “preceded” signifies that the event (onset of disorder or first arrest) occurred at least 1 year earlier. In summary, the predominant sequence was APD > SUD > First Arrest; APD never developed after SUD; and, in only two cases, First Arrest (which occurred during an episode of APD) preceded onset of SUD.

4. Discussion

We found that children with ADHD "uncomplicated" by conduct disorder are at significantly increased risk for later criminality, as measured by arrests, convictions, aggressive offenses, felony charges, and incarcerations (Table 1), but only if they develop an antisocial or substance use disorder in adolescence. Indeed, children with ADHD who had not developed either disorder had similar rates of criminality to those of non-ADHD comparisons. Several follow-up studies have established that children with ADHD are at increased risk for conduct and antisocial personality disorders (Gittelman et al., 1985;Mannuzza et al., 1991,1993,1998;Weiss & Hechtman, 1993;Biederman et al., 1996;Barkley et al., 2004). In addition, we reported, in two independent cohorts and for both probands and comparisons, that individuals with both CD and SUD invariably develop CD before (84%), or around the same time as SUD (16%) (Gittelman et al., 1985;Mannuzza et al., 1991). The present study extended these findings by examining age at first arrest. Since probands had ADHD in the absence of childhood CD, the present results describe a developmental cascade from childhood ADHD, to adolescent antisocial disorder, to substance abuse, and on to criminality. It seems important to attempt to break this chain of events by preventing the development of adolescent antisocial disorder in children with ADHD.

Since oppositional defiant disorder (ODD) was not an exclusion for children with ADHD, it could be argued that ODD increased their risk for CD, as some theories predict (Lahey et al., 2000); in turn, CD increased risk for later criminality. In an earlier report on this sample, we examined the relationship between ODD and CD behaviors in childhood (as measured by parent and teacher ratings) and CD in adolescence. We found that ODD childhood behavior ratings did not predict clinically diagnosed, adolescent CD, but even very low levels of CD-type childhood problems did (Mannuzza et al., 2004). Therefore, in this sample of prospectively followed, children with ADHD, but without clinically diagnosed, childhood CD, ODD childhood behaviors were not a developmental precursor to later CD, but childhood ADHD was.

In addition to rates of judicial events, ADHD probands were also more often arrested, convicted, and incarcerated than comparisons without childhood ADHD (Table 2). Indeed, among those arrested, fewer than half as many probands than comparisons had been arrested only once (25% vs. 64%, $P = 0.002$), and some probands were arrested 20-30 times. However, groups did not differ on age at first, or age at most recent, judicial contact (Table 3). Half of arrested probands and 68% of comparisons had their first encounter with the criminal justice system in adulthood (ns).

Several theories of ADHD are consistent with the finding that ADHD increases the risk for antisocial disorders and criminal behaviors. For example, over a century ago, George Still's theory of defective moral control and, later, Paul Wender's theory of minimal brain dysfunction, gave a principal role to the concept of poor inhibition (Barkley, 1999). More recently, Herbert Quay's theory of behavioral inhibition and Edward Sonuga-Barke's work on impulsivity and delay aversion have emphasized inhibitory deficits associated with ADHD (Barkley, 2006). Perhaps the most comprehensive model of ADHD is Russell Barkley's theory of self-regulation. Barkley proposes a developmental-neuropsychological model of human self-control which implicates the significance of prefrontal lobe function. According to this theory, there is a delay between an event and a reaction (behavioral inhibition), and during this time lag, "executive functions" are initiated which, in concert, produce self-regulation and, consequently, goal-directed, appropriate behaviors that are more governed by long-term, than short-term or immediate outcomes. ADHD is characterized by a deficit in the inhibitory processes which, in turn, disrupt the development of the executive functions and adaptive behaviors they permit (Barkley, 2006). It is beyond the scope of this article to review studies

which support or refute this and other theories. Our purpose is to indicate that several theories predict that ADHD increases risk for later antisocial activities, and that gaining a better understanding of the underlying mechanisms of ADHD may aid in the development of intervention and prevention programs.

