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The Development of Hyperactive Boys:

A 12-Year Follow-up

Dissertation

Submitted to the School of Graduate Studies

of the

University of Ottawa

In Partial Fulfillment of the Requirements for

The Degree of Doctor of Philosophy

by

Diane Claude

Ottawa, Ontario

1993

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To my husband, Robert

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Abstract

Longitudinal research on hyperactivity indicates that hyperactive children are at increased risk for academic problems and antisocial behaviours in adolescence. However, it is unclear whether these adolescent problems are linked to childhood aggressiveness, rather than to the core deficits of hyperactivity specifically. Moreover, further research is needed to identify other childhood predictors that affect adolescent outcome in the endeavour to establish primary prevention.

The present 12-year follow-up study was conducted to investigate the long-term development of 60 hyperactive children, who were further subdivided onto those with and without childhood aggressiveness. They were followed from childhood to late adolescence/early adulthood, and compared on psychiatric, cognitive, and academic outcome with that of 60 matched normal control subjects. Childhood predictors of poor outcome were also explored in the hyperactive group.

Consistent with previous studies, the core deficits of hyperactivity persisted in more than half of the hyperactive group. However, the results called into question the widespread claim that childhood hyperactivity was related to antisocial behaviours in adolescence. Although the hyperactive group displayed significantly more Antisocial Personality Disorder, Drug Use Disorders and comorbidity than the control group in adolescence, these group differences were significantly

attributable to the aggressive subgroup of hyperactive subjects. In contrast, adolescents who were hyperactive only in childhood did not differ significantly from the control group in psychiatric functioning, except for their persistent ADHD. The hyperactive/aggressive subgroup had received the most individual and residential treatment for their behaviour problems. Greater treatment for behavioural problems turned out to be one of the best predictors, along with age, of later psychiatric impairment. Therefore, aggressive/antisocial behaviours seemed to persist through adolescence and appeared relatively resistant to therapeutic change.

Consistent with previous research, at follow-up, hyperactive subjects displayed significantly poorer spelling, arithmetic and reading comprehension skills than did the control group. In comparison with the control group, the hyperactive group had also completed fewer years of High School education, failed more courses, received more special services in High School and fewer of them had attended post-secondary school.

Hyperactive/aggressive and hyperactive only subgroups generally displayed similar problems on these academic variables. The best childhood predictors of adolescent academic problems were early reading problems, inattention and IQ scores, underscoring the need for early identification and remediation of ADHD and reading problems in childhood.

The hyperactive and control groups did not significantly

differ on measures of inattention, impulsiveness, and distractibility on the Gordon Diagnostic System. However, findings were equivocal because of the ceiling effects and questionable validity of these outcome measures. Results from the predictions suggested that childhood inattention was significantly predictive of adolescent impulsiveness, inattention and distractibility. These preliminary findings suggest that chronicity of hyperactive behaviours is in part determined by its severity in childhood. Overall, the present findings suggest that hyperactivity is persistent in a significant number of children and the heterogeneity of ADHD needs to be addressed in order to move towards a better understanding of the long-term development of children with ADHD.

The Development of Hyperactive Boys:

A 12-Year Follow-up

Longitudinal research on hyperactivity or what is now known as Attention Deficit Hyperactivity Disorder (ADHD, American Psychiatric Association, 1987) has grown during the last two decades as old data sets from the early investigations of different treatment modalities are now being used by investigators to conduct follow-up studies with the original subjects (e.g. Barkley, Fischer, Edelbrock, & Smallish, 1990; 1991; Fischer, Barkley, Edelbrock, & Smallish, 1990; Gittelman, Mannuzza, Shenker, & Bonagura, 1985; Loney, Kramer, & Milich, 1981; Loney, Whaley-Klahn, Kosier, & Conboy, 1983; Mannuzza et al., 1991; Satterfield, Hoppe, & Schell, 1982; Weiss, Hechtman, Milroy, & Perlman, 1985; Weiss, Hechtman, Perlman, Hopkins, & Wener, 1979; Weiss, Minde, Werry, Douglas, & Nemeth, 1971). However, these studies have rarely combined an investigation of early high risk indicators with a detailed description of the long-term developmental prospects of these children. Moreover, most of these studies were conducted in an American context. Few well controlled Canadian studies have been conducted.

Research findings generally indicate that most hyperactive children do not outgrow their problems by adolescence, and that many children present with other forms of psychopathology in addition to their ADHD symptomatology once they reach adolescence (Thorley, 1984; Weiss et al., 1979; Weiss et al., 1985).

Although there is some consensus across studies, ratios of problematic behaviours vary, the role of childhood aggressiveness in the adolescent outcome of ADHD children has been greatly neglected, and specificity is lacking in the identification of predictors of poor outcome.

The variability in the results of the longitudinal research may be due in part to design flaws, and to diverse methodological approaches which have often presented a fragmented view of specific dysfunctions. Studies which have used standardized clinical diagnoses are scarce. A lack of homogeneity of the subject samples has also produced variability in the results. More specifically, researchers have typically used broad, undifferentiated diagnoses of "hyperactivity", obscuring important relations within the narrow-band domains of hyperactivity and aggression. A series of reports have provided persuasive data supporting the partial independence and divergent validity of hyperactivity and aggressive problems (Lahey, Green, & Forehand, 1980; Loney & Milich, 1982; McGee, Williams, Silva, 1985). In fact, Loney's research group has shown that hyperactivity, more specifically inattention/overactivity, and aggression have different antecedents and consequences (Loney, Langhorne, & Paternite, 1978; Milich & Loney, 1979). However, their findings were limited by the retrospective nature of the research design. The natural history of hyperactive-aggressive children may be different from that of non-aggressive hyperactive

children and this issue needs to be directly addressed in prospective longitudinal research designs.

Attempts at pinpointing factors that predict adolescent outcome have been undertaken, but high levels of accurate prediction have proven difficult to obtain (Hechtman, Weiss, Perlman, & Amsel, 1984; Lambert, 1988; Loney et al., 1981; Loney et al., 1983; Mannuzza, Gittelman Klein, Horowitz Konig, & Giampino, 1990). Sample heterogeneity, poor assessment tools, treatment contamination and attrition have all contributed to the lower predictions. Moreover, replication of results was often difficult because most measures were based on unstructured interview data rather than on well standardized objective measures. It is important that further research be conducted to identify predictors because these may significantly enhance prevention and control efforts.

The primary purpose of the present study was to report on a variety of outcome variables from 60 subjects diagnosed as ADHD in childhood and an equal number of matched control subjects aged 14 to 24 years. At referral, the hyperactive subjects were selected without regard for their levels of aggressiveness. Most longitudinal studies have studied hyperactive samples without the delineation of subgroups of this diagnosis. As a means of comparison, the present follow-up also examined the hyperactive group as a whole. Because of the pivotal importance of aggression in the development of psychopathology, a secondary

purpose of the study was to perform a finer analysis, subdividing the hyperactive group into aggressive and non-aggressive subjects and comparing these two index groups to a normal control group. A third purpose of the study, which was mostly exploratory in nature, consisted of identifying predictors of adolescent outcome. Specifically, child variables, familial and treatment measures from the referral period were evaluated as predictors, and an attempt was made to assess the relative importance of the identified variables in accounting for that variation. This supplementary work was conducted to generate interest in furthering present knowledge related to the development of hyperactive children.

The review of literature described below includes information on the definition and prevalence of hyperactivity, theoretical models of hyperactivity and a discussion about retrospective and prospective research designs. Examples of longitudinal studies comparing hyperactive and control groups is also presented, followed by an overview of studies that examined the relationship between hyperactivity and aggressiveness. Research that examined sex differences in hyperactive subjects is also briefly reviewed, followed by a review of predictive studies. Finally, the rationale of the study and the research hypotheses is described.

An Historical Perspective of Hyperactivity

Historically, the initial focus in child hyperactivity was

on organic factors (Strauss & Lehtinen, 1947). This led to the adoption of the term "minimal brain dysfunction" (MBD; Clements & Peters, 1962), and an emphasis on distractibility and overactivity as the chief difficulties of this disorder. Subsequently, a shift with an emphasis on behaviour patterns, mainly overactivity, first appeared with the use of the label "Hyperkinetic Reaction of Childhood" in the Second Diagnostic and Statistical Manual of Mental Disorders (DSM-II; APA, 1968). Following a series of studies by Douglas and her colleagues, attention and impulse control deficits became the most important aspects of this disorder (Douglas, 1972). In DSM-III (APA, 1980), the syndrome was named Attention Deficit Disorder with or without Hyperactivity, and was characterized by developmentally inappropriate inattention, impulsiveness, and hyperactivity. In the recent revision of DSM-III (DSM-III-R; APA, 1987), subtyping into two groups no longer exists and the syndrome is considered a single disorder. A child can now have one or more of the three primary deficits and still qualify for the diagnosis of ADHD.

In the present review of the literature, the diagnostic label used by the researcher in each study will be presented as such (e.g., MBD, ADDE, ADHD), reflecting changes in the nomenclature across time. Disorders and syndromes defined in DSM will be referred to in capital letters (e.g., Conduct Disorder) when the intention is to note that the procedures of the diagnostic system have been followed in diagnosing the condition.

To simplify the wording, when general or summary statements about the syndrome will be presented, the term "hyperactivity" will be used.

Definition and Prevalence of Hyperactivity

The essential childhood features of ADHD are age-inappropriate levels of inattention, impulsiveness, and hyperactivity (DSM-III-R; APA, 1987). To meet diagnostic criteria, these problems must emerge before age seven and persist throughout childhood. Manifestations of this disorder usually occur across several settings, although there may be some exceptions. The behavioural deficits typical of ADHD cannot be the result of obvious developmental disabilities, neurological diseases or severe psychopathology (Barkley, 1988).

ADHD has been estimated to affect approximately five percent of school-age children (APA, 1980; Bosco & Robin, 1980). Boys are reported as having the disorder more often than are girls, with ratios ranging from 4:1 to 9:1 across studies (Ross & Ross, 1976). In the Ottawa area, 5.7% of a random sample of 9229 children were found to have the symptoms of ADDH (Trites & Laprade, 1983). By excluding, from the sample, children with concurrent conduct & emotional problems, prevalence dropped to 1.6% of their sample. Their findings raise the possibility that the different prevalence rates of hyperactivity reported across studies may result not only from differences in the measuring instruments being used, but also from varied degrees of

conservatism in classification (Trites & Laprade, 1983).

Theoretical Models of Hyperactivity

The McGill research team has repeatedly demonstrated that hyperactive children have the most difficulty on tasks assessing vigilance or sustained attention, such as the continuous-performance test (Douglas, 1972; Firestone & Douglas, 1975). This test has now become the most widely used laboratory measure on attention in hyperactive children. However, Douglas observed an important degree of variability in the task performances of these children and later included this feature in the defining criteria of the disorder. In particular, Douglas (1983; Douglas & Parry, 1983) as well as other researchers (Barkley, Copeland, & Savage, 1980) found that settings or tasks that involved a high rate of immediate reinforcement or punishment for compliance to instructions resulted in significant reductions in attention deficits. This situational variability led some investigators to adopt a new model to explain the deficits in hyperactive children. This model proposed that motivation or reinforcement mechanisms were the core problems of ADHD (Rosenthal & Allen, 1978; Sroufe, 1975). If the child's motivation were low, as would be the case under social conditions demanding passive, unstimulating activity or during boring, repetitive, or lengthy work assignments, especially if no supervision were provided, greater deficits in sustained attention, activity regulation, impulse control and rule governed behaviour would be observed

(Draeger, Prior, & Sanson, 1986; Steinkamp, 1980).

The motivational model appears consistent with studies that suggest a deficiency in the availability of dopamine in ADHD children and the functions of dopamine pathways, particularly in the striatum, in regulating response inhibition, inattention, and incentive learning or sensitivity to reinforcement (Raskin, Shaywitz, Shaywitz, Anderson, & Cohen, 1984). However, as Barkley (1990) pointed out, this evidence cannot be considered conclusive at this time. Therefore, the debate between the value of the cognitive model of attention and the motivational model in accounting for the deficits in ADHD children is continuing (Barkley, 1990). There may be some truth in both models as pointed out by Lilienfeld and Waldman (1990). These researchers speculated that there might be two forms of ADHD. Individuals with ADHD alone may have a primarily cognitive disorder which impedes their ability to sustain attention and they have a high rate of learning problems. On the other hand, individuals with both ADHD and aggressiveness/Conduct Disorder (CD) may also display some inattention, but these deficits stem from a motivational deficit resulting from boredom and an oversensitivity to reward and novelty rather than from a cognitive inability to sustain attention. Few investigators have examined the cognitive/behavioural characteristics of HO and HA individuals, especially in hyperactive youngsters who have reached late adolescence.

Retrospective and Prospective Research Designs

The long-term outcome of hyperactivity can be studied in different ways. In a retrospective study, the researchers' information is usually based upon recollected data reported by the subjects themselves or by people who were significant in the subjects' lives. Researchers may also have to rely on clinical notes, test data, and diagnoses that were recorded years before any research question had been formulated. Retrospective studies are often problematic because they generally rely on potentially distorted recollections or on partially complete or incomprehensible records. Replication is difficult as the information available from clinical chart summaries varies across patients, as well as across clinical settings. Furthermore, they are usually unsuitable for prediction purposes because the initial selection criteria may be unknown or inappropriately biased, resulting in a selective subject pool (Brown & Borden, 1986).

In longitudinal prospective designs, the investigator selects and studies index subjects and controls, follows them for a certain period, and then reevaluates them. There is greater flexibility in the choice of pre-measures because the researcher is involved with the subjects from the beginning.

As with all experimental designs, the prospective one is not flawless. The greatest problem facing longitudinal studies is that of subject attrition. Researchers (Barkley, Fischer,

Edelbrock, & Smallish, 1990; 1991; Fischer et al., 1990; Gittelman et al., 1985; Mannuzza et al., 1991; Weiss et al., 1979) were successful in obtaining relatively complete data for 73-80% of their hyperactive samples after an 8-10-year follow-up period. Rates were generally higher when the assessment involved interviewing only because subjects who moved from the testing area could be interviewed by telephone. These rates dropped further, in some cases (e.g., Fischer et al., 1990) to 63%, when the study involved extensive in-lab testing in addition to interviews. Retrieval rates were lower (i.e., 59%) when a 15-year follow-up period was involved (Weiss et al., 1985).

Cost may also discourage some researchers. With the passing of time and the advances in scientific development, there is often the realization that initial measures were crude and that some crucial variables were omitted. Moreover, a properly matched control group is rarely planned on a prospective basis, either because of an omission or because the researcher chooses to compare the index subjects with a new control group not previously assessed. This limits the usefulness of the control group since it may render interpretations of any changes more difficult. In view of the strengths and weaknesses of each research designs, the longitudinal prospective design remains the most advantageous. The emphasis in the research review will be on those studies which have used the prospective method.

Overview of Longitudinal Studies Examining Hyperactive Versus Control Groups

Several studies merit review as exemplary attempts at carrying out difficult long-term investigations with hyperactive subjects. A team of American researchers led by Barkley and Fischer (Barkley, Fischer et al., 1990; 1991; Fischer et al., 1990) conducted an 8-year follow-up of hyperactive and normal control children who were re-contacted at the age of 14 years old. At intake, the hyperactive sample was diagnosed as hyperactive based on parent reports and rating scales only. No DSM guidelines were used in the diagnostic process. Subjects had participated in a medication study examining the effects of methylphenidate. Barkley, Fischer et al. (1990) found that at follow-up, significantly more hyperactive subjects received DSM-III-R diagnoses of ADHD (72% vs. 2%), Oppositional Defiant Disorder (ODD; 59% vs. 11%) and CD (43% vs. 2%) than did control subjects.

Symptoms of ADHD were also assessed with laboratory tasks (Fischer et al., 1990). Hyperactive subjects were not significantly more impulsive than normal control subjects on a long version of the Matching Familiar Figures Test, employing 20 stimulus trials (MFFT-20; Cairns & Cammock, 1978). However, in younger populations, the MFFT (Kagan, 1966) has not been consistent in detecting significant differences between hyperactive and normal children (Barkley, DuPaul, & McMurray,

1990; Milich & Kramer, 1985). On a vigilance task (Gordon, 1983; task duration lengthened from 9 to 12 minutes), hyperactive subjects displayed significantly more errors of omission and commission than did the normal control subjects, suggesting more inattention and impulsiveness in the hyperactive group. On the Distractibility task (Gordon, 1983), using standard parameters (9 minutes), hyperactive and normal control subjects did not significantly differ in terms of errors of omission or commission. The groups also did not significantly differ on neuropsychological tests which measured frontal lobe functions. Fischer et al. (1990) postulated that hyperactive subjects may be mainly impaired in brain regions responsible for inhibition of response. However, if these regions were impaired, inhibition problems should have been observed on the Distractibility task as well. The researchers suggested that the latter task may have been too stimulating or too short in comparison with the Vigilance task (9 versus 12 minutes, respectively) to find significant group differences (Fischer et al., 1990).

Hyperactive adolescents also had more school-related problems (Fischer, et al., 1990). Reading, spelling and arithmetic abilities as measured by the Wide Range Achievement Test- Revised (WRAT-R; Jastak & Wilkinson, 1984) were significantly lower for the hyperactive group relative to the control group. When they were observed during a restricted academic situation, hyperactive subjects displayed significantly

more off-task behaviour, fidgeting, vocalizing, distractibility with other objects, and out-of-seat behaviour. At school, they failed significantly more grades, more of them had quit school, and they had more retentions, suspensions and expulsions. Only the persistent ADHD accounted for the grade retentions and only the Conduct Disorders (CD) accounted for the expulsions. Having both ADHD and CD further increased the rate of suspensions and dropping out.

Hyperactive subjects did not use significantly more drugs than normal control subjects, but they tended to use more alcohol than controls. Given that their samples had not yet reached their mid to late teens when substance dependence and abuse seem to peak (Hechtman, Weiss, & Perlman, 1984), these findings may give more information about early onset than about maximum substance use. Moreover, without diagnoses of Substance Use Disorders (SUD), the severity or level of functional impairment cannot be evaluated. Overall, these findings suggested that the passage from childhood to adolescence was characterized by problems with Oppositional Defiant Disorder (ODD), CD, inattention, impulsiveness, academic performance, school behaviour, and possibly by emerging alcohol use.

The longest Canadian investigation to date is that of Weiss and her research group, from Montreal, who summarized 5-year (Weiss et al., 1971), 10-year (Weiss, et al., 1979), and 15-year (Weiss, et al., 1985) follow-ups of children judged to be

hyperactive by teachers and parents. The normal control group was selected at the 5-year follow-up and additional subjects were selected at the 10-year follow-up. When the hyperactive subjects reached the 5-year follow-up, mothers and youngsters (mean age 13.3 years) reported a significant decrease in overactivity, inattention and aggressiveness relative to intake findings. However, these behaviours had not normalized because teacher reports and classroom observations suggested that hyperactive adolescents were significantly more restless, unable to concentrate, aggressive, and they displayed significantly more antisocial behaviour than normal control adolescents recruited at follow-up from the same classrooms as the hyperactive subjects. Based on report cards, hyperactive subjects were also doing more poorly and had repeated more grades than the normal control group. These reported school problems are consistent with Barkley, Fischer et al.'s (1990) and Fischer et al.'s (1990) findings.

At the 10-year follow-up, hyperactive adolescents (aged 17-24 years) were still significantly more restless during the interview (Weiss et al., 1979). Hopkin, Perlman, Hechtman and Weiss (1979) studied a subsample (mean age= 19.5 years) of this population and found that the hyperactive subjects (n=70) were significantly more impulsive, as indicated by a significantly greater number of errors on a visual matching task (MFFT; Kagan, 1966) than normal control subjects (n=42). They did not,

however, commit more errors on the Stroop Test (Stroop, 1935) which also measures impulsiveness. Inattention and distractibility were not assessed. Significant school problems also persisted (Weiss et al., 1979). Hyperactive subjects had completed significantly fewer years of education, more of them had been expelled, their marks were lower, and they had failed more academic subjects. Hyperactive subjects also had significantly more personality disorders based on psychiatric interviews (Weiss et al., 1979). ADDH, CD and other DSM-III axis I disorders were not assessed, rendering any judgment of clinical impairment difficult to make. Although significantly more hyperactive adolescents than normal control adolescents had used non-medical drugs during the 5 years previous to follow-up, they did not use more drugs during the year before follow-up. The severity of drug use was not significantly different between the two groups 1 and 5 years before follow-up.

Alcohol use was assessed 2 years later in half of their original sample (Hechtman, Weiss, & Perlman, 1984). At this 12-year follow-up, significantly more hyperactive adolescents had abused or become addicted to alcohol in the past 5 years. No differences in alcohol use were found for the 3 months preceding this follow-up. Therefore, a significant portion of the hyperactive group had a drinking problem during early adolescence but these problems subsided by early adulthood. At the 15-year follow-up, two thirds of the hyperactive group (aged 21-33 years)

reported at least one symptom of ADDH (Weiss et al., 1985). The percentage of hyperactive individuals who continued to have an ADDH was not reported. Although hyperactive subjects self-reported significantly more DSM-III diagnoses than normal control subjects, the only diagnosis which distinguished the two groups was Antisocial Personality Disorder (APD). Twenty three percent of the hyperactive sample received a diagnosis of APD. On rating scales, hyperactive adults rated themselves as having more clinical psychopathology and as functioning less well than the control adults. These group differences were not significant 5 years previously. No information on drug abuse was available but alcohol abuse was no longer significantly different between the two groups when they reached adulthood. Whether alcohol abuse was based on DSM-III criteria is not clear.

In total, this report suggests that in adolescence and early adulthood, approximately 2/3 of hyperactive subjects have not outgrown all symptoms of hyperactivity and a significant number of hyperactive subjects experience educational problems. Approximately 1/4 of hyperactive subjects develop an APD, and this may be the only form of psychopathology which significantly distinguishes the hyperactive subjects from the normal control subjects. There is also some evidence that significantly more hyperactive subjects, relative to normal control subjects, had used alcohol and drugs, but these differences were only apparent for a short period. More information is needed about rates of

clinically significant disorders as defined by an objective diagnostic system (e.g., DSM-III-R) and patterns of comorbidity.

Aside from Weiss' research, the only other longitudinal Canadian study available, which was conducted by Blouin, Bornstein and Trites (1978), was retrospective. They compared hyperactive adolescents to a group of children referred for psychological assessment because of difficulties in school (unspecified) for reasons other than hyperactivity. The control group was matched with the hyperactive group for age, sex, and IQ. At the five-year follow-up, hyperactive subjects (mean age approximately 13.9 years) received significantly higher ratings of impulsive-hyperactive behaviour, and conduct problems as measured by the Conners' Parent Rating Scale (CPRS; Conners, 1970), than did the comparison group. No differences were found on scales measuring academic achievement (WRAT, Jastak & Jastak, 1976) and intellectual ability (Wechsler Adult Intelligence Scale- Revised, WAIS-R, Wechsler, 1981; or Wechsler Intelligence Scale for Children, WISC-R, Wechsler, 1974), suggesting similar difficulties within both clinical groups. Hyperactive subjects reported significantly greater use of alcohol, but drug use was not significantly greater among these subjects. The level of impairment resulting from alcohol use is unclear because the severity of substance use was not established in this study. Reliance on retrospective childhood diagnoses which were not based on the presence of the primary characteristics of ADHD is

problematic. However, the behavioural and academic problems reported in this 5-year follow-up are generally consistent with those reported by the Weiss research group.

In two prospective longitudinal studies conducted in Long Island, New York, Gittelman, et al., (1985) and Mannuzza et al. (1991) examined two cohorts of adolescent males (ages 16-23 and 16-21, respectively) who had been diagnosed as hyperactive in childhood approximately 10 years previously. The normal control groups were selected at follow-up from medical charts. The diagnostic procedures used at referrals antedated the DSM-III, therefore, children were not assessed for the presence of the primary characteristics of ADDH. At follow-up, subject and parent interview data were used to generate DSM-III diagnoses. Only the Gittelman et al. (1985) study reported diagnoses present any time since age 13 years in addition to diagnoses present at follow-up.

Findings of diagnoses at follow-up from both studies were consistent with each other and will be presented first, and in a combined fashion. Results showed that the full ADDH syndrome was still prevalent in 40-43% of the probands in late adolescence. One quarter to one third of the hyperactive group had a CD/APD. These rates were somewhat higher than those reported by Weiss et al. (1985) with their Montreal sample. Differences may either reflect higher levels of initial aggressiveness in the Gittelman sample or geographical differences in rates of antisocial

behaviours. Alcohol Use Disorders were present in 6-8% of probands and Drug Use Disorders were found in 10-16% of them. The rates of diagnoses given any time since age 13 years were higher for ADD (68%), CD/APD (45%) and Drug Use Disorders (26%) relative to the rates found at follow-up but rates of Alcohol Use Disorders appeared relatively stable for the two time periods (Gittelman et al., 1985). For both time periods, the hyperactive subjects had significantly more ADDH, CD/APD, and Drug Use Disorders than the normal control group but did not have significantly more Alcohol Use Disorders (Gittelman et al., 1985; Mannuzza et al., 1991). Those who received the diagnosis of ADDH at follow-up were two to three times more likely to also have a CD/APD. In turn, one third to two thirds of the youngsters with a CD/APD developed a Drug or Alcohol Use Disorder. The groups did not differ in terms of rates of Affective, Anxiety or Schizophrenic Disorders. In all cases the onset of the CD/APD always preceded or coincided with the onset of the SUD. When official arrest records were obtained, Mannuzza, Gittelman Klein, Horowitz Konig, and Giampino (1989) found that the persistence of childhood ADDH into young adulthood was not a sufficient condition to increase the risk for police contacts. The presence of an APD in young adulthood was a necessary condition for an arrest history.

In Los Angeles, California, Satterfield et al. (1982) studied the delinquent behaviour of 110 hyperactive boys,

followed from initial diagnosis (ages 6-12 years) through adolescence (mean age 17 years). Diagnoses at referral were based on parents and/or teachers reports and offender rates were obtained from the subjects' official records. A normal control group was also followed for the same period of time. Relative to the normal control group, significantly more hyperactive subjects had: (1) been arrested at least once for a serious offense; (2) a record of multiple arrests for a serious offense; (3) been institutionalized for delinquent behaviour. As many as 36-58% of hyperactive boys had at least one arrest for a serious offense, 25-45% had multiple arrests, and 25% of the hyperactive boys had been institutionalized for delinquent behaviour. Rates of arrests in the probands were much higher than those found by other researchers (e.g., Weiss et al., 1979)

Methodological Issues

Diagnostic ambiguity is characteristic of most of these follow-up studies. Researchers have either failed to describe their diagnostic criteria (Blouin et al., 1978) or they simply reported that, based on parent/teacher interviews or rating scales, their samples were rated as hyperactive (Weiss et al., 1971; Gittelman et al., 1985) or hyperactive, inattentive and impulsive (Satterfield et al., 1982). Further elaboration of their diagnostic tools is atypical, largely because at the time, established standards for the assessment and formulation of the hyperactivity diagnosis, and other psychiatric diagnoses were

unavailable. The selection procedures of normal control groups were problematic in some studies. The Weiss team reported that 35 normal control subjects were recruited at the 5-year follow-up and 10 more were recruited at the 10-year follow-up. At both follow-ups, control subjects were excluded if their parents or teachers had ever complained that the subjects had child behaviour problems. Given that at the 5-year and 10-year follow-ups, subjects had reached early adolescence and mid to late adolescence, respectively, part of their sample could be considered "supernormals" given that too many negative developmental effects have been screened out at an advanced age for this subsample. These exclusion criteria would tend to inflate all group differences. Gittelman et al. (1985) and Mannuzza et al. (1991) selected their normal control groups at follow-up from a medical centre. This procedure may also pose some problems. The representativeness of this control group is questionable given that they are presenting at a tertiary level centre.

No Canadian study examined the rates of DSM-III-R diagnoses in a population of older adolescents and young adults. The only Canadian study that examined a similar age group reported the prevalence of specific dysfunctions without the inclusion of diagnoses (Weiss et al., 1979). Psychiatric diagnoses present a less fragmented view, they allow for comparisons across studies, and they assume functional impairment.

A paucity of objective pre- and post-measures was also frequently encountered in the review of longitudinal studies. Primary ADHD symptoms were commonly derived from rating scales (Weiss et al., 1971; Satterfield et al., 1982) or from clinical interviews (Weiss et al., 1979, 1985; Gittelman et al., 1985). Although direct classroom observations were occasionally incorporated to measure distractibility (Weiss et al., 1971), or clinical observations were used to measure restlessness (Fischer et al., 1990; Weiss et al., 1979, 1985), only one study (Fischer et al., 1990), involving young adolescents (mean age 14 years old) used well-controlled laboratory tasks to measure both attention and impulsiveness. It is not known whether these symptoms persist into late adolescence and early adulthood, further supporting the cognitive model of attention and impulsiveness later in life. Pre-measures of academic achievement have also been largely based on verbal reports or school records which may have been incomplete and variable across subjects. The early use of standardized academic achievement measures with children who would be retested 10-15-years later was rare.

Summary of Findings

The prospective data give strong support to the notion that although overactivity and inattention diminish with time, the ADHD syndrome does persist into adolescence and adulthood in a significant number of children with this disorder. They continue

to have problems with restlessness, impulsiveness, inattention and distractibility. A consistent finding across studies is the presence of significant academic difficulties in the hyperactive groups. A significantly higher rate of psychopathology is also reported in the hyperactive groups, although differences between the hyperactive and control groups usually appear only in late adolescence or adulthood, and may involve only hyperactivity and CD/APD. Findings on alcohol and drug use/abuse are equivocal at this point. Group differences in alcohol use were mostly found in populations of young adolescents. Group differences in drug use seemed to vary across studies for both younger and older adolescent populations. Comparisons across studies were difficult to perform because more often than not, researchers did not use standardized psychiatric diagnoses. Rates of antisocial behaviours in hyperactive children who reached adolescence and young adulthood were variable (23-43%). Satterfield et al. (1982) did not use DSM diagnoses but their findings revealed the highest rates of antisocial behaviour. These higher rates relative to those obtained by other researchers cannot be explained by their use of more objective measures of court records because Weiss et al. (1985) later collected official court records on all of their previously interviewed subjects and their findings revealed that there was considerable accuracy in the original interview data. Mannuzza et al. (1989) also found a high percentage (90%) of accuracy between official arrest records

and the combined reports of parents and adolescents.

The considerable variability in the antisocial data may be an indication that the researchers were studying subjects with different levels of aggressive behaviour at referral. As a consequence, what was thought to be a homogeneous sample of "hyperactive" children may have turned out to be a combination of qualitatively different subgroups. Subgrouping according to levels of aggression has rarely been applied in hyperactivity research; therefore, an important proportion of outcome variability, especially regarding antisocial behaviours, may not have been explained. This oversight has important disadvantages because, as presented in the next section, hyperactive/aggressive subjects differ on several referral and outcome measures from subjects who are hyperactive only. These differences need to be examined because they not only reduce the heterogeneity of this disorder, they can also guide clinicians in designing treatment programs to meet the distinct clinical needs of these groups of children.

Overview of Studies Examining the Relationship Between Hyperactive and Aggressive/Antisocial Behaviours

In a preliminary study conducted in New Zealand, McGee, Williams, and Silva (1984a, 1984b) examined the relationship between hyperactivity, aggressiveness, and specific familial variables (McGee et al., 1984a) and other childhood behavioural and cognitive variables (McGee et al., 1984b). The researchers

used 2-standard-deviation cutoff scores, from the parent and teacher Rutter Scales (Rutter, Tizard, & Whitmore, 1970), to assign a large sample of 7-year-old children to four subgroups: (1) Aggressive-only (A); (2) Hyperactive-only (HO); (3) Hyperactive-Aggressive (HA); and (4) Remainder "problem-free" group (R). The original sample has been fully described by McGee and Silva (1982).

Among the most salient results, significant differences were obtained on the following variables: (a) mothers of all three problem groups obtained a lower measure of intellectual ability (SRA verbal form; Thurstone & Thurstone, 1973) and reported significantly more physical and psychological symptoms than mothers of the R group; (b) the A group was more likely to come from single-parent or divorced homes in comparison with the HA, the HO, and the R groups who did not differ significantly from each other; (c) the HO and HA groups were found to be more overactive, emotionally labile and impulsive than the A or R group; (d) the HO group displayed a shorter attention span than did all other groups; (e) all three problem groups showed poorer verbal intelligence quotients (IQ) when compared with the R group, but only the HO and HA groups had significantly lower performance IQs and reading performance in comparison with the R group; (f) the HA group had the highest rate of specific reading retardation; this finding was still present at 2-year follow-up; (g) at 2-year follow-up, the HO and HA groups had more negative

self-perceptions of their scholastic abilities in comparison with the A and R groups.

In essence, these findings suggest that mainly aggressiveness, and hyperactivity to a lesser degree, are linked to more familial distress and that hyperactivity is more closely linked to cognitive deficits. A combination of hyperactivity and aggressiveness may be related to a higher incidence of specific reading retardation and behavioural and psychological problems. In sum, these results suggest some differentiation of subgroups on cognitive, achievement-related, behavioural, and prognostic variables (Hinshaw, 1987).

Unlike the McGee et al. (1984a, 1984b) studies, August, Stewart, and Holmes (1983) did not compare the hyperactive subgroups to a control group but rather to each other. The subjects in the August et al. (1983) study were also tested at a later age (mean age 14.2 years) than the subjects in the McGee et al. (1984a, 1984b) studies. August et al. (1983) divided the group of hyperactive boys into: (1) hyperactive/aggressive (HA) and (2) hyperactive only (HO) subgroups. The criteria used to establish the research diagnoses were based on information provided by 5 informants. At 4-year follow-up, information on hyperactivity and problem behaviours were based on parental report solely. At follow-up (mean age 14.2 years), both hyperactive subgroups (HA & HO) showed deviancy on measures of overactivity, inattention, and reactivity, but the HO group had

significantly greater inattention. The HA group scored significantly higher on noncompliance, aggression, and egocentricity. They also had significantly more parental reports of conduct disturbance, including Alcohol and/or Drug Abuse. At follow-up, none of the HO boys received the additional diagnosis of CD, whereas 37% of HA boys met the diagnosis. These findings suggest that antisocial behaviours reported in early adolescence depended more on the early presence of aggressiveness and conduct problems than on the symptoms of hyperactivity (August et al., 1983).

Lambert (1988) conducted a prospective longitudinal study of subjects who were classified as Hyperactive, Aggressive or both, based on scores on the Behaviour and Temperament Survey, both school and home versions (Lambert & Hartsough, 1987). All subjects were first assessed in elementary school, and were recontacted when they reached the age of 17-18 years. Results from interviews suggested that subjects with either pervasive ADDH (HO) or pervasive aggressiveness (A) in childhood had significantly more CD without Aggressiveness than the normal control group in adolescence. However, in comparison with a normal control group, diagnoses of CD with Aggressiveness were significantly more prevalent in a group who, in childhood, had received a dual diagnosis of pervasive aggressiveness and pervasive hyperactivity (HA). These findings provide additional support to August et al.'s (1983) results which indicate that a

combination of childhood hyperactivity and aggressiveness (HA) puts a child at risk for more aggressive behaviour problems in adolescence. However, the results also suggest that pervasively hyperactive children who are not significantly aggressive (HO) are not immune to later non-aggressive CD. The picture regarding substance use outcomes seemed less clear and the authors suggested that other factors were probably involved as well. Overall, these findings suggested that subjects who were both hyperactive and aggressive in childhood generally had the worst prognosis in adolescence from a behavioural point of view, which is consistent with the findings of McGee et al. (1984a, 1984b) and August et al. (1983).

Langhorne and Loney (1979) conducted a retrospective study on 84 boys who, 5 years previously, had been diagnosed as having the Hyperkinetic/MBD Syndrome. The data were drawn from the files of the Iowa HABIT study conducted at the University of Iowa by Loney and her colleagues (Loney et al., 1976). These researchers performed a within-source principal axis factor analysis of judges' ratings of 13 primary and secondary symptoms at referral. The judges' symptom ratings were made after review of medical records of children seen in an outpatient psychiatric clinic. Two factors resulted from this analysis which they labelled Aggression and Hyperactivity. Langhorne and Loney (1979) sorted the sample into high and low aggression groups as well as high and low hyperactivity groups (by dividing the two

factors at the mean). The authors presented subgroup differences for variables collected at adolescence (ages 12-18 years). Children high on the Hyperactivity Factor were found to have more errors on the Bender Gestalt test at follow-up than children who were low on this factor. Moreover, children high on the Aggression Factor continued to show more aggression at follow-up, as rated by their mothers, as well as more self-esteem deficits, as reported by both the adolescent (using the Piers-Harris Self-Esteem Scale) and the tester's ratings than those who were low on this factor. No such relationship was found between Hyperactivity and self-esteem. Although the follow-back period was short and based on retrospective accounts, the findings suggest some stability in perceptual deficits and aggressiveness and underline the importance of providing separate consideration of aggressiveness and hyperactivity.

Summary of Findings

Four studies described in the preceding section (August et al., 1983; Lambert, 1988; Langhorne & Loney, 1979; McGee et al., 1984b) have provided some clarifications to the previously formulated conjectures that "hyperactive" children are at increased risk for subsequent conduct disturbance, delinquency, and substance abuse (Gittelman et al., 1985; Hechtman, Weiss & Perlman, 1984; Mannuzza et al., 1991; Satterfield et al., 1982; Weiss et al., 1971, 1985). Although these claims were based on rigorous longitudinal studies, they were made on the basis of

initial sampling procedures that yielded combined groups of HO and HA children (Hinshaw, 1987). Most of these investigators relied on diagnostic procedures which were contaminated with items that measured aggression, thus lacking in discriminant validity (Loney, 1987). A shortcoming of having a heterogeneous sample is the difficulty in drawing conclusions about whether the primary symptoms of childhood hyperactivity (inattention, overactivity, impulsiveness) predict later outcome or whether other factors such as aggressiveness have more influence (August et al., 1983). In fact, childhood aggressiveness, more than hyperactivity alone, may have accounted for adolescent aggressive/antisocial behaviours (August et al., 1983; Lambert, 1988; Langhorne & Loney, 1979) and self-esteem deficits (Langhorne & Loney, 1979).

The degree of overlap in hyperactive and aggressive/antisocial behaviours in most studies can be attributed to the clinic-referred nature of the samples used (Loney, 1987). Children with multiple problems (comorbidity) are more likely to be referred to a clinic. However, on the basis of the subgroup studies, one can conclude that despite the considerable overlap between subgroups of "hyperactive" and "aggressive" children, hyperactivity and aggressiveness interact differently with several key criterion variables. In fact, two groups of hyperactive children must be considered. The subjects in one group present aggressive behaviours which put them at risk

for later self-esteem deficits as well as for later antisocial behaviours. They also come from the most distressed families.

Some researchers have postulated that mechanisms for the development and maintenance of aggression in children may occur as a result of the combination of those elements of childhood temperament related to hyperactivity, impulsiveness, persistence in demands, and quickness to anger in conjunction with disordered parental and family functioning (Buss, 1981; Patterson, 1982). Parental psychopathology, especially maternal depression, and marital discord seem to alter parent perceptions and management of child behaviour (Bond & McMahon, 1984; Brody & Forehand, 1986; Webster-Stratton, 1988). These distressed families are more likely to provide inconsistent management, to engage in coercive exchanges with their children and to reinforce negative and coercive behaviour by their children through negative reinforcement (Brody & Forehand, 1986). Repeated negative parent-child encounters increase the chances that aggressiveness and antisocial behaviours will become part of a child's repertoire (Patterson, 1982).

Hyperactive children in the second group show few if any signs of conduct disturbance at a young age (H0), have a higher prevalence of inattention and show few signs of behavioural deviance in early adolescence beyond their difficulties with attention and impulsiveness. Their self-esteem deficits seem limited to scholastic problems. Both groups of hyperactive

children are more cognitively impaired, and have more reading difficulties than normal control groups. There are some suggestions that the HA group has the highest rate of reading retardation, and of enrolment in special schools.

Although the reviewed studies did contribute important information on the development of HA and HO children, they were limited in some regards. Four out of five studies were conducted with populations younger than 15 years old. Therefore, the predictive power of childhood aggressiveness and hyperactivity has been established for a relatively short period involving early to mid-adolescence. No results on objective measures of academic skills or cognitive abilities have been reported with HO, HA, and C subjects who reached late adolescence. Findings are also limited by some methodological problems. There is some concern for the methods used to assign diagnoses of hyperactivity. Diagnoses of hyperactivity were based on clinical interviews which have not known wide-spread use and which may be of questionable validity (August et al., 1983) or on retrospective accounts from medical charts (Langhorne & Loney, 1979). Moreover, diagnoses were based on the results of various questionnaires measuring hyperactive and aggressive/conduct problem factors which have not been shown to be independent (McGee et al., 1984a, 1984b). This suggests that there may still be a considerable overlap between subgroups of aggressive and non-aggressive hyperactive subjects in these studies.

Sex Differences in Hyperactive Subjects

Only one of the four subgroup studies reported above (Lambert, 1988) included females in their subject samples. Most of the published follow-up studies of hyperactive children have used entirely male samples, because the small number of female subjects available for research usually made it impossible for researchers to include them in a separate group. The generalizability of the findings obtained with male populations to female populations is questionable.

Research studies involving sex differences in hyperactive children have yielded controversial results. For example, relative to hyperactive boys, hyperactive girls have been found to exhibit less impulsiveness and fewer conduct problems (Kashani, Chapel, Ellis, & Shekim, 1979; de Haas & Young, 1984), to show more severe cognitive deficits and learning problems (Berry, Shaywitz, & Shaywitz, 1985; Kashani et al., 1979), and to experience better peer relationships (Battle & Lacey, 1972). On the other hand, others have found male and female hyperactive children to be strikingly similar in terms of both primary and secondary symptomatology (Befera & Barkley, 1985; Horn, Wagner, & Ialongo, 1989; McGee, Williams, & Silva, 1987). Horn et al. (1989) explained that the discrepancies in the results probably stemmed from differences in the subject inclusion criteria. Specifically, studies that found significant sex differences usually did not have the requirement for pervasiveness of

hyperactivity whereas subjects in Horn et al.'s (1989) study had to meet this inclusion criterion.

Pervasive and situational hyperactive children have been found to differ on cognitive and behavioural measures (Schachar, Rutter, & Smith, 1981), therefore studies which did not separate the two subgroups probably introduced greater heterogeneity than studies which examined pervasively hyperactive children only. As Horn et al. (1989) state, this increase in heterogeneity could have increased the probability that spurious factors would lead to the finding of sex differences. This hypothesis is feasible given that prior results were even contradictory among themselves as to what kinds of sex differences were found. Thus, it appears that with pervasively hyperactive samples, there were few important sex differences in either the primary or the secondary symptomatology of ADHD, therefore, one might speculate that female hyperactive persons have etiologies and long-term outcomes similar to those of males (Horn et al., 1989). Further work is needed to confirm this hypothesis.

Predictive Studies

The longitudinal studies just presented have addressed a variety of problematic outcomes in the adolescent or adult life of hyperactive subjects. These outcome measures can be classified into three general areas: primary ADHD symptoms, academic adjustment, and social adjustment. A few researchers have attempted to identify potential predictors of adolescent

outcome, using a multiple regression approach. In the review that follows, the most significant predictors of each of the three categories of adolescent outcome, which were identified in longitudinal studies, will be presented.

1. Primary ADHD Symptoms

Loney et al. (1981) conducted a retrospective archival study of 30 boys who, at referral (ages 6-12 years) displayed the hyperkinetic/minimal brain dysfunction syndrome, and participated in a drug study at the University of Iowa. These researchers found that at follow-up (subjects aged 12-18 years), hyperactivity, as reported by mothers, was best predicted by the following referral variables: a lower socioeconomic status (SES), more child aggression, and more perinatal complications. Judgment deficits (e.g., impulsiveness, immaturity) were also predicted by childhood aggression, whereas inattention was best predicted by the age of ADHD symptom onset. Childhood overactivity was not predictive of adolescent ADHD symptomatology. The children were all hyperactive, therefore the lack of predictive power of overactivity might reflect its initially low variance (Taylor, 1988). Length of treatment with stimulant medication was not examined as a predictor of adolescent hyperactivity. Measures of childhood aggression and hyperactivity were derived retrospectively from patient charts, and the follow-up data were based uniquely on mothers' reports; therefore, the findings should be regarded as preliminary.