A limitation of the study is that about one-third of subjects from each group were not included since their residence during the follow-up interval could not be determined. It is encouraging that the proportion of subjects "lost to follow-up" was the same for both groups, and that arrest history analyses based on all 207 probands and 178 comparisons showed the same major findings presented in the current report. Also, there seems to be no reason to suspect that the relationship between proband-comparison arrest histories was different for subjects who were not included, compared to subjects who were included. Finally, our findings are consistent with those from our previous report in which the residential status of all subjects was known (Mannuzza et al., 1989).

A second limitation is that criminal records were restricted to New York State, and that only subjects who resided in New York State throughout the follow-up interval were included in the analyses. The issue concerns whether the arrest histories of subjects who move out of state are systematically different from those of subjects who do not, and whether probands and comparisons are differentially characterized by this in-state/out-of-state relationship. For example, what if comparisons (but not probands) were more likely to be arrested for crimes committed out of state than in state? Then, by excluding subjects who moved out of state, the findings would be biased. We believe that such a relationship is remote, and are comforted by the findings that in-state and out-of-state probands and comparisons did not differ on any demographic variable.

It is also possible that differences other than childhood ADHD contributed to the development of later criminality. Since comparisons were not recruited in childhood, contemporaneous information was not available. Also, not all potentially relevant childhood variables (e.g., environmental traumas) were systematically studied in probands. However, the fact that probands and comparisons were identified from the same geographic regions (i.e., they lived in the same neighborhoods, attended the same schools, etc.) and were comparable in age and socioeconomic status when recruited in adolescence, diminishes the chances that childhood factors other than ADHD were of overriding significance to the groups as a whole.

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Table 1

Arrests, Convictions, and Incarcerations in Probands and Comparisons

Variable	Probands (n = 93) N (%)	Comparisons (n = 93) N (%)	Adjusted Odds Ratio[a]	P ≤
Arrested				
Any offense				
At least one	44 (47)	22 (24)	2.44	0.01
More than one	33 (35)	8 (9)	4.46	0.001
Aggressive offense[b]				
At least one	29 (31)	8 (9)	3.59	0.006
More than one	16 (17)	0 (0)	16.19	0.01
Felony charge				
At least one	27 (29)	6 (6)	5.57	0.001
More than one	17 (18)	4 (4)	4.64	0.02
Convicted				
Any offense				
At least one	39 (42)	13 (14)	3.47	0.002
More than one	22 (24)	4 (4)	5.97	0.003
Aggressive offense[b]				
At least one	18 (19)	3 (3)	4.71	0.02
More than one	6 (6)	0 (0)	4.89	0.05
Felony conviction				
At least one	13 (14)	1 (1)	13.93	0.02
More than one	9 (10)	0 (0)	9.31	0.05
Incarcerated				
At least one	14 (15)	1 (1)	13.45	0.02
More than one	11 (12)	0 (0)	11.44	0.03

[a] adjusted for socioeconomic status and IQ

[b] murder, rape, robbery, assault, arson, extortion, weapons offenses

Table 2

Mean Number of Arrests, Convictions, and Incarcerations of Subjects who were Arrested

Variable	Probands (n = 44) Mean (SD)	Comparisons (n = 22) Mean (SD)	F[a]	P ≤
Number of Arrests				
Any offense	5.9 (7.1)	2.0 (1.7)	4.15	0.05
Aggressive offense[b]	2.1 (3.2)	0.4 (0.5)	3.27	[0.08]
Felony charge	3.3 (5.1)	0.6 (1.0)	4.28	0.05
Number of Convictions				
Any offense	3.6 (4.5)	1.0 (1.4)	4.40	0.05
Aggressive offense[b]	0.8 (1.6)	0.1 (0.4)	2.15	ns
Felony conviction	1.0 (2.0)	0.1 (0.2)	4.07	0.05
Number of Incarcerations	1.4 (2.8)	0.1 (0.2)	3.37	[0.07]