2. Academic Adjustment

The hyperactive subjects', not unlike non-clinical subjects' mean IQ at referral has been found to be a significant predictor of success in school in a group of young adolescents (mean age 13 years; Weiss, et al., 1971). The same population was reevaluated a few years later, and IQ was found to be the best predictor of the number of grades completed, the second best predictor of the adolescent's academic standing, and it was within the top 10 predictors of the number of grades failed (Hechtman, Weiss, Perlman, & Amsel, 1984). Achievement measures, based on teachers' ratings, (Loney et al., 1981) or based on a standardized achievement battery (Lambert, 1988), as well as past school performance (Loney et al., 1981) have also been found to be consistent predictors of later academic outcome. In fact, Lambert (1988) found the achievement battery (Peabody Individual Achievement Test; Dunn & Markwardt, 1970) to be a more salient predictor of adolescent educational variables (attended special school, completed High School, attended college) than IQ. Within the demographic variables, SES was an important predictor in a group of older adolescents only (aged 17-24 years; Hechtman, Weiss, Perlman, & Amsel, 1984). Hyperactivity had greater predictive power than measures of aggression for educational outcome variables (Hechtman, Weiss, Perlman, & Amsel, 1984). A positive response to stimulant treatment predicted WRAT-R Reading and Arithmetic scores in adolescence (Loney et al., 1981), but

length of stimulant treatment was not predictive of academic achievement. In summary, IQ, past academic achievement or school ratings, SES, childhood hyperactivity and response to stimulant treatment have all been found to be prominent predictors of later educational outcomes.

3. Social Adjustment

(i) Antisocial behaviour

Some predictive studies (Weiss et al., 1971; Loney et al., 1981; Lambert, 1988) have reported that childhood measures of aggression were salient predictors of adolescent antisocial behaviour. In Hechtman, Weiss, Perlman, & Amsel's (1984) study, aggression did not enter the regression equation but the authors speculated that this was due to the significantly high correlation between aggression and another variable, emotional stability, which did enter the predictive model. Both aggression and emotional stability were assessed through mother and child interviews. A low IQ significantly predicted the number and severity of criminal offenses (Hechtman, Weiss, Perlman, & Amsel, 1984), whereas a low self-concept was found to be a significant predictor of the frequency of aggressive and non-aggressive CD in adolescence (Lambert, 1988).

Researchers who examined familial measures (through interviews) found that the parents' SES, their mental health, child-rearing practices, and the emotional climate of the home were also salient predictors of later antisocial behaviour in the

child (Hechtman, Weiss, Perlman, & Amsel, 1984; Lambert, 1988; Weiss et al., 1971). This supports the model that a combination of negative child characteristics (e.g., aggression) and family distress contribute to the development of antisocial behaviour.

In summary, childhood aggression, childhood emotional stability, familial distress, SES, and the childhood IQ, seem to be the best predictors of adolescent and early adult antisocial behaviour. The prediction of CD/APD in adolescence and adulthood appears more difficult than the prediction of specific antisocial behaviours. Loney et al. (1983) found that only a lower IQ and a greater number of siblings were associated with the presence of a diagnosis of APD. In a sample of 9-year-old males who were followed-up to the age of 18 years, Mannuzza et al., (1990) found that at follow-up, subjects with CD (N=27) could not be distinguished from pure ADD subjects (N=19) or from subjects with no disorder (N=50) based on 40 intake variables.

(ii) Involvement with Drugs and Alcohol

Some childhood predictors were significant for both illegal drugs and alcohol. The most prominent predictors of involvement with either substance included aggression (Hechtman, Weiss, Perlman, & Amsel, 1984; Loney et al., 1981), and antisocial behaviour (Hechtman, Weiss, Perlman, & Amsel, 1984). In fact, Gittelman et al. (1985) found that, according to the subjects' self-reports, CD always preceded the SUD. Familial variables were again prominent (Lambert, 1988; Hechtman, Weiss, Perlman, &

Amsel, 1984), particularly the parents' mental health. Age at referral was a salient predictor of later substance use in Loney et al.'s (1981) study. Children who were older at referral were at a higher risk for substance use at follow-up. Loney et al. (1981) explained these results by stating that children who were older at referral were also older - and further into the age-related risk period for substance use - at follow-up. Lambert (1988) found that a negative self-concept predicted later substance use.

There were also specific predictors that placed children at risk for alcohol use only or drug use only. For example, Hechtman, Weiss, Perlman, & Amsel (1984) found that IQ was a strong predictor of the use of hallucinogens, stimulants and barbiturates. This variable was not a significant predictor in other studies. Loney et al. (1981) reported that a positive response to stimulant medication predicted less involvement with illegal drugs. Length of stimulant medication treatment was not predictive of involvement with drugs or alcohol. Lambert (1988) found that the use of hard liquor was predicted by the parents' use of diet pills.

In summary, substance use may be best predicted by measures of childhood aggressive/antisocial behaviour, the parents' mental health, the child's age at referral, the child's self-concept, the child's response to stimulant medication treatment, and possibly the child's IQ and the parents' use of diet pills. As

in the case of CD/APD, diagnoses of SUD were more difficult to predict than specific substance use behaviours. For example, in the Loney et al. (1983) study, a lower IQ was the only predictor of Alcohol Use Disorders whereas in the Mannuzza et al. (1990) study, only 3/40 variables significantly discriminated between subjects classified in a SUD, ADD, and no disorder group. As noted by Mannuzza et al. (1990), these associations would probably have been expected by chance alone.

Summary of Findings

A search for patterns of predictors over all outcomes provides preliminary evidence about whether each outcome variable has its specific antecedents or whether there are particular predictors that place a child at risk generally. For example, on the basis of the findings from the predictive studies, it appeared that unfavourable familial variables, particularly a low SES, as well as a low childhood IQ were predictive of a generally poor adolescent outcome. Aggression was a significant predictor of antisocial behaviour, substance overuse, and of adolescent symptoms of hyperactivity and impulsiveness. The relationship between childhood aggression and later antisocial behaviours and substance overuse has been reported by others as well (Loney et al., 1983; Weiss et al., 1971). However, the importance of childhood aggression in predicting parent ratings of adolescent hyperactivity and impulsiveness may be due to an overlap between the aggression factor and the hyperactivity and impulsiveness

factors. The relationship between aggressiveness and hyperactive behaviours may not hold when hyperactivity is assessed using laboratory measures.

On the other hand, childhood hyperactivity and academic variables were more specific predictors of adolescent academic adjustment. The relationship between these variables is understandable given that the school setting does require sustained attention, impulse control and an ability to remain in one place for extended periods of time.

Generally, these findings suggested that no single predictor, alone, was useful in predicting the outcome of hyperactive children (Barkley, 1990). The combination of several factors, including childhood and familial characteristics appeared to be necessary in predicting outcome.

Although these predictive studies were sophisticated conceptually and analytically, some of them were flawed by failing to specify the diagnostic procedures (Loney et al., 1981). An overreliance on secondary report measures rather than direct observations and standardized tests was also characteristic of several predictive studies (Hechtman, Weiss, Perlman, & Amsel, 1984; Lambert, 1988; Loney et al., 1981; 1983; Weiss et al., 1971). Specifically, there was an absence of objective familial measures, and standardized academic and cognitive measures. Antisocial measures were often based exclusively on the reports of children whose motivation may have

been to present themselves in a favourable light. Additional information from mothers' reports could present a more realistic view of the child's state. Outcome measures also largely consisted of specific behaviours instead of psychiatric diagnoses. Identifying early predictors of later diagnoses of ADHD, and Alcohol and Drug Dependence/Abuse is more informative from a descriptive and functional point of view than evaluating predictors of "judgment deficits", substance use, or emotional adjustment which carry very idiosyncratic meanings, not easily comparable across studies. The only two studies that attempted to predict diagnostic grouping generally failed to find significant predictors (Loney et al., 1983; Mannuzza et al., 1990). The lack of objective measures at intake may account for some of these findings. Moreover, little information was available on the ability of treatment variables to predict adolescent outcome.

Rationale and Hypotheses

Despite various research efforts, the long-term outcome of hyperactive children remains unclear. This is particularly true for the Canadian context. No Canadian study has examined the rates of psychiatric diagnoses in hyperactive children who have reached late adolescence/early adulthood. This raises the question of whether hyperactive children are seriously at risk for later functional impairment. A team of American researchers (Gittelman et al., 1985; Mannuzza et al., 1991) reported a significant risk for CD/APD and Drug Use Disorders in hyperactive children who reached late adolescence. However, differences between Canada and the United States in societal norms, family cohesiveness, socioeconomic factors, and educational and health care systems may well result in differences in the way this high risk group develops in the two countries.

No known long-term study involving hyperactive subjects in late adolescence/early adulthood has combined an assessment of psychiatric diagnoses and objective measures of cognitive (i.e., inattention, impulsiveness, distractibility) and academic performance. Moreover, examining how HA and HO children develop and compare to each other and to a control group in adolescence would disentangle the possible confounding role of aggressiveness in the relation between ADHD and adolescent antisocial behaviour, yielding important prognostic information to parents and child specialists. Identification of predictors of adolescent outcome

is at a very exploratory stage given that the work to date has not been clearly linked to theory. This area is very important because the identification of predictors would facilitate early detection and treatment of children at high risk for later problems.

In the present study, some of the design flaws discussed in the literature review were corrected in the following ways: (1) diagnoses of hyperactivity were derived at intake from rating scales and from clinical interviews which included assessments of whether participants met DSM-III criteria for AD/HD; (2) baseline and outcome measures were well known, objective and psychometrically sound; (3) in addition to the child variables, a number of predictor variables consisted of rigorous measures of the parents of the hyperactive subjects; (4) the hyperactive group (HYP) were subdivided, using psychometrically sound measures recorded at intake, into Hyperactive-Aggressive (HA) and Hyperactive-Only (HO) subgroups based on the most commonly used measure for which convergent and discriminant validity of factors has been shown (Inattention/Overactivity with/out Aggression Conners Teacher Rating Scale: IOWA Conners; Loney & Milich, 1982; Milich & Landau, 1988); (5) at follow-up, normal control subjects were recruited from a variety of settings and were not excluded for any symptomatology which developed after the mean age of referral of the hyperactive group, thus reducing possibilities of recruiting a "supernormal" control group.

Specifically, the following hypotheses were formulated at follow-up:

1. Psychiatric Classifications: DSM-III-R Diagnoses:

a) Significantly more subjects from the HYP group, in comparison with subjects from the normal control (C) group, will receive the following DSM-III-R diagnoses as measured by the Schedule for the Assessment of Conduct, Hyperactivity, Anxiety, Mood, and Psychoactive Substances (CHAMPS; Mannuzza & Gittelman-Klein, 1987):

- (i) ADHD
- (ii) CD/APD
- (iii) Alcohol Abuse or Dependence
- (iv) Drug Abuse or Dependence
- (v) A dual diagnosis of CD/APD and of SUD (Alcohol or Drugs)

b) Significantly more subjects from the HO and HA groups, in comparison with subjects from the C group, will receive diagnoses of ADHD.

c) Significantly more subjects from the HA group, in comparison with subjects from the HO or the C groups who will not differ from each other, will receive the following DSM-III-R diagnoses:

- (i) CD/APD
- (ii) Alcohol Abuse or Dependence
- (iii) Drug Abuse or Dependence
- (iv) A dual diagnosis of CD/APD and of SUD (Alcohol or Drugs)

2. Cognitive Performance:

a) Deficits in impulsiveness, attention, and distractibility will be present to a greater extent in the HYP group than the C group. Specifically, the HYP group will:

- (i) obtain significantly lower Efficiency Ratios on the Delay Task of the Gordon Diagnostic System (GDS: Gordon, 1982), a measure of impulsiveness.
- (ii) commit a greater number of errors of omission (attention) and commission (impulsiveness) on the Vigilance Task of the GDS.
- (iii) commit a greater number of errors of omission (distractibility) and of commission (impulsiveness) on the Distractibility Task of the GDS.

b) It is hypothesized that deficits in impulsiveness, attention, and distractibility will be present to a greater extent in the HO and HA groups than the C group.

Specifically, the HO and HA groups will:

- (i) obtain significantly lower Efficiency Ratios on the Delay Task of the GDS, a measure of impulsiveness.
- (ii) commit a greater number of errors of omission and commission on the Vigilance Task of the GDS.
- (iii) commit a greater number of errors of omission and commission on the Distractibility Task of the GDS.

3. Academic Performance:

a) Deficits in academic functioning will be present to a greater extent in the HYP group than the C group. Specifically, the HYP group will:

- (i) obtain significantly lower scores on the Spelling, Arithmetic, and Reading (word recognition) subtests of the Wide Range Achievement Test (WRAT-R; Jastak & Wilkinson, 1984).
- (ii) have a significantly lower score on the Reading Comprehension subtest of the Peabody Individual Achievement Test- Revised (PIAT-R; Markwardt, 1989).
- (iii) have completed significantly fewer High School grades. Significantly more HYP subjects will have failed High School courses and of those who have failed, they will have a significantly greater number of failed courses. HYP subjects will also have received significantly more special services in High School (resource or special education classes), and significantly fewer HYP subjects will have attended post-secondary school (college or university).

b) Deficits in academic functioning will be present to a greater extent in the HO and HA groups than the C group. This comparison is exploratory in that it will examine HA versus HO group differences as well. It is hypothesized that the HO and HA groups will:

- (i) obtain significantly lower scores on the Spelling, Arithmetic, and Reading (word recognition) subtests of the WRAT-R.
- (ii) have a significantly lower score on the Reading Comprehension subtest of the PIAT-R.
- (iii) have significantly fewer High School grades

completed, significantly more HO and HA subjects will have failed High School courses and of those who will have failed, they will have a significantly greater number of failed courses. HO and HA subjects will also have received significantly more special services in High School (resource or special education classes), and significantly less HO and HA subjects will have attended post-secondary school (college or university).

4. Self-Reports of Hostility/Aggressiveness:

- a) The HYP group will report significantly more hostility/aggressiveness than the C group, as measured by the Total Hostility Score of the Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957).
- b) The HA group will report significantly more hostility/aggressiveness, as measured on the BDHI, than the HO or the C groups who will not differ from each other.

Exploratory predictive hypotheses:

- 5. Higher childhood IQ and more favourable familial variables (higher SES and maternal education, greater marital satisfaction) will be significant predictors of better outcome for psychiatric diagnoses of CD/APD, dual diagnoses of CD/APD and SUD, and Alcohol and Drug Use Disorders, as well as for academic performance and self-reports of hostility/aggressiveness.
- 6. Childhood aggression will be a significant predictor of poorer outcome for psychiatric diagnoses of CD/APD, and Alcohol and Drug Use Disorders, as well as for self-reports of hostility/aggressiveness.
- 7. Greater childhood inattention will be significantly predictive of ADHD, poorer cognitive performance, and poorer academic performance at follow-up.
- 8. Lower academic scores in childhood will be predictive of poorer academic performance in adolescence.

METHOD

Hyperactive Subjects

The current study is an outgrowth of a series of research projects carried out in the Department of Psychology of the Children's Hospital of Eastern Ontario (CHEO; Firestone, 1982; Firestone, Crowe, Goodman, & McGrath, 1986; Firestone, Kelly, Goodman, & Davey, 1981; Firestone, & Witt, 1982). Hyperactive subjects were initially recruited for two intervention studies which were carried out from 1977 to 1980, and which looked at the effects of various intervention techniques with hyperactive children and their families. Children between the ages of four and ten years were referred from the various departments within the hospital, or their primary care physicians if they satisfied the following criteria:

- 1) had a suspected diagnosis of hyperactivity made by the referring physician.
- 2) met the diagnostic criteria for Attention Deficit Disorder with Hyperactivity as outlined in the DSM-III (APA, 1980), and determined by a registered psychologist specializing in hyperactive children. Although some of the first subjects who were assessed during the two intervention studies were diagnosed according to DSM-II (APA, 1968) criteria for the Hyperkinetic Reaction of Childhood, they were rediagnosed prior to the completion of the project according to DSM-III (APA, 1980) criteria for Attention Deficit Disorder with Hyperactivity.
- 3) demonstrated symptoms of overactivity, short attention span, and impulsiveness both at home and at school since before 3 years of age.
- 4) received a Hyperactivity Index score of 15 or higher on the Conners Teacher Rating Scale (CTRS; Conners, 1969).

- 5) achieved a Peabody Picture Vocabulary Test (PPVT; Dunn, 1965) standard score of 80 or higher.
- 6) regularly attended school.
- 7) lived at home with at least one parent.
- 8) did not show definite signs of brain damage, epilepsy, or psychosis.

One hundred and fifty-four families initially accepted the referral to the research program. Of these, 97 families met the inclusion criteria and had sufficient pretest data to be eligible to participate in the follow-up study. Recruitment and attrition rates will be reported in the Results section. Before the follow-up, the hyperactive subjects were subdivided according to their intake scores on the Inattention-Overactivity (IO) Factor and the Aggressiveness (A) Factor as determined by the IOWA Conners Teacher Rating Scale research cutoff scores (Pelham, Milich, & Murphy, 1985). Aggression in the present study referred to the following items: Quarrelsome, acts "smart", temper outbursts, explosive and unpredictable behaviour, defiant and uncooperative. A description of the IOWA, along with a review of the literature bearing on its psychometric properties is presented under the heading of "Description of Assessment Instruments from Intake that were Chosen as Predictors" (p. 89). From the intake sample of 97 hyperactive subjects, 19 subjects met the IO and A Factor cutoff scores and could be classified as HA, and 42 subjects met the IO Factor cutoff score and not the A Factor cutoff score and could be classified as HO. The remaining

subjects (N=36) could not be classified in the HA or HO subgroups and were not potential subjects for the subgroup analyses.

Normal Control Subjects

The 60 control subjects were chosen at the time of follow-up by group matching them with the present hyperactive probands on sex, SES, language, and age (within a 3 month range). The control participants were recruited in person from High Schools, colleges, universities, shopping malls, and the workplace, or from people in these settings who suggested their friends or relatives. The number of individuals registered at follow-up in post-secondary schools was matched to the 1989-90 Ontario Census (37%; extrapolated for individuals aged 18-24 years with an IQ above 80).

Subjects were excluded from the control group if, prior to the age of 7, they met any of the following characteristics: (1) had received a clinical diagnosis of ADHD; (2) had a serious or life-threatening medical history; (3) had histories of psychological or learning problems (measured by asking whether they had ever been referred to a professional for psychological or learning problems); (4) had been hospitalized for more than 4 days; (5) had a history of psychotropic medication use. Subjects were not excluded from the control group if they met any of these conditions after the age of 7 years.

The cutoff point for the exclusion criteria was 7 years of age for two reasons: (1) had the control group been recruited at

the same time as the original HYP sample and matched on age (the mean age for the original HYP group was 7 years), the exclusion criteria would have been in effect prior to the age of seven and any subsequent symptomatology would not be considered as exclusion factors; (2) the diagnostic criteria for ADHD (DSM-III-R; APA, 1987) require an onset of the disorder before the age of seven. Subjects in the control group who were treated for serious chronic ailments (e.g., diabetes, serious asthma) were also excluded from the study because of possible secondary behavioural and emotional complications that could confound the results. No subjects had to be rejected because of these ailments.

Design and Procedure

The families of the 97 hyperactive index cases were contacted by mail to explain the nature of the follow-up study and to request their participation. If the hyperactive subject was 16 years old or over, the letter was addressed to him/her, otherwise, it was addressed to the parents. This letter (Appendix A) included a description of the project and a notice that they would be contacted by the experimenter, by telephone, to request participation and to further explain the nature and procedures of the study. Hyperactive subjects who were taking psychotropic medication were asked to abstain from it for at least 48 hours prior to assessment. This procedure eliminated the effects of a potentially significant confounding variable.

Only 2 hyperactive subjects were taking medication at the time of the follow-up and abstained for 48 hours prior to testing.

A brief description of the project was given verbally to normal control subjects during the first contact. If they were interested in participating, they were re-contacted by telephone to further explain the nature and procedures of the study.

Individual appointments were scheduled for each subject and the testing took place at CHEO, the Child Study Centre at the University of Ottawa, or in the subject's home, whichever was most convenient for the participant. The room in which the testing took place was free of any extraneous visual and auditory stimuli. Each individual testing session lasted 2.5 to 3 hours. The parent interview was performed separately, in person or over the telephone. This interview took place after the adolescent interview and ranged from 15 to 45 minutes depending on the number of symptoms reported. Given that there were single mothers at intake, at follow-up parental information was gathered primarily from mothers. Fathers were interviewed (10% of HYP group; 8% of control group) when mothers were unavailable or when fathers had more contact with the youngster since the age of 13 years old.

Before the testing began, each subject was fully informed about the general objectives and procedures of the study. Subjects were made aware and guaranteed that all individual results obtained would be used only within group statistics and

that all information revealed would be kept strictly confidential. A written description of the project was provided to the participants and written consent was obtained from participants. Hyperactive or control subjects who were aged below 16 were required to have written parental consent (Appendix B) to participate in the study. As specified in this consent form, every adolescent who participated in the present study had to do so voluntarily. Hyperactive or control subjects who were aged 16 years or over were requested to sign the Adult Informed Consent Form (Appendix C), and parental consent was not needed. Parents (of all participants) who wished to participate in the study were also given a verbal description of the study and signed the Adult Informed Consent Form when interviews were conducted in person (Appendix C) or gave verbal consent when interviews were done by telephone.

The primary researcher who administered all the tasks and conducted the adolescent and parent interviews was blind to the subject's group status or diagnosis. The primary researcher contacted all participants to explain the nature and procedures of the study but blindness was attained by having a second researcher schedule the appointments and by keeping the subjects' name concealed during the interviews. Subjects were asked not to reveal their identity and were identified by a number given to them on the telephone by the second researcher. Moreover, no biographic material about the subject's first 12 years was

gathered except at the end of the interview when they were questioned about any past treatment received. A diagnosis of ADHD requires an onset prior to the age of 7. Following Gittelman et al.'s (1985) and Mannuzza et al.'s (1991) procedures, control subjects were given the diagnosis of ADHD in adolescence without this onset requirement. This is the only departure from adherence to DSM-III-R standards. The identity of proband subjects before interview was known in 22% of the cases. Blindness was not possible with the first and last few hyperactive subjects tested because matching procedures required that testing begin with hyperactive subjects and end with normal control subjects. Moreover, due to travelling costs, control subjects were required to live within a 1-hour drive when tested at home. Therefore, any subject tested outside of this range was necessarily a hyperactive subject, and blindness could not be kept. Blindness was not associated with the rate of diagnosis in either group.

All of the subjects were administered the IQ subtests at the beginning of the session and the CHAMPS interview at the end. The other measures were administered in a random order to control for any possible sequencing effects. The interviewer made sure that reasonable rapport was attained prior to initiating the interview to minimize any level of discomfort which may have been experienced by the subjects having to reveal personal information. The research procedures did not involve any level

of physical risk or discomfort, but any subject who wished to withdraw from the testing session at any time could do so without penalty. No subjects withdrew. Proband and normal control subjects were paid 20 dollars for their participation in the follow-up study. Full feedback of individual results obtained on all the measures were provided to each subject by telephone one week after the testing took place. If, on the basis of the testing results, a subject was found to have psychiatric problems, the primary researcher informed the subject of treatment options. If a subject requested treatment, the primary researcher facilitated a referral to an appropriate clinical setting.

Description of 4 Parts of the Study

Part I. Recruited Versus Non-Recruited: Recruited subjects and subjects lost to attrition were compared on intake measures to insure that they were comparable.

Part II. Demographic and Intellectual Variables, and Treatment History: The second part examined group differences on demographic and intellectual variables, and treatment history. The following groups were compared:

- (i) the HYP group versus the C group
- (ii) the HA group versus the HO group versus the C group

Intellectual Abilities:

Each subject was tested on either the Wechsler Intelligence Scale for Children (WISC-R; Wechsler, 1974) or the Wechsler Adult Intelligence Scale- Revised (WAIS-R; Wechsler, 1981) Vocabulary and Block Design subtests as an estimate of their IQ.

Wechsler Intelligence Scale for Children - Revised Vocabulary and Block Design Short Form (WISC-R; Wechsler, 1974)

The Vocabulary and Block Design subtests of the WISC-R are widely used for screening purposes (Kilian & Hughes, 1978). Both have the highest correlations of any of the subtests with the Full Scale IQ score (.74 for Vocabulary and .69 for Block Design), have consistently high reliability coefficients (.86 for Vocabulary and .85 for Block Design), and have a combined validity coefficient of .90. The scores will be used in order to estimate Verbal, Performance and Full Scale IQ (Sattler, 1982). The time required for the administration of both subtests is estimated at 25 minutes.

Wechsler Adult Intelligence Scale - Revised Vocabulary and Block Design Short Form (WAIS-R; Wechsler, 1981)

The WAIS-R Vocabulary and Block Design subtests are also widely used for screening purposes. The Full Scale score correlates at .82 with the Vocabulary subtest score and at .67 with the Block Design subtest score. The split-half reliability

coefficients, corrected by the Spearman Brown formula, range across 9 age groups from .95 to .96 for the Vocabulary subtest, and from .83 to .89 for the Block Design subtest. Test-retest reliability coefficients (for 2-7 weeks time interval) for 71 subjects aged 25-34 years are estimated at .93 for the Vocabulary and Block Design subtests respectively, suggesting excellent stability for these two subtests. The time required for the administration of both subtests is estimated at 25 minutes.

To establish an estimated level of IQ, all subjects 15 years of age and under were administered the Vocabulary and Block Design subtests of the Wechsler Intelligence Scale for Children - Revised (WISC-R; Wechsler, 1974), whereas subjects aged 16 and over were given the Vocabulary and Block Design subtests of the Wechsler Adult Intelligence Scale - Revised (WAIS-R; Wechsler, 1981). The WISC-R and WAIS-R Vocabulary and Block Design subtests have the highest correlations with the Full Scale score (.74 and .69, .81 and .68 for the WISC-R and WAIS-R Vocabulary and Block Design subtests, respectively).

The Vocabulary and Block Design scaled scores were summed and the estimated Full Scale IQ scores were extrapolated using the procedure (Deviation Quotient) recommended by Tellegen and Briggs (1967). Using the formula derived by Mosier (Guilford, 1954, p.393), the reliabilities of the WISC-R and WAIS-R estimates were calculated using the reliabilities and

intercorrelations of the two component subtests (obtained from Wechsler manuals). The reliabilities of the WISC-R and WAIS-R estimates were found to be $\underline{r}=.92$ and $\underline{r}=.94$, respectively.

The correlation between the IQ estimate and the Full Scale score was calculated using a modified coefficient of correlation which corrects for the violation of the assumption of error independence (Tellegen & Briggs, 1967, p.501). This coefficient was also based on a formula comprising reliabilities and intercorrelations which were obtained from the Wechsler manuals. Using this modified coefficient of correlation, the WISC-R IQ estimate correlated at .90 with the WISC-R Full Scale IQ score, and the WAIS-R IQ estimate correlated at .89 with the WAIS-R Full Scale IQ score. The time required for the administration of both subtests of the WISC-R or the WAIS-R was 20 minutes.

Treatment History:

Treatment history was obtained by asking subjects and their parents if they had ever sought professional help to deal with behaviour, alcohol, drug, mood or anxiety problems. Within each of these categories of problems, participants were questioned about medication, individual, family, group, and residential treatment received.

Part III. Hypothesized Group Differences: The third part examined the hypothesized group differences on the dependent

measures. The following groups were compared:

- (i) the HYP group versus the C group
- (ii) the HA group versus the HO group versus the C group

The HYP group was compared to the C group in five areas of adolescent outcome: (1) psychiatric functioning; (2) cognitive performance; (3) academic performance; and (4) self-reports of hostility/aggressiveness. The following section describes the four areas of adolescent outcome and lists the outcome measures which were used to measure each area. The choice of outcome measures was based on the validity and the reliability of the measures, the length of the tasks, and the appropriateness of the measures for the present populations and age range (when feasible).

(1) Psychiatric Functioning: DSM-III-R Diagnoses

Assessment of the adolescents' psychiatric status was derived from both subject and parent interviews which were conducted by a trained staff member using the CHAMPS (Mannuzza & Gittelman-Klein, 1987).

The Schedule for the Assessment of Conduct, Hyperactivity, Anxiety, Mood, and Psychoactive Substances (CHAMPS; Mannuzza & Gittelman-Klein, 1987)

The CHAMPS is a structured interview which is designed for

an adolescent population, and which includes the necessary coverage for formulating the DSM-III-R (APA, 1987) lifetime diagnoses of: (1) CD/APD; (2) ADHD; (3) Anxiety Disorders; (4) Mood Disorders; (5) Psychoactive Substance Abuse and Dependence Disorders and (6) Psychotic and Delusional Disorders (also referred to as Thought Disorders). Several well-known semi-structured interview schedules were consulted in developing the CHAMPS: items on Anxiety Disorders were derived primarily from the Schedule for Affective Disorders and Schizophrenia - Lifetime Anxiety Version (SADS-LA: Fyer, Endicott, Mannuzza, & Klein, 1985; Mannuzza, Fyer, Klein, & Endicott, 1986); items on DSM-III-R criteria were, in part, based on the Structured Clinical Interview for DSM-III-R - Patient Version (SCID-P: Spitzer, Williams, & Gibbon, 1986); items on adolescent functioning and antisocial behaviours were taken from the Teenager Or Young Adult Schedule (TOYS: Gittelman & Mannuzza, 1979), which was itself based on Version 2 of the Diagnostic Interview Schedule (DIS: Robins, Helzer, Croughan, & Ratcliff, 1981). The DIS was developed for use in the large Epidemiological Catchment Area (ECA) study (Regier et al., 1984) and was designed to be administered by lay interviewers since the cost of conducting such a large study using psychiatrists as diagnosticians would have been prohibitive. Helzer et al. (1985) obtained reasonable agreement between lay and psychiatrists' DIS results among community volunteers, suggesting that information

variance is substantially reduced by the DIS' complete coverage of symptoms. Studies of the DIS among clinic samples indicated acceptable validity (Robins et al., 1981; Robins, Helzer, Ratcliff, & Seyfried, 1982). The CHAMPS takes approximately one hour and a half to administer.

For the parent interview, the questions were reformulated in the second person to interview them about their offspring. Parents were only questioned on diagnoses of CD/APD, Alcohol and Drug Use Disorders, and ADHD. They were not questioned about their offspring's Anxiety, Mood, and Thought Disorders because it was believed that they would only have limited knowledge about these more internalizing disorders (Gittelman et al, 1985). Both subjects and parents were interviewed because Gittelman et al. (1985) found that parents of hyperactive adolescents were more likely to report primary ADDE symptoms in their adolescents than the adolescents themselves. The presence of a syndrome was recorded if either the parent or the adolescent reported it. All sessions were audiotaped and twenty percent of these were rated by a second person (psychology honours student) who was blind to the subjects' group status. Both raters were trained using the Diagnostic Narrative Summaries and CHAMPS training tapes (Mannuzza & Gittelman Klein, 1989) recorded by the original contributors (Gittelman et al., 1985).

(2) Cognitive Performance:

Measures of inattention, distractibility and impulse control were derived from the subjects' performance on the GDS (Gordon, 1983).

Gordon Diagnostic System (GDS; Gordon, 1983)

The GDS is a microprocessor-based portable unit which was developed to measure vigilance and impulse control in ADD/H children. The GDS can also be used with adolescent and adult populations. The measure of distractibility assesses the impact of distraction on a subject's ability to sustain attention. The subject is required to sufficiently sustain attention in order to press a button every time a "1" follows a "9" in the middle column, while ignoring the numbers that flash on either side of the center (i.e. relevant) digit. It automatically records the number of correct responses, the number of times the subject failed to respond to the appropriate stimulus (errors of omission), and the number of extraneous button presses (errors of commission). Research has recently shown the Vigilance task, which is almost identical to the Distractibility task (except that random digits do not flash on the outer positions of the electronic display) discriminates ADD/H and normal children and adolescents (Fischer et al., 1990; Gordon, 1979; McClure & Gordon, 1984) and is sensitive to stimulant drug treatment with ADD/H children (Barkley, Fischer, Newby, & Breen, 1988).

The Delay Task, requires the child to inhibit responding in order to earn points by pressing a button, waiting a while, and then pressing the button again. The task produces three measures: (1) the number of rewarded responses (correct responses); (2) the total number of button responses; and (3) the ratio of total number of rewarded responses to the absolute number of responses (efficiency ratio). Age and IQ were found to be unrelated to the Delay task performance with a sample of emotionally disturbed hyperactive children (McClure & Gordon, 1984). All three measures of the Delay task have been found to significantly discriminate ADD/H from non-ADD/H clinic-referred children, and to correlate significantly with ratings from the original Conners Teacher Rating Scale (CTRS) and Conners Parent Rating Scale (Gordon, 1979). In a second study, McClure and Gordon (1984) found that only the total number of responses and the efficiency ratio significantly discriminated ADD/H from control subjects. The efficiency ratio was also found in this study to correlate significantly with the Hyperactivity factor of the CTRS and with both measures from the 20-item version of the Matching Familiar Figures Test (Cairns & Cammock, 1978).

Normative data is available on 1266 boys and girls aged from 4 to 16 years of age (Gordon & Bilinski Mettelman, 1988). Test-retest reliability coefficients of 90 of these children after 45 days and after 1 year were .60 and .56, respectively, for the efficiency ratio. Test-retest coefficients after 22 days were

.72 for the Total Correct (proportional to errors of omission), and .84 for the Total Commission errors. After 1 year, these coefficients were .68 and .94 for the Total Correct and Total Commission errors, respectively. The test-retest coefficients for the Distractibility task after 22 days were .67 for the Total Correct and .85 for the Total Commission errors. The administration of the Vigilance, Distractibility and Delay tasks takes 36 minutes.

Although norms are available for a normal adolescent population (ages 12-16 years) and for a clinical (chronic pain) adult population (refer to GDS manual for norms; Gordon, McClure, & Post, 1986), in the present study, the control group served as the normative group. As suggested by Fischer et al. (1990), task difficulty was increased on the GDS by lengthening the tasks. The Delay task was lengthened from 8 minutes to 12 minutes, and the Vigilance and Distractibility tasks from 9 minutes to 12 minutes. The GDS was administered without supervision by the examiner in order to simulate learning contexts where individuals are expected to retain their focus on a task without continued adult supervision.

(3) Academic Performance:

Measures of adolescent academic achievement included the

subjects' performance on the Spelling and Arithmetic subtests of the WRAT-R (Jastak & Wilkinson, 1984).

Wide Range Achievement Test- Revised (WRAT-R; Jastak & Wilkinson, 1984)

A total of 5600 subjects, or 200 subjects in each of 28 age groups from 5 to 74 years, composed the standardization sample. Stratification variables included age, sex, race, geographical region, and metropolitan versus nonmetropolitan residence. The manual reported test-retest reliability coefficients ranging from .79 (Level 2 Arithmetic) to .97 (Level 1 Spelling) for unspecified time intervals. Merrill (1985) reported correlations of .70 to .85 for the WRAT-R and Woodcock-Johnson achievement tests (Woodcock, 1977). Spruill and Beck (1986) found correlations ranging from .47 to .71 for the WRAT-R subtests and WAIS-R (Wechsler, 1981) Verbal, Performance, and Full scales. The test is timed and takes approximately 20-30 minutes to administer.

In order to obtain a comprehensive evaluation of their reading abilities, subjects were tested on the Reading subtest of the WRAT-R (for a measure of word recognition) and the Reading Comprehension subtest of the PIAT-R (Markwardt, 1989).

Peabody Individual Achievement Test-Revised (PIAT-R; Markwardt, 1989)

The PIAT-R was designed to measure academic achievement for students aged 5-0 to 18-11 years old. The Reading Comprehension subtest consists of 82 items and measures the student's ability to draw meaning from printed sentences. The student must silently read a printed sentence, then select, by recalling the sentence, one of four pictures that best represents the meaning of the sentence. The words used in the sentences were selected according to difficulty level from graded vocabulary lists. The standardization sample for the PIAT-R consisted of 1563 kindergarten through 12th grade students from 33 communities in the continental U.S.. Split-half reliability estimates for the Reading Comprehension subtest ranged from .90-.94 (median=.92) and the Kuder-Richardson reliability coefficients ranged from .92 to .96 (median=.94). Test-retest reliability coefficients for a 2-4-week span were also high for the Reading Comprehension subtest ranging from .78 to .97 (median=.88). The PIAT-R Reading Comprehension subtest was moderately correlated with the PPVT-R ($r=.66$). The Reading Comprehension subtest is not timed but takes approximately 15 minutes to administer.

The CHAMPS (Mannuzza & Gittelman-Klein, 1987) was used to obtain information on the subjects' school performance, including: (1) Highest grade of High School completed; (2)

Proportion of subjects failing courses in High School; (3) Of those who did fail courses, number of High School courses failed; (4) Proportion of subjects who received special services in High School (resource or special education classes); and (5) Proportion of subjects who ever attended post-secondary school (college or university).

(4) Self-reports of Hostility/Aggressiveness:

The subjects' level of hostility/aggressiveness, at outcome, was based on self-reports using the BDHI (Buss and Durkee, 1957) Total Hostility Score. Appendix D presents a copy of the BDHI questionnaire. The BDHI Total Hostility Score is a global measure of hostile feelings and tendency to act out anger.

Buss-Durkee Hostility Inventory (BDHI; Buss & Durkee, 1957)

The BDHI has been the most widely used measure of hostility during the past 30 years (Ramanaiyah, Conn, & Schill, 1987). The BDHI has 75 items, and it contains eight rationally developed scales designed to measure two kinds of hostility (resentment and suspicion), five kinds of aggression (assault, indirect aggression, irritability, negativism, and verbal aggression) and guilt. Because of the questionable validity of some of the BDHI subscales, only the BDHI Total Hostility score will be assessed in the present study.

Internal consistency was measured using the biserial

correlation coefficient and the criterion for item selection was a correlation of at least .40 for both the male and female samples.

Biaggio, Supplee and Curtis (1981) administered the BDHI to a sample of 60 student volunteers and found a 2-week test-retest reliability coefficient of .82 for the Total BDHI score.

Biaggio (1980) reported significant correlations ($r=.64$, $p<.01$) between the BDHI Total Hostility score and the Anger Self-report (ASR; Zelin, Alder, & Myerson, 1972) Total score, indicating that the total scores for these scales are assessing similar modes of anger/hostility expression. At the subscale level, the researchers also found that the BDHI and the ASR appear to measure similar variables and showed appropriate absence of correlation with dissimilar variables.

In a sample of 100 college students, Mauger and Adkinson (1980) examined the relationship between different measures assessing aggressiveness and/or assertiveness. These researchers found that the General Aggressiveness Rational scale of the Interpersonal Behaviour Survey (IBS; Mauger & Adkinson, 1980) had moderate to high correlations with the scales of the BDHI, and, including a value of .65 with the Total Hostility scale. Mauger and Adkinson's (1980) findings also suggest that the BDHI is measuring aggressiveness as opposed to assertiveness. Minimal correlations were reported between the aggression scales of the BDHI and the General Assertiveness Rational scale (SGR) of the

IBS, including a correlation of $-.05$ between the SGR and the Total Hostility scale of the BDHI, suggesting good discriminant validity.

Support for the BDHI's construct validity is provided by Buss, Fischer, and Simmons (1962) who found that psychiatrists' ratings of aggression in patients correlated significantly with all subscales except Assault, Indirect Hostility, and Suspicion. The BDHI has also been shown to be clinically useful in differentiating between High and Low assaultive prisoners. Lothstein and Jones (1978) examined the BDHI scores of a sample of 61 male adolescent prisoner (mean age 18.5 years). They found that the High assaultive group had significantly larger Total Hostility scores than the Low assaultive group. The BDHI takes approximately 25 minutes to administer.

(ii) The HYP group was subdivided into an HA group and an HO group and comparisons were made between the HA, HO and C groups on variables assessing psychiatric functioning, cognitive performance, academic functioning and self-reports of hostility/aggressiveness using the dependent measures mentioned above. As mentioned previously, the HYP group was divided into HA and HO subgroups based on the IOWA Connors scores (Loney & Milich, 1982). Subjects who did not meet the cutoff scores on the IO Factor were not included in the analyses of this section of the study.

Part IV. Exploratory Predictions: Child, familial and treatment measures from the referral period were examined as predictors of psychiatric, cognitive and academic variables, and self-reports of hostility/aggressiveness recorded at follow-up. Psychiatric outcome variables included diagnoses of ADHD, CD/APD, dual diagnoses of CD/APD and SUD, Drug Use Disorders and Alcohol Use Disorders. Cognitive outcome variables consisted of omission and commission errors of the Vigilance and Distractibility tasks. Academic outcome variables included measures of arithmetic, spelling, and reading comprehension, as well as highest grade completed in High School, and number of courses failed in High School. Subject self-reports of hostility/aggressiveness on the BDHI were also included in the outcome measures. An attempt was made to assess the relative importance of each predictor in accounting for the variability of outcome variables. To reduce the number of variables entered as predictors for each outcome measure, a few intake variables were chosen for empirical reasons which were based on past research findings and for statistical reasons. In the next section, the empirical reasons for choosing the predictor variables will be presented. Each area of adolescent outcome will be presented with its specific predictor variables. Following this section, a description of the statistical reasons for choosing the predictor variables will be reported. A description of the intake measures which were chosen as predictors will then be presented.

Rationale for Selection of Predictor Variables

(a) Empirical Reasons:

1. Psychiatric Diagnoses:

Outcome variable: ADHD

Predictor variables:

Based on Loney et al.'s (1981) research, low SES/income, the child's age at symptom onset, more perinatal complications, and more childhood aggressiveness were predictive of later ADHD symptoms. In the present study, it was predicted that childhood inattention would be the best predictor of later ADHD. The following predictors were used in an attempt to discriminate subjects who, at follow-up, received a diagnosis of ADHD versus those who did not receive one: age at referral, combined family income (INC), the A Factor, the IO Factor, Mean Reaction Time (MRT) on the Continuous Performance Task (CPT), number of months on stimulant medication (STIMU), number of sessions of parent-training (PARTRAIN), and number of sessions of individual or family therapy for behavioural problems (BEHther). The MRT, which was a measure of attention, was assessed using the Delayed Reaction Time Test.

Hyperactivity scores were not significant predictors in Loney et al.'s (1981) study. However, the use of more reliable and objective measures of hyperactivity in the present study (teacher ratings & Continuous Performance Task (CPT) scores) in

comparison with the clinical judgments of patient charts used in the Loney study may yield significant predictors. Based on previous research with younger hyperactive populations, it was believed that greater symptom severity in childhood would result in persistent ADHD at follow-up (Campbell, Breau, Ewing, & Szumowski, 1986; Campbell & Ewing, 1990). Three types of behaviour treatment variables were also included because their goals were primarily to improve hyperactive and oppositional/aggressive behaviours.

Outcome variables: CD/APD, dual diagnoses of CD/APD and SUD, Drug Use Disorder, Alcohol Use Disorders

Predictor variables:

Based on past studies, hyperactive children who were more aggressive, had lower IQs, were older at referral, and came from lower income families with parents who experienced considerable personal distress were more likely to develop a CD/APD and SUD in adolescence than children who did not have these characteristics. (Hechtman, Weiss, Perlman, & Amsel, 1984; Lambert, 1988; Loney et al., 1981; Weiss et al., 1971). The present hypotheses concerning the development of CD/APD and SUD in adolescence were based on these past findings. Little is known about the long-term effects of treatment on the development of these disorders. In the present study, the same intake variables were used in an attempt to discriminate between probands who did or did not

receive diagnoses of CD/APD, dual diagnoses of CD/APD and SUD, Drug Use Disorders (dependence or abuse) and Alcohol Use Disorders because previous research found similar predictors for these diagnoses. The following intake variables were examined as predictors of these 4 diagnoses: age at referral, IQ (PPVT, Dunn, 1965), INC, A Factor, IO Factor, mother's Locke-Wallace Marital Adjustment scores (MLW), mothers' education (MED), STIMU, PARTRAIN, and BEHther.

2. Cognitive Variables:

Outcome variables: Errors of omission and errors of commission of the Vigilance and Distractibility tasks.