[a] adjusted for socioeconomic status and IQ

[b] murder, rape, robbery, assault, arson, extortion, weapons offenses

ns- P > 0.10

Table 3

Age (years) at Occurrence of Judicial Event

Variable	Probands	Comparisons	Adjusted OR[a] or F[a]	P ≤
Arrested [44,22][b]				
Age at first arrest				
Mean (SD)	19.3 (4.1)	22.5 (7.5)	4.22	ns
Minimum-Maximum	16–30	16–40		
Age at most recent arrest				
Mean (SD)	28.1 (6.9)	24.9 (8.3)	0.35	ns
Minimum-Maximum	16–40	16–40		
Arrested prior to age 18 [N (%)]	22 (50)	7 (32)	1.35	ns
Arrested age 18 or later [N (%)]	22 (50)	15 (68)	0.74	ns
Convicted [39, 13][c]				
Age at first conviction				
Mean (SD)	23.4 (5.5)	23.4 (6.8)	0.77	ns
Minimum-Maximum	17–36	18–40		
Age at most recent conviction				
Mean (SD)	28.8 (6.1)	26.1 (7.9)	0.17	ns
Minimum-Maximum	17–38	18–40		
Convicted prior to age 18 [N (%)]	6 (15)	3 (23)	0.79	ns
Convicted age 18 or later [N (%)]	33 (85)	10 (77)	1.27	ns
Incarcerated [14, 1][d]				
Age at first incarceration				
Mean (SD)	23.6 (6.3)	30	- - -	- - -
Minimum-Maximum	17–34	30		
Age at most recent incarceration				
Mean (SD)	30.8 (5.7)	30	- - -	- - -
Minimum-Maximum	19–37	30		
Incarcerated prior to age 18 [N (%)]	2 (14)	0 (0)	- - -	- - -
Incarcerated age 18 or later [N (%)]	12 (86)	1 (100)	- - -	- - -

[a] odds ratio or F-value adjusted for socioeconomic status and IQ

[b] number of (probands, comparisons) who had been arrested

[c] number of (probands, comparisons) who had been convicted

[d] number of (probands, comparisons) who had been incarcerated

ns- P > .10

Table 4

Types of Charges of Subjects who were Arrested

Category of Charge	Probands (n = 44) N (%)	Comparisons (n = 22) N (%)	Adjusted Odds Ratio[a]	P ≤
Aggressive				
Murder	1 (2)	0 (0)	0.40	ns
Rape/other sex offenses	2 (5)	0 (0)	0.26	ns
Assault	24 (55)	7 (32)	1.91	ns
Robbery	9 (21)	0 (0)	6.93	ns
Weapons Offenses	15 (34)	3 (14)	2.33	ns
Arson	1 (2)	0 (0)	0.01	ns
Non-Aggressive				
Theft-related[b]	30 (68)	8 (36)	6.67	0.01
Substance-related[c]	17 (39)	6 (27)	1.05	ns
Vehicular[d]	11 (25)	6 (27)	1.26	ns
Miscellaneous[e]	18 (41)	7 (32)	1.11	ns

[a] adjusted for socioeconomic status and IQ

[b] burglary, larceny, fraud, embezzlement, etc.

[c] possession, sale, public intoxication, etc.

[d] driving while intoxicated, unauthorized use of vehicle, etc.

[e] trespassing, loitering, criminal mischief, etc.

ns- P > 0.10

Table 5

Relationship between Arrest History, Antisocial Disorder[a], and Substance Use Disorder[b]

Diagnosis (Yes, No)/ Arrest History	Probands N (%)	Comparisons N (%)
Antisocial Disorder		
YES [Totals = 51, 27]		
Multiple arrests	19 (37)	3 (11)
Multiple convictions	11 (22)	0 (0)
Incarcerations	10 (20)	0 (0)
NO [Totals = 40, 66]		
Multiple arrests	3 (8)	2 (3)
Multiple convictions	0 (0)	1 (2)
Incarcerations	0 (0)	0 (0)
Substance Use Disorder		
YES [Totals = 51, 39]		
Multiple arrests	19 (37)	3 (8)
Multiple convictions	11 (22)	0 (0)
Incarcerations	9 (18)	0 (0)
NO [Totals = 40, 54]		
Multiple arrests	3 (8)	2 (4)
Multiple convictions	0 (0)	1 (2)
Incarcerations	1 (3)	0 (0)

[a] clinical diagnosis of antisocial personality disorder (adulthood) or conduct disorder (adolescence)

[b] clinical diagnosis of alcohol or non-alcohol abuse or dependence in adolescence or adulthood