Predictor variables:

The same predictor variables as those chosen to predict diagnoses of ADHD were selected for the errors of omission scores and errors of commission scores of the Vigilance and Distractibility tasks of the GDS. Again, it was predicted that childhood inattention would be the best predictor of these adolescent cognitive variables. Predictors included the child's age at referral, child IQ, INC, A Factor, IO Factor, MRT on the CPT, and STIMU. Given the more cognitive nature of these measures, other forms of treatment which have not been found to affect these measures were not included (e.g., PARTRAIN).

3. Academic Variables:

Outcome variables: WRAT-R Spelling, WRAT-R Arithmetic, PIAT-R Reading Comprehension, Highest grade completed in High School, Number of failed subjects in High School.

Predictor variables:

Based on previous studies (Hechtman, Weiss, Perlman, & Amsel, 1984; Loney et al., 1981; Weiss et al., 1971), academic variables in adolescence would be best predicted by childhood IQ, past academic achievement, SES/income, and childhood hyperactivity. In the present study, the hypotheses were based on these past findings. The child's age at referral, child IQ, INC, IO Factor, MRT on the CPT, MED, and STIMU were included as predictors of Spelling, Arithmetic, and Reading scores recorded at follow-up. In addition, to predict Spelling and Reading scores at follow-up, intake scores on the Gates MacGinitie Reading Test Vocabulary Grade (GMRT-Voc) were included, and to predict Arithmetic scores at follow-up, intake scores on the Metropolitan Achievement Test Mathematic Grade (MAT-Math) were used as predictors.

4. Subject Self-reports of Hostility/Aggressiveness:

Outcome variable: BDHI total Hostility score.

Predictor variables:

Given the similarities between aggressiveness and conduct problems, the same predictors as those chosen to discriminate

subjects with and without diagnoses of CD/APD were chosen to predict proband subjects' self-reports of hostility/aggressiveness on the BDHI.

(b) Statistical Reasons:

Other intake variables were also considered as potential predictors but due to high correlations between those variables and the chosen ones, they had to be dropped. Table 1 presents the correlations between the chosen predictors and Table 2 displays the correlations between a few selected predictors and other intake variables not chosen as predictors. For example, the Gates MacGinitie Reading Test Comprehension Grade score (GMRT-Comp) was not included in the analyses because it correlated at $r=.91$ ($p<.01$) with the GMRT-Voc. The Total Impulsive Response scores on the CPT were not included because of the significant correlation between these scores and the MRT scores of the CPT ($r=.57$, $p<.01$). Given that mothers' and fathers' highest education level and Locke-Wallace Marital Adjustment Scores were significantly correlated ($r=.54$ and $r=.61$, respectively, $p<.01$) and that more mothers than fathers answered this marital adjustment questionnaire at intake, only the mothers' variables were considered for analyses.

The mothers' Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1966) Total Psychopathology Score, which yielded a level of general maladjustment or overall pathology at

Table 1

Pearson Product Moment Correlation of All Predictors

	IQ	lgINC	lgMRT	DGMRT-Voc	DMAT-Math	IO	A	MED	MLW	STIMU	PARTRAIN	BEHther
AGE	-.10	.09	-.66**	-.17	-.58**	.08	-.07	-.10	.07	-.18	-.01	-.28*
IQ		.03	.03	.32*	.43**	-.12	-.04	.30*	.09	.25	.13	.03
lgINC			-.14	-.01	-.09	.13	.23	.44**	-.07	-.20	.20	-.03
lgMRT				-.40**	.08	-.07	.003	-.07	.04	.17	.01	.22
DGMRT-Voc					.64**	.05	.04	.23	-.18	.001	.15	-.09
DMAT-Math						.13	-.08	.37*	-.01	.05	.07	.02
IO							-.13	.03	-.01	-.21	-.08	.11
A								.04	.01	.10	.14	.29
MED									-.16	-.17	-.05	.06
MLW										-.09	-.20	.24
STIMU											.06	.09
PARTRAIN												-.17

*p<.05 **p<.01

Age=child's age at referral; IQ=child's PPVT score; lgINC=log. of family income; lgMRT=log. of Mean reaction time of CPT
 DGMRT-Voc=difference score of Gates MacGinitie Reading Test Vocabulary Grade; DMAT-Math=difference score of Metropolitan
 Achievement Test Math Grade; IO=Inattention/Overactivity Factor scores of IOWA; A=Aggressiveness Factor scores of IOWA;
 MED=mother's education; MLW=mother's Locke-Wallace Marital Adjustment Scale Scores; STIMU=number of months on
 stimulant medication; PARTRAIN=number of sessions of parent-training; BEHther=number of sessions of individual or family
 therapy for behaviour problems.

Table 2
Pearson Product Moment Correlations of 4 Predictors with Other Intake Measures

	lgTIMPR	FED	DGMRT-Comp	FLW
lgMRT	.59**			
MED		.54**		
DGMRT-Voc			.89**	
MLW				.61**

lgMRT= log. of Mean reaction time of CPT; MED= mother's education; DGMRT-Voc= difference score of Gates MacGinitie Reading Test Vocabulary Grade; MLW= mother's Locke-Wallace; lgTIMPR= log. of total impulsive responses on CPT; FED= father's education; DGMRT-Comp= difference score of Gates MacGinitie Reading Test Comprehension Grade; FLW= father's Locke-Wallace.

**p<.01

intake was considered as an important predictor. However, it was not included in the analyses because most parents obtained scores within normal limits, thus producing a low variance of scores.

Only STIMU, PARTRAIN, and BEHther were chosen as treatment variables because they were amongst the few treatment variables that discriminated the HYP and normal control groups (refer to Table 5 of Results Section for details). Although residential treatment for behavioural problems was also significantly different between the two groups, it was not included as a predictor because less than 10% of the HYP group had received this type of treatment.

Description of the Assessment Instruments from Intake that were Chosen as Predictors:

Conners Teacher Rating Scale (CTRS; Conners, 1969)

The CTRS has become one of the most popular and widely used means of evaluating hyperactive children. It is comprised of 39 behavioural items which are numerically weighted according to a 4- point system (0-3) with the higher values indicating more severe symptomatology. A total score is obtained by summing across all items, and factor scores are derived by summing across only items on factors of interest.

Goyette, Conners and Ulrich (1978) extrapolated from the original scale, a 10-item Hyperkinesis Index (HI) factor. Typically, a deviant score on the HI factor (1 or 2 standard deviations above the age norm) is employed as a cutoff score for inclusion into an ADHD group.

The CTRS has well established reliability and validity. Conners (1973) reported test-retest reliability coefficients between .70 and .90 across all factor scores. Inter-rater reliability between teachers was .92 for the total score (Vincent, Williams, Harris, & Duvall, 1977). Achenbach and Edelbrock (1983) reported good concurrent validity between the CTRS and the Child Behavior Checklist.

Loney & Milich (1982) have demonstrated that the mixture of aggressive conduct items together with restlessness and inattentiveness, produces heterogeneous samples of mixed

aggressive-hyperactive-inattentive children when the CTRS instrument is used for subject selection.

Inattention/Overactivity with/out Aggression (IOWA) Conners
(Loney & Milich, 1982)

The IOWA Conners, which was derived from items of the original CTRS, is commonly utilized when a clear distinction between aggressive and hyperactive symptomatology is required (Barkley, 1987). The scale was constructed by correlating individual items on the Conduct Problem and Hyperactivity factors with medical chart derived ratings of hyperactivity and aggression (Loney, Langhorne, & Paternite, 1978). The resultant 5-item Inattention/Overactivity factor (IO) and 5-item Aggression Factor (A) include only those items which correlated with chart ratings of one factor and not the other. "Aggression", in these studies, does not refer to physical attacks against others so much as to a constellation of negative temperament (e.g., temper outbursts) and oppositional and defiant behaviours (e.g., quarrelling, refusing to cooperate, acting "smart"; Barkley, 1988).

Several studies (Loney & Milich, 1982; Pelham, Milich, & Murphy, 1985; Loney, 1987) reported acceptable levels of reliability and validity from the original and subsequent validation samples.

The IOWA displays good discriminant validity in its ability to distinguish between clinic and nonclinic populations and to predict observed classroom behaviours for a school-age sample of clinic-referred boys (Milich & Fitzgerald, 1985; Milich & Landau, 1988). Milich and Fitzgerald (1985) and Milich and Landau (1988) found that discrimination between the teacher IO and A factors was best in large-group classroom activities demanding student participation while the teacher was presenting lessons (versus small-group work or individual seatwork). The internal consistency within the original classroom sample of 120 boys was .87 for the IO subscale and .85 for the A subscale (Loney & Milich, 1982). These are comparable to those obtained with the clinic sample which were .80 and .87 for the IO and A subscales respectively. One-week stability coefficients for the classroom sample were .89 and .86 for the IO and A subscales respectively.

In a more recent replication/validation study by Pelham et al. (1985), ratings on the IOWA were obtained on 608 boys and girls from kindergarten to sixth grade in two different schools. This study reported similar psychometric properties as Loney & Milich (1982), however, the norms for different age groups decrease for older children. The cutoff scores recommended by Pelham et al. (1985) will be used in the present study.

This separation of factors, using items from one of the most widely used rating scales (CTRS), is valuable for reinterpreting adolescent follow-up studies of hyperactive children. Separate consideration of the I/O and A factors also appears

necessary because they appear to be relatively independent and associated with different etiological antecedents and different prognostic consequences (Loney & Milich, 1982). Only a handful of studies to date have attempted to make such a differentiation (Milich, Loney, & Landau, 1982).

Peabody Picture Vocabulary Test (PPVT; Dunn, 1965)

The PPVT is a nonverbal, multiple-choice test designed to evaluate the receptive vocabulary of children and adults. This a convenient method for estimating a child's IQ, and has been used in lieu of the more comprehensive and time consuming WISC-R (Wechsler, 1974). The PPVT yields three types of scores: a mental equivalent, an intelligence quotient (standard score), and a percentile equivalent.

The PPVT was standardized on 4012 subjects aged 2.5 to 18.0 years. Alternate form reliability coefficients ranging from .67 at the 6-year level to .84 at the 17- and 18-year levels are cited in the manual. Moed, Wight, and James (1963) reported a test-retest coefficient of .88 after one year, with 29 physically disabled children. Congruent validity correlations comparing Wechsler full scale IQ scores for children with PPVT scores are reported to range from .30 to .84, with a median of .61. The PPVT is an untimed individual test, administered in 15 minutes or less.

Delayed Reaction Time Test

The Mean Reaction Time, which is a measure of inattention, was measured with the Delayed Reaction Time Test. This task has known wide use with young children, and has been shown to discriminate between hyperactive and normal children (Cohen & Douglas, 1972; Firestone & Douglas, 1975; Firestone & Martin, 1979). In the present study, the correlation between intake measures of mean reaction time and number of impulsive responses was positive ($r=.57$, $p<.01$) and significant. Therefore, reaction time (and errors) at intake appeared to accurately monitor attention processes, not accuracy (Sergeant & van der Meere, 1990).

The apparatus provides a pre-programmed series of auditory and visual stimuli. An auditory tone of 70 db SPL intensity and 1 second duration is fed directly to the subject's earphones and serves as the warning signal to activate the sequence. Two seconds after the auditory warning signal, a 7.5 watt light bulb is flashed. The subject who is normally maintaining a reaction time button in a depressed position is instructed to release the button as soon as possible following the visual signal. After the subject's response, there is a 5-second wait period. A new trial is then initiated. The presentation of the auditory warning signal occurs at random within the next 10-second interval. Testing continues for 60 trials. The signal light is

housed in an enclosure placed on a table in front of the child whereas the reaction time button is fixed to the arm of a chair. An electric timer is simultaneously started with the onset of the reaction signal (i.e., the light flash) and continues recording until the subject releases the response button. The mean reaction time over 60 trials is then calculated.

Gates-MacGinitie Reading Test - Vocabulary subtest (GMRT-Voc; Gates & MacGinitie, 1965)

The GMRT was designed to assess reading abilities in grades 1-12. Each level contains two subtests, vocabulary and comprehension. For the lower levels (A & B), the vocabulary subtests consists of 45 pictures, each paired with four graphically similar words. This allows one to assess the child's general level of reading vocabulary and decoding skills. At higher levels (C-F), the vocabulary subtests consist of 45 target words with either four or five choices. The correct answer is a synonym for the target word and the others are distracters. Therefore, at these higher levels, there is a shift from decoding words to understanding the meanings of words. On most forms, the correlations between vocabulary and comprehension are high: only a few are below .80. Internal consistency was measured using Kuder-Richardson Formula 20. All of these coefficients were above .88, with the majority being above .90. Concurrent correlations between the GMRT and the Metropolitan Achievement Tests (Durost, Bixler, Wrightstone, Prescott, & Balow, 1971) ranged between .79 and .92, with the higher correlations for total test scores. Johns (1975) reported satisfactory validity for the Gates-MacGinitie Reading Test using the Classroom Reading Inventory (Silvaroli, 1976) as the criterion (correlations between .70 and .80 for a sample of fourth grade children). For all levels, administration of the Vocabulary subtest takes 20 minutes.

Metropolitan Achievement Test - Mathematics subtest (MAT-Math; Durost, Bixler, Wrightstone, Prescott, & Balow, 1971)

The MAT was designed to assess school curriculum from kindergarten through twelfth grade. The mathematic subtest assessed mathematic concepts, computation and problem solving, depending on the level (primary, elementary, intermediate, etc.). Reliability estimates in the form of Kuder-Richardson Formula 20 coefficients range from .86 to .90 for the Mathematic subtest at different age levels. Correlations between the MAT and the Otis-Lennon School Ability Test (OLSAT, Otis & Lennon, 1979) range from .55 to .89 with the majority of subscores being correlated at .73 or better for sample sizes exceeding 650. A correlation of .63 has been reported between the KeyMath and the MAT for a sample of children with learning disabilities (Kratochwill & Demuth, 1976). The close correspondence between the grade-equivalent scores of the MAT and the Stanford-Binet can also be

used as evidence of concurrent validity. The Mathematic subtest takes 90-125 minutes to administer (less time for lower levels).

Locke-Wallace Marital Adjustment Scale (Locke & Wallace, 1959)

The Locke-Wallace Marital Adjustment Scale is a self-report questionnaire, with scores ranging from 2 to 158 points. Higher scores (approximately 130 plus), on the 15 weighted item test, reflect greater satisfaction and lower scores (below 100) reflect poorer marital adjustment. This scale is reported to have stable test-retest reliability over a two-year period (Kimmel & Van der Veen, 1974). The reliability coefficient, computed by the split-half technique and corrected by the Spearman-Brown formula, was .90 (Haynes, Follingstad, & Sullivan, 1979). The Locke-Wallace Marital Adjustment Scale was able to clearly differentiate, among a sample of 13 married couples, between persons who were well-adjusted and those who were maladjusted in marriage, thus possessing a high level of discriminant validity (Haynes et al., 1979). The Adjustment Scale was also significantly correlated to other marital satisfaction questionnaires (Haynes et al., 1979).

Operational Definitions and Abbreviations of Predictors:

(a) Subject predictors:

child's age at referral
(AGE)

Age in months

Child's IQ
(IQ)

The score achieved on the
PPVT

Vocabulary Reading Test
(GMRT-Voc)

The score achieved on the
Gates-MacGinitie Reading
Test (Vocabulary)

Mathematical Computation Test
(MAT-Math)

The score achieved on the
Mathematic computation
subtest of the Metropolitan
Achievement Test Grade
Score

Mean Reaction Time
(MKT)

Mean Reaction Time on the
CPT. The MRT is a measure
of inattention

Child Inattention/Overactivity
(IO Factor)

Teachers' IOWA
Inattention/Overactivity
Factor score

Child Aggressiveness
(A Factor)

Teachers' IOWA
Aggressiveness Factor score

(b) Familial (parent) predictors:

Family Income
(INC)

Combined family income

Mothers' Education
(MED)

Number of years of
scholarship

Mothers' Marital Adjustment
(MLW)

The total score on the
Locke-Wallace Marital
Adjustment Scale

(c) Treatment predictors:

Number of months on stimulant
Medication
(STIMU)

Total number of months (not
necessarily consecutive) on
stimulant medication from
infancy to follow-up.

Number of sessions of
Parent-training
(PARTRAIN)

Total number of sessions of
parent-training from time
of infancy to follow-up.

Number of sessions of
individual/family therapy
for behaviour problems
(BEHther)

Total number of sessions of
individual or family
therapy aimed at dealing
with the probands'
behaviour problems. It
covered the period from
infancy to follow-up.

Statistical Analyses

(a) Correcting for Type I Error:

Analyses were performed using the SPSS statistical package. To control for Type I Error, Holm's procedure (Holland & DiPonzio Copenhaver, 1988) was used to correct the α level of significance in multiple univariate analyses of categorical and continuous variables. The Holm's procedure was recommended by Holland and DiPonzio Copenhaver (1988) as an alternative to the Bonferroni correction because the Holm's procedure has a stagewise nature which provides increased power for the tests conducted. The Holm's procedure involves the following steps: (1) ordering of obtained p values from smallest to largest, and numbering them from 1 to k , where k is the total number of variables in the analysis; (2) The Holm p for the variable with the smallest obtained p will be α/k ; (3) the Holm p for the variable with the second smallest p will be $\alpha/(k-1)$; (4) the Holm p for the

variable with the third smallest p will be $\alpha/(k-2)$, etc., until one reaches the largest p where the Holm p will equal $\alpha/(k-k+1)$. When the obtained p value on the left is smaller than the Holm p on the right, the null hypothesis is rejected, otherwise, it is accepted. When Holm's procedure was used in the analyses, significance levels were labelled as p_k . For all analyses in the present study, trends were not discussed.

(b) Analyses of Categorical Variables:

The statistical analyses of categorical variables (e.g., psychiatric diagnoses) involved χ^2 tests. As mentioned above, Holm's procedure was used with these χ^2 analyses to control for Type I Error. This procedure was performed in the following way: Hypothesis 1a included 5 diagnoses. The significance levels (p) obtained for the 5 diagnoses were ordered in increasing order (e.g., .001, .01, .10). The smallest p (most significant one) was required to be smaller than $.05/5$ diagnoses = .01. The second smallest p had to be smaller than $.05/4 = .0125$. The third smallest p had to be smaller than $.05/3 = .0167$, etc., until the last variable which had to have a p smaller than $.05/1 = .05$. Therefore, the significance criterion changed for each variable in a specific hypothesis.

Where the χ^2 was significant, post-hoc comparisons were performed using the procedure outlined by Everitt (1977, p.44). Following this procedure, the overall $2 \times c$ chi-square matrix was sub-divided into 2×2 tables and the χ^2 values obtained from

each of the 2 x 2 tables were compared against the one degree of freedom value from tables with α' levels of:

$\alpha' = \alpha / [2(c-1)]$, where α was the chosen significance level (i.e., .05) and c was the number of subgroups ($c=3$). The present study had 3 subgroups. Therefore, the denominator always equalled 4. The α was the one used after Holm's procedure was used. Therefore, as mentioned previously, the significance criterion changed for each variable in a specific hypothesis. When Everitt's procedure was used in addition to a Holm's procedure, significance levels were labelled as p_{ϵ} .

(c) Analyses of Continuous Variables:

A priori hypotheses of continuous variables were tested using ANCOVAs and MANCOVAs with IQ serving as a covariate. Separate MANCOVAs were used for comparisons: "HYP vs C" and "HA vs HO vs C", and for sets of variables in the Cognitive Domain and for the Academic Domain. An overall significance criterion of .05 was adopted. Where significant T (Pillai Trace) ratios were obtained, Univariate Analyses of Covariance (ANCOVA) using Holm's correction to control for inflated Type I Error were used to test for group differences. When more than two groups were compared, and the planned comparisons revealed significant results, post-hoc comparisons, using the Tukey-Kramer Ranges test were conducted.

(d) Exploratory Predictions:

To determine which variables collected at intake were the

best predictors of later functioning at follow-up, standard multivariate regression analyses were used (SPSS- "Enter" method). When the outcome measure was dichotomous, standard (direct) discriminant function analyses were performed. For both types of analyses, Holm's procedure was used to correct for Type I Error.

Although hypotheses were formulated regarding the importance of certain intake variables in predicting specific outcome measures, these hypotheses were based mostly on studies that did not include psychiatric diagnoses, that were retrospective or that included such a high number of predictors that their significant results largely capitalized on chance (Hechtman, Weiss, Perlman, & Amsel, 1984; Mannuzza et al., 1990). Given the methodological problems of these past studies, and the small ratio of independent variables per subject in the present study, predictions were exploratory in nature. Model-testing procedures such as hierarchical regressions or hierarchical discriminant function analyses would be premature at this point in examining predictors of long-term outcome in hyperactivity. It was for this reason that standard regressions and discriminant function analyses were performed.

Given that the GMRT-Voc and the MAT-Math were grade scores and subject to age differences, they were transformed into difference scores (DGMRT-Voc and DMAT-Math) using the following equations:

DGMRT-Voc= GMRT-Voc - expected grade based on age + constant

DMAT-Math= MAT-Math - expected grade based on age + constant

Grade equivalent scores were used in the initial study because out-of-grade level testing was required for some subjects who were too weak academically to obtain an adequate basal at their grade level. Scores from different testing levels were not comparable (e.g., primer vs. elementary) because of the different item samples; therefore, grade equivalent scores were used to insure more comparability across subjects.

Interrater Reliability and Subject/Parent Agreement of DSM-III-R Diagnoses:

Coefficients of interrater reliability for twenty four interviews (20%), and coefficients of subject/parent agreement of DSM-III-R diagnoses were calculated using the most frequently used index of agreement (Fleiss, 1981; p.212): $p_0 = a + d$, where a and d equal the proportions of agreement between raters on the presence/presence and absence/absence of a specific diagnosis. The p_0 has been proposed as the agreement index of choice by Holley and Guilford (1964) and by Maxwell (1977).

RESULTS

Subjects

Follow-up intervals ranged from 9.6 to 14.9 years, with a mean of 12.4 years ($SD=1.20$). Sixty (62%) of the 97 eligible HYP subjects were recontacted and agreed to participate in the follow-up. Of the remaining children of the initial sample, 32 (33%) had moved too far to be tested or could not be located, 3 (3%) refused to participate, 1 (1%) was in prison, and 1 (1%) had died in a car accident. The age range for the HYP and the C groups at follow-up was 14.4 to 24.9 years, with a mean of 19.7 years ($SD=2.0$). Both groups consisted of 52 males and 8 females.

Recruited HYP subjects were subdivided according to their IO Factor scores and their A Factor scores as determined by the IOWA Conners Teacher Rating Scale research cutoff scores (Pelham, Milich, & Murphy, 1985). The HO group numbered 27 (24 males) and the HA group numbered 12 (9 males). Some recruited subjects were not included in the subgroup analyses because they met the A Factor but not the IO Factor (3 subjects) or they did not meet either IOWA Factor cutoff score (12 subjects), or they had missing IOWA scores (6 subjects).

Comparisons between recruited and non-recruited HYP subjects:

It has been suggested that subjects lost to follow-up studies may represent a different sample from recruited subjects rather than a random sample of the original hyperactive group (Weiss et al., 1979). To evaluate whether those subjects who

could not be recruited for the follow-up study differed in their initial characteristics from those who were recruited, these groups were compared on initial measures using two-tailed t tests. Table 3 displays the findings. Comparisons were made on the following child measures: child's age at referral, child's IQ, family income (INC), Mean reaction time (MRT) on a CPT, DGMRT-Voc scores and DMAT-Math scores. Comparisons were also made on mothers' and teachers' ratings on the Conners Hyperactivity Index, and teachers' IOWA IO and A Factor scores, as well as mother's education, and mother's Locke-Wallace Marital Adjustment scores.

Two of these variables were transformed to reduce substantial positive skewness and to improve the normality and linearity of the variables. Logarithmic transformations were used on income (lgINC) and the subjects' mean reaction time score (lgMRT) of the CPT. There were no significant differences on any of these measures between the recruited and non-recruited subjects when Holm's procedure was used to correct for Type I Error. On initial measures, those who failed to participate at follow-up appeared equivalent to those who participated.

Comparisons between Males and Females:

Group comparisons on the demographic variables were comparable when girls were included or excluded from the analyses. However, when the females were included in the analyses aimed at testing the hypotheses, some group differences

Table 3
T Test Comparisons Between Hyperactive Subjects Who Did And Did
not Participate at Follow-up on Measures Gathered at Intake

Measures		Recruited N=60	Not Recruited N=37	GP DIFFS	P _H
Child age (months)	<u>M</u> <u>SD</u>	88.8 18.8	84.1 17.3	NS	>.0071
Child IQ (PPVT)	<u>M</u> <u>SD</u>	111.1 14.9	109.1 16.5	NS	>.0125
lgINC	<u>M</u> <u>SD</u>	1.4 0.2	1.3 0.2	NS	>.0046
lgMRT	<u>M</u> <u>SD</u>	1.9 0.2	2.0 0.1	NS	>.004
DGMRT-Voc (GMRT)	<u>M</u> <u>SD</u>	4.1 (2.7) 1.2 (1.6)	4.4 (2.4) 1.1 (1.8)	NS	>.008
DMAT-Math (MAT)	<u>M</u> <u>SD</u>	2.5 (2.1) 0.9 (1.0)	2.8 (1.9) 0.7 (1.2)	NS	>.005
MCHI	<u>M</u> <u>SD</u>	21.2 5.6	19.7 6.5	NS	>.006
TCHI	<u>M</u> <u>SD</u>	19.5 3.5	19.2 4.4	NS	>.017
IO	<u>M</u> <u>SD</u>	11.5 1.9	11.6 2.1	NS	>.05
A	<u>M</u> <u>SD</u>	6.0 4.2	5.9 4.6	NS	>.025
Mother's education (years)	<u>M</u> <u>SD</u>	12.8 2.1	12.1 2.6	NS	>.0056
Mother's Locke- Wallace	<u>M</u> <u>SD</u>	103.28 28.31	107.80 25.88	NS	>.01

GP DIFFS= group differences; PPVT= Peabody Picture Vocabulary Test; lgINC= log. of family income; lgMRT= log. of Mean Reaction Time of CPT; DGMRT-Voc= difference scores of Gates MacGinitie

Table 3 (continued)

Reading Test Vocabulary Grade; DMAT-Math= difference scores of Metropolitan Achievement Test Math Grade; MCHI= Mother's Conners Hyperactivity Index; TCHI= Teacher's Conners Hyperactivity Index, IO= IOWA Inattention/Overactivity Factor; A = IOWA Aggressiveness Factor, Score. p_H = p with Holm's correction

were attenuated (e.g., some psychiatric variables), while others were intensified (e.g., some academic variables). Given that the number of females per group ($N=8$) was too small to consider gender as a separate variable, they were excluded from all further analyses. Therefore, all findings were based on male samples only.

Group Comparisons on Demographic and Intellectual Variables, and on Treatment History:

The hyperactive (HYP) and normal control groups (C) were compared on the demographic and intellectual variables collected at outcome using t tests or Chi square analyses, as appropriate. Holm's corrections were made to control for Type I Error. The results are shown in Table 4.

The two groups did not significantly differ on socioeconomic status (SES; highest parent income; Hollingshead & Redlich, 1958, two factor scale), $t=1.50$, $p_H>.025$, nor on the subject's age at follow-up, ($t=.34$, $p_H>.05$) but the C group had a significantly higher IQ (based on Vocabulary and Block Design subtests of WISC-R/WAIS-R) than the HYP group, $t=-3.27$, $p_H<.0167$. The HYP and the C groups did not significantly differ in terms of number of subjects who were married or who were parents at follow-up. Few subjects in either group were married (HYP=0%, C=2%) and/or parents (HYP=4%, C=2%).

The HA, HO and C groups did not significantly differ on age

Table 4
T Test and Chi-Square Comparisons of Demographic and Intellectual Variables of Hyperactive (HYP), Hyperactive/Aggressive (HA), Hyperactive Only (HO) and Normal Control (C) Males at Outcome

Measures		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS
Age at follow-up (mo.)	<u>M</u>	237.96	240.44	240.33	236.27	NS _c
	<u>SD</u>	24.60	27.65	22.92	25.71	
IQ estimate	<u>M</u>	102.12	100.22	103.75	109.81	C>HYP _a
	<u>SD</u>	12.89	12.69	14.92	11.00	
Socioeconomic Status (SES)	<u>M</u>	3.23	2.89	3.29	2.89	NS _b
	<u>SD</u>	1.25	1.45	1.12	1.10	
Married	<u>Fq</u> <u>(%)</u>	0	0	0	1 (2)	NS _b
Parent	<u>Fq</u> <u>(%)</u>	2 (4)	0	1 (11)	1 (2)	NS _c

_a= $p_H < .0167$ _b= $p_H > .025$ _c= $p_H > .05$

p_H = p with Holm's correction; GP DIFFS= group differences; HYP= all hyperactive males; HA= hyperactive/aggressive males; HO= hyperactive only males; C=normal control males; IQ estimate=based on Vocabulary and Block Design subtests of WISC-R/WAIS-R; SES= highest parent income (Hollingshead & Redlich, 1958, two-factor scale); Parent= Number of subjects who were parents.

at follow-up, $F(2, 84)=.267$, $p_H>.05$, nor on SES, $F(2, 84)=1.09$, $p_H>.025$, nor on IQ, $F(2, 84)=3.51$, $p_H>.0167$. The results are shown in Table 4 and the ANOVAs are displayed in Appendices E & F. Group differences on IQ were quite large, especially between the HA and C groups (almost 10 points). The lack of significance may be due to small sample sizes.

Because of the group differences on IQ, correlations were computed between IQ and the battery of dependent measures. On those measures where significant correlations were found, for both the group and subgroup analyses, IQ was used as a covariate when testing hypotheses.

Information on treatment received by the HYP and C groups is displayed in Table 5. Some sub-categories of treatment were excluded from the table despite having questioned the subjects in those areas because no subject in either group had received them (e.g., Individual therapy for alcohol problems). The HYP and C groups only differed on treatments aimed at improving behaviour problems. In comparison with the control subjects, significantly more HYP subjects received medication $\chi^2(1, N=104)=89.14$, $p_H<.01$, individual $\chi^2(1, N=104)=26.46$, $p_H<.013$, parent-training $\chi^2(1, N=101)=31.31$, $p_H<.017$, family $\chi^2(1, N=104)=14.48$, $p_H<.025$, and residential treatment $\chi^2(1, N=104)=5.25$, $p_H<.05$.

Subgroups HA, HO and C were compared on only one category of treatment, "treatment received for behaviour problems", because this was the only category with frequencies that were sufficient

Table 5
Treatment History of the Hyperactive (HYP),
Hyperactive/Aggressive (HA), Hyperactive Only (HO) and Normal
Control (C) Males at Outcome

Types of Treatment		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS	$P_{H/E}$
Treatment For Behaviour							
Medication	%	92.3	88.9	91.7	0	HYP>C HA,HO>C	$H < .01$ $E < .0025$
Duration	#mos.	55.88	49.3	50.0	0	NS	$H > .05$
Individual	%	48.1	44.4	50.0	3.8	HYP>C HA,HO>C	$H < .0125$ $E < .003$
Duration	#sess.	39.20	53.5	11.4	3.00	HA>C, HO	$H < .01$
Parent Training	%	48.1	55.6	45.8	0	HYP>C HA,HO>C	$H < .017$ $E < .004$
Duration	#sess.	9.4	9.0	9.8	0	NS	$H > .017$
Family	%	28.8	33.3	29.2	1.9	HYP>C HA,HO>C	$H < .025$ $E < .006$
Duration	#sess.	14.73	19.3	15.7	4.00	NS	$H > .025$
Residential	%	9.6	22.2	8.3	0	HYP>C HA>C	$H < .05$ $E < .0125$
Duration	#days	205	435	75	0	NS	$H > .0125$
Treatment for Alcohol							
Group	%	3.8			0	NS	$H > .025$
Duration	#sess.	33.0			0	-	
Residential	%	7.7			1.9	NS	$H > .05$
Duration	#days	257.75			49.00	NS	

(continued next page)

Table 5 (continued)

Types of Treatment	HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS	$p_{H/E}$
Treatment for Drugs						
Individual $\%$	3.8			0	NS	$p_H > .025$
Duration $\#sess.$	22.00			0	-	
Residential $\%$	7.7			1.9	NS	$p_H > .05$
Duration $\#days$	257.75			49.00	NS	
Treatment for Mood						
Medication $\%$	1.9			1.9	NS	$p_H > .025$
Duration $\#weeks$	3.00			36.00	NS	
Individual $\%$	1.9			7.7	NS	$p_H > .05$
Duration $\#sess.$	15.00			76.75	NS	
Treatment for Anxiety						
Medication $\%$	0			1.9	NS	$p_H > .025$
Duration $\#weeks$	0			60.00	-	
Individual $\%$	1.9			1.9	NS	$p_H > .05$
Duration $\#sess.$	1.00			3.00	NS	

$p_{H/E}$ = p with Holm's or Everitt's correction

GP DIFFS= group differences; HYP= all hyperactive males; HA= hyperactive/aggressive males; HO= hyperactive only males; C=normal control males; Duration= duration of treatment based only on subjects who received that particular treatment; α levels were corrected using Holm's procedure for each category of problem;

"-"=t tests not possible because of an empty group.

to perform the analyses. Table 5 displays the findings. Relative to the normal control subjects, significantly more HA and HO subjects received medication treatment, $\chi^2(1, N=61)=53.20$, $\chi^2(1, N=76)=67.09$, $p_e < .0025$, respectively. Similarly, significantly more HA and HO subjects received individual therapy, $\chi^2(1, N=61)=14.26$, $\chi^2(1, N=76)=23.28$, $p_e < .003$, respectively, and significantly more HA and HO subjects had parents who received parent-training, $\chi^2(1, N=61)=29.79$, $\chi^2(1, N=76)=29.32$, $p_e < .004$, respectively. Finally, significantly more HA and HO subjects received family therapy, $\chi^2(1, N=61)=12.35$, $\chi^2(1, N=76)=12.94$, $p_e < .006$, respectively, but HA subjects were the only hyperactive subjects who received significantly more residential placements, $\chi^2(1, N=61)=11.95$, $p_e < .0125$. Moreover, when subgroups were compared on the duration of the five types of treatment (for behaviour) received, only one significant group difference emerged in the post-hoc tests. Of those who received individual therapy for behaviour problems, the HA group received significantly more sessions than the control and HO groups, $F(2, 17)=13.48$, $p_h < .01$.

The CHAMPS: Interrater Reliability and Agreement between Subject/Parent on the Presence of DSM-III-R Disorders

Twenty-four interviews (20%) were diagnosed independently by two raters. Very high agreement occurred between raters. Disagreement only occurred for 1/24 subjects on a diagnosis of ADHD.

In the current study, parents and their adolescent offspring achieved moderate to high agreement on most diagnoses except ADHD in the proband group (52%: ever since age 13; and 56%: at follow-up). Refer to Tables 6 and 7 for results. Other percentages of agreement ranged from 65% to 100%. The highest agreement was reached for the diagnoses at follow-up given that rates of diagnoses were generally low in both groups (except ADHD).

Testing the Hypotheses

I. Psychiatric Functioning:

Hypotheses 1 (a), (b), and (c) stated that the HYP, HA, and HO groups would obtain significantly more diagnoses of ADHD at follow-up than the C group, and that only the HYP and the HA groups would receive significantly more diagnoses of CD/APD, Drug and Alcohol Use Disorders, and dual diagnoses of CD/APD and SUD than the C group. Given that the follow-up period covered more than a decade, diagnoses were recorded for two time periods: (1) Any time from age 13 years to follow-up (early/mid-adolescence); and (2) At follow-up (mid-adolescence/early adulthood).

[A] Ever Since Age 13 Years:

(a) HYP vs C

These diagnoses, as reported by subjects or parents, were based on the recall of symptoms present any time since the age of 13 years. Subjects may have recovered from some of these diagnoses before follow-up. Table 8 shows the distribution of

Table 6
Agreement Between Adolescent Subjects and Their Parents on the Presence of DSM-III-R Disorders Any Time Since Age 13 Years in the Hyperactive and Normal Control Groups (Males Only)

Subject/Parent-Based Diagnoses						
		Yes/No (b)	No/Yes (c)	Yes/Yes (a)	No/No (d)	Percent Agreement
<u>Hyperactive Gr.</u> (N=52)						
ADHD	<u>N</u> (%)	14 (27)	11 (21)	12 (23)	15 (29)	52
CD/APD	<u>N</u> (%)	5 (9)	1 (2)	16 (31)	30 (58)	89
Alcohol Use Disorder	<u>N</u> (%)	13 (25)	2 (4)	8 (15)	29 (56)	71
Drug Use Disorder	<u>N</u> (%)	9 (17)	0 (0)	5 (10)	38 (73)	83
<u>Control Gr.</u> (N=52)						
ADHD	<u>N</u> (%)	3 (6)	0 (0)	1 (2)	48 (92)	94
CD/APD	<u>N</u> (%)	6 (11)	0 (0)	1 (2)	45 (87)	89
Alcohol Use Disorder	<u>N</u> (%)	18 (35)	0 (0)	2 (4)	32 (61)	65
Drug Use Disorder	<u>N</u> (%)	4 (8)	0 (0)	1 (2)	47 (90)	92

ADHD= Attention Deficit Hyperactivity Disorder; CD/APD= Conduct Disorder or Antisocial Personality Disorder.

% Agreement= (a + d) (Fleiss, 1981; p.212)

Table 7
Agreement Between Adolescent Subjects and Their Parents on the Presence of DSM-III-R Disorders at Follow-up in the Hyperactive and Normal Control Groups (Males Only)

		Subject/Parent-Based Diagnoses				
		Yes/No (b)	No/Yes (c)	Yes/Yes (a)	No/No (d)	Percent Agreement
<u>Hyperactive Gr.</u> (N=52)						
ADHD	<u>N</u> (%)	7 (13)	16 (31)	3 (6)	26 (50)	56
CD/APD	<u>N</u> (%)	3 (6)	0 (0)	2 (4)	47 (90)	94
Alcohol Use Disorder	<u>N</u> (%)	7 (13)	0 (0)	3 (6)	42 (81)	87
Drug Use Disorder	<u>N</u> (%)	3 (6)	0 (0)	0 (0)	49 (94)	94
<u>Control Gr.</u> (N=52)						
ADHD	<u>N</u> (%)	0 (0)	0 (0)	1 (2)	51 (98)	100
CD/APD	<u>N</u> (%)	1 (2)	0 (0)	0 (0)	51 (98)	98
Alcohol Use Disorder	<u>N</u> (%)	5 (10)	0 (0)	0 (0)	47 (90)	90
Drug Use Disorder	<u>N</u> (%)	0 (0)	0 (0)	0 (0)	52 (100)	100

ADHD= Attention Deficit Hyperactivity Disorder; CD/APD= Conduct Disorder or Antisocial Personality Disorder.
 % Agreement= (a + d) (Fleiss, 1981; p.212)

Table 8
Chi Square Comparisons of Rate of Psychiatric Disorders of
Hyperactive (HYP), Hyperactive/Aggressive (HA), Hyperactive Only
(HO), and Normal Control (C) Males Ever Since Age 13 Years

Disorders		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS	$P_{H/E}$
ADHD	<u>F</u> (%)	37 (71)	6 (67)	17 (71)	4 (8)	HYP>C HA>C HO>C	$H < .01$ $E < .0025$ $E < .0025$
Conduct/Antisocial Personality Disorder (CD/APD)	<u>F</u> (%)	22 (42)	5 (56)	9 (38)	7 (14)	HYP>C HA>C	$H < .017$ $E < .0042$
Alcohol	<u>F</u> (%)	23 (44)	5 (56)	9 (38)	20 (39)	NS	$H > .05$ $E > .0125$
Drugs	<u>F</u> (%)	14 (27)	3 (33)	8 (33)	5 (10)	HYP>C	$H < .025$ $E > .0063$
CD/APD + Alcohol or Drug Disorder	<u>F</u> (%)	19 (37)	5 (56)	8 (33)	6 (12)	HYP>C HA>C	$H < .013$ $E < .0031$

Mood Disorder	<u>F</u> (%)	13 (25)	-	-	15 (29)	NS	$H > .05$
Anxiety Disorder	<u>F</u> (%)	3 (6)	-	-	11 (21)	NS	$H > .0167$
Thought Disorder	<u>F</u> (%)	1 (2)	-	-	0	NS	$H > .025$

$P_{H/E}$ = p with Holm's or Everitt's correction

GP DIFFS= group differences; HYP= all hyperactive males;
 HA=hyperactive/aggressive males; HO=hyperactive only males;
 C=normal control males.

mental disorders. Almost three quarters (71%) of the HYP group met criteria for ADHD at some time since the age of 13 years, whereas 8% of the control group met this diagnosis. As predicted, this difference was significant, $\chi^2(1, N=104)=43.85$, $p_H<.01$. A history of CD/APD was also found in significantly more of the HYP group (42%) relative to the control group (14%), $\chi^2(1, N=104)=10.76$, $p_H<.017$. No significant group differences were found in the frequency of Alcohol Use Disorders (HYP=44%, C=39%), $\chi^2(1, N=104)=0.36$, $p_H>.05$ but the HYP group had significantly more Drug Use Disorders (27%) than the control group (10%), $\chi^2(1, N=104)=5.22$, $p_H<.025$. The HYP group also had significantly more dual diagnoses of CD/APD and SUD (37%) than the C group (12%), $\chi^2(1, N=104)=8.90$, $p_H<.013$.

Clustering of diagnoses received any time since age 13 years was also examined in the hyperactive group. Figure 1 displays the findings in a diagram. HYP subjects who received the diagnosis of ADHD any time since age 13 years had a 51% chance of also receiving a CD/APD diagnosis. This finding did not reach significance, $\chi^2(1, N=52)=4.30$, $p_H>.03$. If HYP subjects had both ADHD and CD/APD, they had a significant chance of 90% of having a SUD, $\chi^2(1, N=37)=17.03$, $p_H<.01$. If a subject had ADHD only (without CD/APD), his chances of also having a SUD were only 22%, and non-significant, $\chi^2(1, N=30)=1.00$, $p_H>.05$. A subject with CD/APD without ADHD had a significant 67% chance of also having SUD, $\chi^2(1, N=15)=5.10$, $p_H<.02$. Therefore, there is a significant

link between CD/APD and SUD, but ADHD alone is not significantly associated with SUD except if there is also a CD/APD present. The low frequency of diagnoses in the HYP group at follow-up and in the C group for both time periods (since age 13 and at follow-up) did not permit similar comparisons. The HYP and C groups did not significantly differ in their frequencies of Mood (25%, 29%, respectively), $\chi^2(1, N=104)=.20$, $p_H>.05$, Anxiety (6%, 21%), $\chi^2(1, N=104)=.02$, $p_H>.017$, or Thought (1%, 0%) Disorders, $\chi^2(1, N=104)=1.01$, $p_H>.025$.

(b) HA vs HO vs C

Table 8 also displays the rate of psychiatric diagnoses in the groups HA, HO and C. The rate of ADHD was significantly different between the HA, HO, and C groups during the period which covered age 13 years to the time of follow-up (67%, 71%, 8%, respectively), $\chi^2(2, N=85)=35.86$, $p_E<.0025$. Significantly more subjects from the HA, $\chi^2(1, N=61)=19.47$, $p_E<.0025$, and the HO, $\chi^2(1, N=76)=32.74$, $p_E<.0025$ subgroups qualified for this diagnosis relative to the control group. The HA and HO subgroups did not differ from each other on this diagnosis, $\chi^2(1, N=33)=0.05$, $p_E>.0025$. The HA, HO and C groups also significantly differed on the diagnoses of CD/APD (56%, 38%, 14%, respectively), $\chi^2(2, N=85)=10.25$, $p_E<.0042$, and a dual diagnosis of CD/APD and SUD (56%, 33%, 12%, respectively), $\chi^2(2, N=85)=10.89$, $p_E<.0031$. Group differences on both diagnoses were due to the higher incidence of CD/APD, $\chi^2(1, N=61)=8.60$,

$p_E < .0042$, and CD/APD/SUD, $\chi^2(1, N=61)=10.06$, $p_E < .0031$, in the HA relative to the C group. Frequencies for the HO group fell in between the HA and C groups on these two diagnoses. When HA subjects were removed from the HYP group and the previous comparisons of HYP vs. C were performed again, the latter groups no longer differed significantly on the diagnoses of CD/APD or CD/APD/SUD. The three subgroups did not significantly differ on the diagnoses of Alcohol, $\chi^2(2, N=85)=1.02$, $p_E > .0125$, and Drug Use Disorders, $\chi^2(2, N=85)=7.43$, $p_E > .0063$.

In summary, during early-mid-adolescence, the HYP group continued to display significantly more ADHD relative to the C group. They also developed significantly more CD/APD and CD/APD/SUD than the C group but these differences were due to the higher incidence of these disorders in the HYP subjects who were also aggressive in childhood (HA). Although Drug Use Disorders were significantly more prominent in the HYP group relative to the C group, subjects who were aggressive in childhood (HA) were not more likely to develop this disorder in adolescence than subjects who were hyperactive only (HO) in childhood. The rate of Alcohol Use Disorders in adolescence was high for all groups and not significantly different. A clustering of diagnoses was evident in the HYP adolescents. A significant 67% of HYP subjects with CD/APD but not ADHD in adolescence also had a SUD, whereas almost all HYP subjects with ADHD and CD/APD in adolescence also had a concurrent SUD (90%). Hyperactive

subjects with ADHD only in adolescence were not significantly at risk of having a concurrent CD/APD or SUD.

[B] At Follow-up:

(a) HYP vs C

The sample of HYP males was compared with the sample of C males in the area of psychiatric functioning as reported by subjects or parents at follow-up. Table 9 shows the distribution of mental disorders. As predicted, ADHD was significantly more prevalent in the proband subjects (50%) than the control subjects (2%), $\chi^2(1, N=104)=31.27, p_H<.01$. These findings also suggested that approximately 20% of the HYP sample lost their diagnosis of ADHD during the time period between the age of 13 years and the time of follow-up. No other significant differences were found between the HYP and control groups on any of the other disorders, including CD/APD (10% and 2%), $\chi^2(1, N=104)=2.83, p_H>.025$, Drug Use Disorders (6% and 0%), $\chi^2(1, N=104)=3.09, p_H>.013$, Alcohol Use Disorders (19% and 10%), $\chi^2(1, N=104)=1.95, p_H>.05$, and dual diagnoses of CD/APD and SUD, (6% and 2%), $\chi^2(1, N=104)=1.04, p_H>.017$. As expected, the groups also did not significantly differ in the frequency of Mood Disorders (8% and 4%), $\chi^2(1, N=104)=0.71, p_H>.05$, Anxiety Disorders (6% and 15%), $\chi^2(1, N=104)=2.54, p_H>.017$, and Thought Disorders (2% and 0%), $\chi^2(1, N=104)=1.01, p_H>.025$.

(b) HA vs HO vs C

Significant group differences were found between the HA, HO

Table 9
Chi-Square Comparisons of Rate of Psychiatric Disorders of
Hyperactive (HYP), Hyperactive/Aggressive (HA), Hyperactive Only
(HO), and Normal Control (C) Males at Follow-up

Disorders		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS	$P_{H/E}$
ADHD	<u>F</u> (%)	26 (50)	3 (33)	13 (54)	1 (2)	HYP>C HA>C HO>C	$H < .01$ $E < .0025$ $E < .0025$
Conduct/Antisocial Personality Disorder (CD/APD)	<u>F</u> (%)	5 (10)	2 (22)	1 (4)	1 (2)	NS	$H > .025$ $E > .006$
Alcohol	<u>F</u> (%)	10 (19)	3 (33)	4 (17)	5 (10)	NS	$H > .05$ $E > .013$
Drugs	<u>F</u> (%)	3 (6)	3 (33)	0	0	HA>C HA>HO	$H < .013$ $E < .0031$
CD/APD + Alcohol or Drug Disorder	<u>F</u> (%)	3 (6)	2 (22)	0	1 (2)	NS	$H > .017$ $E > .004$

Mood Disorder	<u>F</u> (%)	4 (8)	-	-	2 (4)	NS	$H > .05$
Anxiety Disorder	<u>F</u> (%)	3 (6)	-	-	8 (15)	NS	$H > .017$
Thought Disorder	<u>F</u> (%)	1 (2)	-	-	0	NS	$H > .025$

$P_{H/E}$ = p with Holm's or Everitt's correction

GP DIFFS= group differences; HYP= all hyperactive males; HA= hyperactive/aggressive males; HO= hyperactive only males; C=normal control males.

and C groups on the diagnosis of ADHD (33%, 54%, 2% respectively), $\chi^2(2, N=85)=29.13$, $p_F<.0025$. Table 9 displays the findings. Both the HA, $\chi^2(1, N=61)=12.35$, $p_F<.0025$ and the HO, $\chi^2(1, N=76)$, $p_F<.0025$ subgroups had significantly more diagnoses of ADHD than the C group at follow-up. The HA and HO groups did not significantly differ from each other on this diagnosis, $\chi^2(1, N=33)=1.14$, $p_F>.0025$. Significant group differences were found in the frequency of Drug Use Disorders, $\chi^2(2, N=85)=26.26$, $p_F<.0031$. The HA group had significantly more Drug Use Disorders than the HO (33% and 0%), $\chi^2(1, N=33)=8.80$, $p_F<.0031$, and the C groups (33% and 0%), $\chi^2(1, N=61)=18.23$, $p_F<.0031$. No subject in the HO or C groups received a diagnosis of Drug Use Disorder at follow-up. The HA, HO, and C groups did not significantly differ on the diagnoses of CD/APD (22%, 4%, 2%, respectively), $\chi^2(2, N=85)=7.07$, $p_F>.006$, Alcohol Use Disorders (33%, 17%, 10%, respectively), $\chi^2(2, N=85)=3.74$, $p_F>.013$, and on dual diagnoses of CD/APD and SUD (22%, 0%, 2%), $\chi^2(2, N=85)=10.51$, $p_F>.004$.

In summary, at follow-up, the HYP subjects continued to display significantly more ADHD than the C groups. A decrease in the number of significant group differences was observed from age 13 years to the follow-up period and previous group differences in the CD/APD were no longer significant. However, at follow-up, the HA group had significantly more Drug Use Disorders than both the HO and C groups.

II. Cognitive Functioning:

Hypotheses 2a and 2b predicted that the HYP group, and the HO and HA subgroups would display greater difficulty inhibiting their responses, and remaining attentive, and that they would be more distractible than the C group, as indicated by lower Efficiency Ratios on the Delay task of the GDS, and a greater number of errors of omission and commission on the Vigilance and Distractibility tasks of the GDS.

Prior to analyses, the dependent variables were examined through various SPSS programs for fit between their distributions and the assumptions of multivariate analysis. Ceiling effects were observed on all dependent variables. To reduce the extreme skewness and kurtosis, the Efficiency Ratio, and the errors of omission scores from the Vigilance and Distractibility tasks were logarithmically transformed (e.g., $\log_{10}(\text{VTOM}+1)$). The errors of commission scores from the Vigilance and Distractibility tasks were inversely transformed (e.g., $1/(\text{VTCOM}+1)$). No cases were identified through Mahalanobis distance as multivariate outliers with $p < .001$.

(a) HYP vs C

Correlations between IQ and the transformed GDS outcome measures revealed significant correlations. A MANCOVA with IQ serving as a covariate was used to evaluate the scores from the GDS between the HYP and C groups. Results indicated no significant group differences between the HYP and C groups on

these measures $F(5, 97)=0.77, p>.05$. The means and standard deviations for the five cognitive test scores are shown in Table 10 and the results of the MANCOVA are displayed in Appendix G.

(b) HA vs HO vs C

A MANCOVA with IQ serving as a covariate was used to evaluate the scores from the GDS between the HA, HO and C groups. No significant group differences were found between the 3 groups on these measures $F(10, 156)=0.56 p>.05$. The means and standard deviations for the five cognitive test scores are shown in Table 10 and the results of the MANCOVA are displayed in Appendix H.

III. Academic Performance:

Hypotheses 3a and 3b stated that the HYP and the HA and HO groups would have more deficits on academic achievement tests and school performance than the C group.

A correlation of .83 was found between the WRAT-R Reading and Spelling subtests (refer to Appendix I for correlations). Given that another reading test (PIAT-R) was also available and correlated only moderately with the WRAT-R Spelling subtest ($r=.42$) and the WRAT-R Reading subtest ($r=.53$), the WRAT-R Reading subtest was eliminated from subsequent analyses. The score distribution of the PIAT-R Reading Comprehension subtest revealed a significant negative skewness (ceiling effect) for both the HYP and C groups. Therefore, PIAT-R scores were transformed (reflect and square root) before entering into the

Table 10
MANCOVA of GDS Scores of Hyperactive (HYP),
Hyperactive/Aggressive (HA), Hyperactive Only (HO) and Normal
Control (C) Males with IQ as a Covariate

Variables		HYP N=52	HA N=9	HO N=24	C N=52
Delay Task					
Efficiency					
Ratio	<u>M</u>	.873	.894	.887	.866
	<u>SD</u>	.105	.088	.089	.089
Vigilance Task					
Errors Omission	<u>M</u>	1.87	1.89	2.00	1.02
	<u>SD</u>	1.94	1.90	2.27	1.38
Errors Commis-					
sion	<u>M</u>	1.87	2.11	1.92	1.04
	<u>SD</u>	2.29	2.62	2.62	1.64
Distractibility					
Task					
Errors					
Omission	<u>M</u>	4.73	6.00	4.83	3.64
	<u>SD</u>	4.95	5.83	5.72	4.06
Errors Commis-					
sion	<u>M</u>	2.02	2.22	2.17	1.90
	<u>SD</u>	2.80	1.99	3.33	2.47

MANCOVA is non-significant
 GP DIFFS= group differences; HYP= all hyperactive males;
 HA=hyperactive/aggressive males; HO=hyperactive only males;
 C=normal control males.

analyses. No cases were identified through Mahalanobis distance as multivariate outliers with $p < .001$.

Correlations between IQ and outcome measures of academic achievement were significant in most cases. Therefore, IQ was used as a covariate in a MANCOVA to evaluate the WRAT-R Spelling, WRAT-R Arithmetic and transformed PIAT-R Reading Comprehension scores.

Chi-square and ANCOVA analyses were performed to evaluate whether the two groups differed on school performance variables. IQ was used as a covariate when it correlated with a dependent variable. The groups were compared on the highest grade of High School completed (IQ as cov.), proportion of subjects failing courses in High School and of those who did fail courses, number of High School courses failed (IQ as cov.). Groups were also compared on the number of individuals receiving special services in High School (resource or special education classes), and on the proportion of students of age (18 years and over) who had ever attended post-secondary school (college or university).

(a) HYP vs C

1) Academic Achievement Scores:

Significant differences were found between the HYP and C groups on these academic measures, $F(3, 99) = 6.02$, $p < .05$. The means and standard deviations for the three achievement test scores are shown in Table 11 and results of the MANCOVA are displayed in Appendix J. These analyses indicated that HYP

Table 11
MANCOVA of Academic Achievement Test Scores of Hyperactive (HYP),
Hyperactive/Aggressive (HA), Hyperactive Only (HO) and Normal
Control (C) Males with IQ as a Covariate

Measures		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS
WRAT-R						
Spelling	<u>M</u>	91.64	95.11	95.25	104.44	HYP<C _a
	<u>SD</u>	16.55	20.37	14.46	11.11	
Arithmetic	<u>M</u>	87.21	89.56	91.00	100.00	HYP<C _b
	<u>SD</u>	14.68	13.32	13.60	13.12	
PIAT-R						
Reading Comprehension	<u>M</u>	101.77	101.22	102.13	110.00	HYP<C _c
	<u>SD</u>	12.39	14.78	13.59	5.77	

_a= $p_H < .0167$ _b= $p_H < .025$ _c= $p_H < .05$

GP DIFFS= group differences; HYP= all hyperactive males;
 HA=hyperactive/aggressive males; HO=hyperactive only males;
 C=normal control males.

subjects scored significantly lower than the C group on the WRAT-R Spelling $F(1, 101)=12.66$, $p_H<.0167$ and Arithmetic subtests $F(1, 101)=10.51$, $p_H<.025$, and on the PIAT-R Reading Comprehension subtest $F(1, 101)=7.74$, $p_H<.05$. However, the hyperactive group only scored .5 to 1 standard deviation lower than the control group on all three subtests.

2) School Performance:

The means and standard deviations of the continuous variables related to school performance are shown in Table 12 and the two ANCOVAs are shown in Appendix K. The control group had completed significantly more grades than the HYP group at the High School level, (12.0, 10.9, respectively), $F(1,103)=8.56$, $p_H<.0167$. Relative to the C group, the HYP group had a significantly higher proportion of subjects who failed at least one High School course (42% and 77%, respectively), $\chi^2(1, N=104)=12.94$, $p_H<.0125$, and of those subjects in both groups who did fail, the HYP subjects failed a significantly greater number of courses per student in comparison with the control group (3.73 and 1.46, respectively), $F(1, 61)=5.28$, $p_H<.025$. Significantly more HYP subjects participated in High School special education or resource classes relative to the C group (44% and 2%, respectively), $\chi^2(1, N=104)=26.22$, $p_H<.01$. Significantly more C subjects than HYP subjects attended post-secondary school at some

Table 12
ANCOVA with IQ as a Covariate and Chi-Square Comparisons of
School Performance of Hyperactive (HYP), Hyperactive/Aggressive
(HA), Hyperactive Only (HO) and Normal Control (C) Males

Measures		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS	$p_{H/E}$
High School level completed	<u>M</u>	10.89	10.78	11.17	12.02	HYP<C	$p_H < .0167$
	<u>SD</u>	1.54	2.28	1.44	1.29		$p_E > .05$ Tukey(.05)
no. subjects who failed High School course(s)	<u>F</u>	40	8	15	22	HYP>C	$p_H < .0125$
	<u>(%)</u>	(77)	(89)	(63)	(42)		$p_E > .003$
-no. courses failed	<u>M</u>	3.73	3.50	4.13	1.46	HYP>C	$p_H < .025$
	<u>SD</u>	3.54	3.12	3.09	1.30	HO>C	$p_H < .025$ $p_E > .05$ Tukey(.05)
no. received special services in High School	<u>F</u>	23	5	12	1	HYP>C	$p_H < .01$
	<u>(%)</u>	(44)	(56)	(50)	(2)	HA>C	$p_H < .0025$
						HO>C	$p_E > .0025$
no. attended post-secondary school any time	<u>F</u>	6	1	4	13	HYP<C	$p_H < .05$
	<u>(%)</u>	(14)	(13)	(19)	(31)		$p_E > .0125$

$p_{H/E} = p$ with Holm's or Everitt's correction

GP DIFFS= group differences; HYP= all hyperactive males;
 HA=hyperactive/aggressive males; HO=hyperactive only males;
 C=normal control males.

time in the past or present (31% and 14%, respectively), $\chi^2(1, N=86)=3.74, p_H<.05$.

(b) HO vs HA vs C

1) Academic Achievement Scores:

The WRAT-R Spelling and Arithmetic scores and the transformed PIAT-R Reading Comprehension score of the HO, HA and C groups were compared in a MANCOVA with IQ serving as a covariate. No significant differences between the 3 groups were found on these measures, $F(6, 160)=1.48, p>.05$. The means and standard deviations for the three achievement test scores are shown in Table 11 and the results of the MANCOVA are displayed in Appendix L.

2) School Performance:

The HO, HA and C groups were compared on school performance variables using chi-square and ANCOVA analyses. IQ was used as a covariate with both continuous variables. The results are shown in Table 12 and Appendices M and N.

The HA, HO, and C groups did not significantly differ in terms of highest grade of High School completed, (10.78, 11.17, and 12.02, respectively), $F(2, 84)=2.12, p_H>.0167$, nor in the number of subjects who failed High School courses (89%, 63%, and 42%, respectively), $\chi^2(1, N=85)=7.91, p_E>.003$. However, of those subjects who did fail, the HO group failed a significantly greater number of courses per student in comparison with the control group (4.13 vs 1.46), $F(2, 44)=4.73, p_H<.025$. Both the

HA, $\chi^2(1, N=61)=24.88$, $p_e<.0025$, and HO groups, $\chi^2(1, N=76)=26.77$, $p_e<.0025$ had received significantly more school services than the C group (56%, 50%, and 2%, respectively). No group differences were found in the number of subjects, aged 18 years and over, from the HA, HO, or C group who had ever attended post-secondary school (13%, 19%, and 31%, respectively), $\chi^2(1, N=71)=1.84$, $p_e>.0125$.

In summary, in comparison with the C group, the HYP group displayed fewer skills in Spelling, Arithmetic, and Reading Comprehension, they completed less High School education and fewer HYP subjects had pursued a post-secondary education. More HYP subjects, including those who were aggressive in childhood (HA) and those who were not (HO), received resource or special education classes, more HYP subjects failed High School courses and of those who failed, HYP subjects, especially those who were hyperactive only in childhood (HO), failed more courses. No significant group differences were found between the HA and HO groups on any academic achievement or school performance variables.

IV. Self-reports of Hostility/Aggressiveness:

Hypotheses 4 (a) and (b) stated that the HYP and the HA groups would report significantly more aggression than the control group. The HO group was not expected to differ from the C group.

(a) HYP vs C

A significant correlation was found between IQ and the BDHI Total Hostility Score. Therefore, an ANCOVA with IQ serving as a covariate was used to evaluate the hostility score from the BDHI between the HYP and C groups. Results indicated no significant group differences between the groups on this measure $F(1, 103) = .323, p > .05$. The HYP group did not report significantly more hostility/aggressiveness than did the control group. The means and standard deviations of the BDHI total scores are shown in Table 13 and the ANCOVA is displayed in Appendix O. All groups had mean Hostility scores below the recommended cutoff score of 38; therefore, the groups reported normal levels of hostile/aggressive feelings.

(b) HA vs HO vs C

A MANCOVA with IQ serving as a covariate was used to evaluate the BDHI scores between the HA, HO, and C groups. Again, no significant group differences were found between the 3 groups on this measure $F(2, 84) = 1.14, p > .05$. The means and standard deviations are shown in Table 13 and the ANCOVA is shown in Appendix O.

V. Exploratory Predictions

As stated earlier, two variables, income (lgINC) and mean reaction time (lgMRT), were logarithmically transformed to satisfy the assumptions of normality and linearity. With the use

Table 13
ANCOVA of Self-Reports of Hostility/Aggressiveness Between the Hyperactive (HYP), Hyperactive/Aggressive (HA), Hyperactive Only (HO) and Normal Control (C) Groups with IQ as a Covariate

Measure		HYP N=52	HA N=9	HO N=24	C N=52	GP DIFFS
Total Hostility/ Aggressiveness Score	<u>M</u>	29.29	27.44	30.67	26.27	NS
	<u>SD</u>	9.63	5.10	8.97	9.71	

GP DIFFS= group differences ($p > .05$); HYP= all hyperactive males;
HA=hyperactive/aggressive males; HO=hyperactive only males;
C=normal control males.

of a $p < .001$ criterion for Mahalanobis distance, no outliers among the cases were identified.

Some intake variables had missing data. The missing data appeared mostly in the MLW (10%) and the teachers' IOWA IO and A Factor ratings (12%). Of the 10% of missing data on the MLW, 8% was due to the fact that single mothers could not complete the marital scale. Subjects with and without missing data on the MLW and IO and A Factors were compared on the selected predictors. No significant group differences were found ($p > .01$) on the MLW, and IO and A Factors. Given that both the MLW and IOWA Factors were considered important predictors/discriminators, they were not eliminated from the analyses.

Outcome Measures:

1. Psychiatric Diagnoses including ADHD, CD/APD, CD/APD/SUD, Drug Use Disorders and Alcohol Use Disorders. Predictions were not made on diagnoses applicable only to the follow-up period because subjects were too unevenly distributed into the categories of positive versus negative diagnoses to yield valid results. Predictions were made only on diagnoses based on the time period between the age of 13 years and follow-up. Attempts were made to predict these diagnoses using child and familial variables taken at intake as well as treatment variables.

Table 14 presents the results of the discriminant analysis for the diagnosis of ADHD in adolescence. The 30 males who

Table 14
Standard Discriminant Analysis of Pretest Variables on the
Diagnosis of ADHD in the Group of Hyperactive Males Any Time
since the Age of 13 Years

Discriminant function non-significant at $p_H < .0167$

Group Means	lgINC	Age	A Factor	IO Factor	lgMRT
No ADHD N=11	1.40	93.82	5.27	11.55	1.85
ADHD N=30	1.41	87.40	6.17	11.40	1.90

Group Means	STIMU	PARTRAIN	BEHther
No ADHD N=11	37.64	4.91	7.00
ADHD N=30	56.93	5.73	18.43

lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; lgMRT= log. of Mean Reaction Scores of CPT; STIMU= number of months on stimulant medication; PARTRAIN= number of sessions of parent-training; BEHther= number of sessions of individual or family therapy for behaviour problems.

received the diagnosis of ADHD in adolescence could not be differentiated from the 11 males who did not receive the diagnosis on the basis of the selected intake and treatment measures, including child age, INC, IgmRT scores, teachers' IO or A Factor ratings, STIMU, PARTRAIN and BEHther.

Ten intake variables were used to attempt to discriminate between proband males who did or did not receive diagnoses of CD/APD, dual diagnoses of CD/APD and SUD, Drug Use Disorders (dependence or abuse) and Alcohol Use Disorders. The same intake variables were examined as discriminators of all 4 diagnoses: Child IQ, INC, child age at referral, teachers' A and IO Factors, MLW, MED, STIMU, PARTRAIN, and BEHther. Only two diagnoses, CD/APD/SUD and Alcohol Use Disorders, yielded significant discriminant functions.

The 26 males who did not receive a dual diagnosis of CD/APD and SUD in adolescence were significantly discriminated from the 14 males who did receive this diagnosis based on the discriminant function, $\chi^2(10)=26.06$, $p_H<.0125$. The results are presented in Table 15. The structure matrix of correlations between predictors and the discriminant function suggests that the best predictors for distinguishing the two groups were age and BEHther, accounting for 15% and 9% of the outcome variability, respectively. Correlations less than .30 were not interpreted. HYP males who developed a dual diagnosis of CD/APD and SUD were significantly older at referral (mean= 8.3 years) than those

Table 15
Standard Discriminant Analysis of Pretest Variables on the Dual
Diagnosis of CD/APD and Substance Use Disorder in the Group of
Hyperactive Males Any Time since the Age of 13 Years

Predictor Variables	Correlations of predictor variables with discriminant function		Univariate F(1,38)				
Age	.39		7.05				
BEHther	.30		4.12				
MLW	.28		3.46				
MED	.26		3.13				
lgINC	.23		2.43				
STIMU	-.23		2.36				
PARTRAIN	-.07		0.23				
IO Factor	.02		0.01				
A Factor	.01		0.01				
Canonical R	.74						
Eigenvalue	1.20						
Wilks' λ	.45						
p	.004						

Group Means	lgINC	Age	IQ	MED	MLW	A	IO
No CD/APD/SUD N=26	1.39	84.27	110.96	12.42	94.77	5.81	11.42
CD/APD/SUD N=14	1.47	99.86	114.79	13.57	112.71	5.93	11.50

Group Means	STIMU	PARTRAIN	BEHther
No CD/APD/SUD N=26	58.50	5.92	9.42
CD/APD/SUD N=14	37.79	4.14	27.50

Table 15 (continued)

Classification Results

Actual GP	N	Predicted GP Membership	
		No CD/APD/SUD	CD/APD/SUD
No CD/APD/SUD	26	23 (88.5%)	3 (11.5%)
CD/APD/SUD	14	2 (14.3%)	12 (85.7%)
% Correctly Classified = 87.50%			

lgINC= log. of family income; MED= mothers' education; MLW= mothers' Locke-Wallace Marital Adjustment Scale scores; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication; PARTRAIN= number of sessions of parent-training; BEHther= number of sessions of individual or family therapy for behaviour problems.

without the diagnosis (mean= 7.0 years), and they received significantly more sessions of individual or family therapy for behaviour problems (mean= 27.5) than those without the diagnosis (mean= 9.4). On the basis of that function, 87.5% or 35 subjects of a total of 40 subjects were accurately distinguished with regard to the dual diagnosis of CD/APD and SUD.

The 16 males who received a diagnosis of Alcohol Use Disorder could be significantly distinguished from the 24 males who did not receive this diagnosis based on intake and treatment variables, $\chi^2(10)=26.42$, $p_H<.01$. The results are presented in Table 16. The structure matrix of correlations between predictors and the discriminant function suggests that the best predictors for distinguishing the two groups were again age and BEHther, accounting for 21% and 10% of the outcome variability, respectively. Males who received a diagnosis of Alcohol Use Disorder in adolescence were significantly older at referral (mean= 8.3 years) than those who did not receive the diagnosis (mean= 6.9 years), and they received significantly more sessions of individual or family therapy for behaviour problems (mean= 27.1 sessions) than those without the diagnosis (mean= 8.2 sessions). On the basis of the function, 87.50% or 35 subjects of a total of 40 subjects were accurately classified with regard to the diagnosis of Alcohol Use Disorder.

The 24 proband subjects who did not receive the diagnosis of CD/APD during adolescence could not be significantly

Table 16
Standard Discriminant Analysis of Pretest Variables on the
Diagnosis of Alcohol Use Disorder in the Group of Hyperactive
Males Any Time since the Age of 13 Years

Predictor Variables	Correlations of predictor variables with discriminant function		Univariate F(1, 38)				
Age	.45		9.60				
BEHther	.32		4.87				
STIMU	-.24		2.73				
MLW	.19		1.64				
MED	.16		1.20				
lgINC	.13		0.77				
IQ	.08		0.30				
IO Factor	.02		0.02				
A Factor	.004		0.001				
PARTRAIN	-.003		0.001				
Canonical R	.74						
Eigenvalue	1.23						
Wilks' λ	.45						
p	.003						

Group Means	lgINC	Age	IQ	MED	MLW	A	IO
No Alcohol N=24	1.40	82.83	111.21	12.54	96.13	5.83	11.42
Alcohol N=16	1.44	100.06	113.94	13.25	108.44	5.88	11.50

Group Means	STIMU	PARTRAIN	BEHther
No Alcohol N=24	59.88	5.67	8.17
Alcohol N=16	38.31	5.63	27.13

Table 16 (continued)

Classification Results

Actual GP	N	Predicted GP Membership	
		No Alcohol	Alcohol
No Alcohol	24	21 (87.5%)	3 (12.5%)
Alcohol	16	2 (12.5%)	14 (87.5%)
% Correctly Classified = 87.50%			

lgINC= log. of family income; MED= mothers' education; MLW= mothers' Locke-Wallace Marital Adjustment Scale Scores; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication; PARTRAIN= number of sessions of parent-training; BEHther= number of sessions of individual or family therapy for behaviour problems.

discriminated from the 16 probands who did receive it. The results are displayed in Table 17.

The 28 subjects who did not have Drug Use Disorders could not be significantly discriminated from the 12 who did not receive the diagnosis. Table 18 displays the results.

In summary, subjects who continued to be diagnosed as ADHD and those who developed diagnoses of CD/APD, or Drug Use Disorders in adolescence could not be differentiated from those who did not receive these diagnoses. Being older at referral and having received more individual or family therapy aimed at diminishing behaviour problems were predictive of a greater incidence of CD/APD/SUD and Alcohol Use Disorders in adolescence.

2. Cognitive Performance was assessed using the GDS. It included 2 measures of impulsiveness (Total commissions on Vigilance and Distractibility tasks), one measure of attention and one measure of distractibility (Total omissions on the Vigilance and Distractibility tasks, respectively). The Delay task of the GDS was excluded from these analyses because of the very small group differences and low score variability.

The same predictors were used to predict all 4 measures of GDS scores. The child's age and IQ, lgINC, lgMRT, the IO and A Factors, and STIMU were selected as predictors. The transformed GDS scores were used in these analyses (refer to previous section on group comparisons in cognitive functioning for details).

Table 17
Standard Discriminant Analysis of Pretest Variables on the
Diagnosis of CD/APD in the Group of Hyperactive Males Any Time
since the Age of 13 Years

Discriminant function non-significant at $p_{\text{H}} < .05$

Group Means	lgINC	Age	IQ	A	IO	MLW	MED
No CD/APD N=24	1.39	85.00	111.67	5.67	11.38	96.75	12.54
CD/APD N=16	1.46	96.81	113.25	6.13	11.56	107.50	13.25

Group Means	STIMU	PARTRAIN	BEHther
No CD/APD N=24	60.63	6.04	7.13
CD/APD N=16	37.19	5.06	28.69

lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; MLW= mothers' Locke-Wallace Marital Adjustment Scale Scores; MED= mothers' education; STIMU= number of months on stimulant medication; PARTRAIN= number of sessions of parent-training; BEHther= number of sessions of individual or family therapy for behaviour problems.

Table 18
Standard Discriminant Analysis of Pretest Variables on the
Diagnosis of Drug Use Disorder in the Group of Hyperactive Males
Any Time since the Age of 13 Years

Discriminant function non-significant at $p_H < .025$

Group Means	lgINC	Age	IQ	MLW	A	IO	MED
No Drug N=28	1.40	84.68	112.46	94.79	6.21	11.36	12.68
Drug N=12	1.45	101.50	111.92	115.67	5.00	11.67	13.17

Group Means	STIMU	PARTRAIN	BEHther
No Drug N=28	58.54	6.14	14.54
Drug N=12	34.25	4.50	18.58

lgINC= log. of family income; MLW= mothers' Locke-Wallace Marital Adjustment Scale Scores; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; MED= mothers' education; STIMU= number of months on stimulant medication; PARTRAIN= number of sessions of parent-training; BEHther= number of sessions of individual or family therapy for behaviour problems.

Two out of four outcome measures, the errors of commission from the Vigilance task and the errors of omission from the Distractibility task, were significantly predicted on the basis of the selected predictors. Tables 19 (a,b,c) and 20 (a,b) display the unstandardized regression coefficients (B) and intercept, the standardized regression coefficients (β), the semipartial correlations (sr^2), and R , R^2 , and adjusted R^2 . R for regression was significantly different from zero for both the errors of commission from the Vigilance task, $F(7, 33)=4.03$, $p_H<.0125$, and the errors of omission from the Distractibility task, $F(7, 33)=3.01$, $p_H<.0167$.

For the errors of commission from the Vigilance task, no predictor contributed significantly to the prediction when age and lgMRT were included simultaneously in the analysis with the other predictors (see Table 19a). Given that lgMRT and age at referral were significantly correlated ($r=.66$, $p<.01$), two other regressions were performed. First, as displayed in Table 19b, when age was eliminated from the regression, lgMRT was the only predictor that contributed significantly to the prediction ($sr^2=.29$). Second, when lgMRT was eliminated from the regression, as shown in Table 19c, two significant predictors emerged, age ($sr^2=.27$) and the IO Factor ($sr^2=.12$). Therefore, lgMRT and age which had a shared variance of 44%, significantly predicted impulsiveness in adolescence. Childhood inattention-overactivity (IO Factor), as rated by teachers, was also a

Table 19a
Standard Multiple Regression on Hyperactive Males' Transformed
Total Commission Scores of the Vigilance Task

Predictors	B ^a	β	sr ² (unique)	r
IO Factor	-.063	-.35	.11	-.21
lgMRT	-.905	-.34	.07	-.54 _b
Age	.006	.31	.05	.51 _b
lgINC	.366	.18	.03	.12
A Factor	-.009	-.12	.01	-.08
STIMU	-.001	-.10	.01	-.14
IQ	.0002	-.01	.00	.01
Intercept= 2.12				
			R ² = .46	
			Adjusted R ² = .35	
			R= .68*	

^a No single variable contributed significant unique variance

* $p_H < .0125$ $p_b < .01$

Note: All signs of correlations (r) must be reversed before interpreting because commission errors were inversely transformed.

Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; lgMRT= log. of Mean Reaction Scores of CPT; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

(continued next page)

Table 19b
Previous Analysis Repeated Without the Age Variable

Predictors	B	β	sr^2 (unique)
lgMRT	-1.44*	-.54	.29
IO Factor	-.06		
lgINC	.33		
A Factor	-.01		
STIMU	-.001		
IQ	-.001		
Intercept	3.74		
		Adjusted $R^2 = .41$	
		$R^2 = .30$	
		$R = .64^*$	

* $p_H < .0125$

Table 19c
Previous Analysis Repeated Without the lgMRT Variable

Predictors	B	β	sr^2 (unique)
Age	.01*	.53	.27
IO Factor	-.07*	-.36	.12
lgINC	.45		
STIMU	-.001		
A Factor	-.01		
IQ	.001		
Intercept	-.17		
		Adjusted $R^2 = .42$	
		$R^2 = .33$	
		$R = .65^*$	

* $p_H < .0125$

Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; lgMRT= log. of Mean Reaction Scores of CPT; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

Table 20a
Standard Multiple Regression on Hyperactive Males' Transformed
Total Omission Scores of the Distractibility Task

Predictors	B	β	sr^2 (unique)	r
lgMRT	1.940*	.64	.23	.50 _a
IQ	-.006	-.22	.05	-.28
STIMU	-.002	-.19	.03	-.16
Age	.004	.20	.02	-.19
IO Factor	-.032	-.15	.02	-.11
lgINC	.245	.10	.01	-.02
A Factor	-.002	-.02	.00	.01
Intercept= -2.64				
			$R^2 = .39$	
			Adjusted $R^2 = .26$	
			$R = .62^*$	

* $p_H < .0167$ _a = $p < .01$

lgMRT= log. of Mean Reaction Scores of CPT; Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

Table 20b
Previous Analysis Repeated Without the Age Variable

Predictors	B	β	sr^2 (unique)
lgMRT	1.54*	.51	.25
IQ	-.01		
STIMU	-.002		
IO Factor	-.03		
lgINC	.22		
A Factor	-.003		
Intercept= -2.64			
			$R^2 = .39$
			Adjusted $R^2 = .26$
			$R = .62^*$

* $p_H < .0167$

significant, although less important predictor of adolescent impulsiveness.

In the case of errors of omission from the Distractibility task, only lgMRT contributed significantly to the prediction ($sr^2=.23$). Table 20a displays the results. Given the previous findings, two additional analyses were performed. First, Table 20b shows that when age was removed from the equation, lgMRT continued to be a significant predictor ($sr^2=.25$). On the other hand, when lgMRT was eliminated, the regression equation was no longer significant. Therefore, childhood inattention, as measured on the mean reaction time task, was predictive of adolescent distractibility regardless of age effects.

Omission scores on the Vigilance task and commission scores on the Distractibility task were not significantly predicted by the selected intake and treatment variables. Tables 21 and 22 display the findings. However, the significant correlations between childhood lgMRT, age and these two outcome variables are consistent with findings on the other two tasks. The small sample size, the small range of scores and the ceiling effects on all GDS tasks may explain the difficulty in finding more significant predictors on these and the other tasks.

3. Academic Performance included the WRAT-R Spelling and Arithmetic subtest scores, the transformed PIAT-R Reading Comprehension subtest scores, the highest grade completed in High School, and the number of courses failed in High School.

Table 21
Standard Multiple Regression on Hyperactive Males' Transformed
Total Omission Scores of the Vigilance Task

Predictors	B	β	sr^2 (unique)	r
Regression equation non-significant at $p_H < .025$				
lgMRT				.46 _b
Age				-.39 _a
IQ				-.20 ^a
STIMU (mo.)				.13
A Factor				-.03
IO Factor				-.03
lgINC				.003

_a = $p < .05$ _b = $p < .01$

lgMRT= log. of Mean Reaction Score of CPT; Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

Table 22
Standard Multiple Regression on Hyperactive Males' Transformed
Total Commission Scores of the Distractibility Task

Predictors	B	β	sr^2 (unique)	r
Regression equation non-significant at $p_H < .05$				
lgMRT				-.38 _a
Age				.34 _a
A Factor				-.20 ^a
STIMU				-.18
lgINC				.11
IO Factor				-.11
IQ				.07

_a = $p < .05$

Note: All signs of correlations (r) must be reversed before interpreting because commission errors were inversely transformed.

Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; lgMRT= log. of Mean Reaction Scores of CPT; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

The regression information for the WRAT-R Spelling subtest is contained in Table 23. R for regression was significantly different from zero, $F(8, 26)=2.73$, $p_H<.025$. Only DGMRT-Voc contributed significantly to prediction of adolescent Spelling scores, explaining 14% of the outcome variability ($sr^2=.14$). HYP males with higher childhood Reading (Vocabulary) scores on the DGMRT-Voc obtained significantly higher WRAT-R Spelling scores in late adolescence. Altogether, 46% (29% adjusted) of the variability in WRAT-R Spelling scores was predicted by knowing the values on all 8 predictors.

Table 24 displays the findings for the WRAT-R Arithmetic subtest scores. The regression equation did not significantly predict WRAT-R Arithmetic subtest scores. The lgMRT was significantly correlated with outcome scores. However, its contribution to the equation, even when age was removed, was not sufficient to produce a significant prediction.

Table 25 displays the regression equation for prediction of PIAT-R Reading Comprehension scores. Due to the transformation of PIAT-R scores (reflect & square root), the r values have opposite signs and must be reversed before interpretation. R for regression was significantly different from zero, $F(8, 26)=5.78$, $p_H<.0167$. Only two predictors contributed significantly to prediction of Reading Comprehension scores, IQ ($sr^2=.11$) and lgMRT ($sr^2=.10$). Results suggested that males who, in childhood, had higher IQs and were more attentive scored significantly

Table 23
Standard Multiple Regression on Hyperactive Males' WRAT-R
 Spelling Scores

Predictors	B	β	sr^2 (unique)	r
DGMRT-Voc	6.515*	.54	.14	.55 _b
IQ	- 0.260	-.23	.03	.05
MED	1.836	.20	.03	.37 _a
STIMU	- 0.059	-.15	.02	-.23 _a
lgINC	12.614	.13	.01	.20
lgMRT	-14.488	-.11	.01	-.33
IO Factor	- 0.545	-.07	.00	.05
Age	- 0.059	-.06	.00	-.05
Intercept= 98.42				
			$R^2 = .46$	
			Adjusted $R^2 = .29$	
			$R = .68^*$	

* $p_H < .025$ $_a = p < .05$ $_b = p < .01$

DGMRT-Voc= difference scores of Gates MacGinitie Reading Test Vocabulary Grade; Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; lgMRT= log. of Mean Reaction Scores of CPT; IO Factor= Inattention/Overactivity Factor scores of IOWA; MED= mother's education; STIMU= number of months on stimulant medication.

Table 24
Standard Multiple Regression on Hyperactive Males' WRAT-R
Arithmetic Scores

Predictors	B	β	sr^2 (unique)	r
Regression equation non-significant at $p_H < .05$				
lgMRT				-.40 ^a
lgINC				.31
IQ				.29
MED				.28
DMAT-Math				.27
Age				.12
IO Factor				.07
STIMU				.05

^a = $p < .05$

lgMRT= log. of Mean Reaction Scores of CPT; Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; MED= mother's education; DMAT-Math= Difference scores of Metropolitan Achievement Test Math. Grade; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

Table 25
Standard Multiple Regression on Hyperactive Males' Transformed
PIAT-R Reading Comprehension Scores

Predictors	B	β	sr^2 (unique)	r
IQ	-0.038*	-.40	.11	-.46 _b
lgMRT	5.409*	.51	.10	.56 _b
MED	-0.262	-.35	.08	-.35 _a
STIMU	-0.006	-.20	.03	-.20 _a
Age	-0.014	-.18	.01	-.21
IO Factor	0.028	.04	.00	.09
DGMRT-Voc	0.050	.05	.00	-.38 _a
lgINC	0.312	.04	.00	-.23 _a
Intercept= 2.11				
			$R^2 = .64$	
			Adjusted $R^2 = .53$	
			$R = .80^*$	

* $p_H < .0167$ $a = p < .05$ $b = p < .01$

Note: All signs of correlations (r) must be reversed before interpreting because PIAT-R scores transformed by reflect and square root procedures.

IQ= child's PPVT score; Age= child's age at referral; lgMRT= log. of Mean Reaction Scores of CPT; lgINC= log. of family income; MED= mother's education; DGMRT-Voc= Difference scores of Gates MacGinitie Reading Test Vocabulary Grade; IO Factor= Inattention/Overactivity Factor scores of IOWA; STIMU= number of months on stimulant medication.

higher on the Reading Comprehension subtest of the PIAT-R in late adolescence. Altogether, 64% (53% adjusted) of the variability in PIAT-R Reading Comprehension scores was predicted by knowing the values on all 8 predictors.

The highest grade completed in High School and the number of courses failed in High School were not significantly predicted by any of the selected intake measures or treatment measures. Results are presented in Tables 26 and 27.

4. Self-reports of Hostility/Aggressiveness which were assessed at outcome with the Total Hostility score of the BDHI were not significantly predicted by the selected childhood and treatment measures, including age at referral, IQ, lgINC, MED, MLW, the IOWA A and IO Factors, STIMU, PARTRAIN and BEHther. Results are presented in Table 28.

Table 26
Standard Multiple Regression on Hyperactive Males' Highest Grade Completed in High School

Predictors	B	β (unique)	sr^2	r
Regression equation non-significant at $p_H < .025$				
STIMU				.28
lgMRT				-.25
MED				.24
DGMRT-Voc				.16
IO Factor				.15
Age				.12
A Factor				-.12
IQ				.07
lgINC				.06
MLW				-.01

Age= child's age at referral; IQ= child's score on PPVT; lgINC= log. of family income; DGMRT-Voc= Difference scores of Gates MacGinitie Reading Test Vocabulary Grade; lgMRT= log. of mean reaction time on CPT; IO Factor= Inattention/Overactivity Factor scores of IOWA; A Factor= Aggressiveness Factor scores of IOWA; MED= mother's education; MLW= mother's Locke-Wallace; STIMU= number of months on stimulant medication.

Table 27
Standard Multiple Regression on Hyperactive Males' Number of
Courses Failed in High School

Predictors	B	β	sr^2 (unique)	r
Regression equation non-significant at $p_H < .05$				
Age				.40 ^a
lgMRT				-.26 ^a
IQ				-.22
A Factor				.21
lgINC				.20
STIMU				-.15
MED				.09
IO Factor				-.02
MLW				-.01
DGMRT-Voc				.004

^a = $p < .05$

Age= child's age at referral; IQ= child's score on PPVT; lgINC= log. of family income; DGMRT-Voc= Difference scores of Gates MacGinitie Reading Test Vocabulary Grade; lgMRT= log. of mean reaction time on CPT; IO Factor= Inattention/Overactivity Factor scores of IOWA; A Factor= Aggressiveness Factor scores of IOWA; MED= mother's education; MLW= mother's Locke-Wallace; STIMU= number of months on stimulant medication.

Table 28
Standard Multiple Regression on Hyperactive Males' Total
Hostility/Aggressiveness Score

Predictors	B	β	sr^2 (unique)	r
Regression equation non-significant at $p_H < .05$				
A Factor				-.26
BEHther				.21
lgINC				.13
IO Factor				-.08
MED				-.07
IQ				-.05
Age				.03
MLW				-.03
STIMU				.02
PARTRAIN				.003

Age= child's age at referral; IQ= child's PPVT score; lgINC= log. of family income; A Factor= Aggressiveness Factor scores of IOWA; IO Factor= Inattention/Overactivity Factor scores of IOWA; MED= mother's education; MLW= mother's Locke-Wallace Marital Adjustment Scale Scores; STIMU= number of months on stimulant medication; PARTRAIN= number of sessions of parent-training; BEHther= number of sessions of individual or family therapy for behaviour problems.

DISCUSSION

The present research was conducted to investigate the long-term development of hyperactive children followed from childhood to late adolescence/early adulthood, and to compare their psychiatric, cognitive, and academic outcome with that of a matched normal control group. The study also examined the prognostic utility of subtyping hyperactive children into aggressive and non-aggressive youngsters. These analyses addressed what few investigators in the literature have examined, that is the possible confounding role of aggressiveness in the adolescent/adult outcome of hyperactive children (Lilienfeld & Waldman, 1990). Finally, the study examined the degree to which certain childhood and early family characteristics, as well as treatment variables would predict the adolescent/adult outcomes of hyperactive children.

The results of the study provided support for greater incidence of psychiatric and academic problems in the hyperactive group relative to the normal control group. Findings also lent support for the childhood subgrouping of hyperactive subjects into HO and HA subgroups. Some important distinctions were made between the subgroups in terms of treatment history, and adolescent psychiatric functioning and school performance 12 years after subjects were categorized. The hypotheses that hyperactive subjects would display significantly more cognitive deficits and report more hostility/aggressiveness in adolescence

were not confirmed in the present study. A discussion of the implications of these results as well as a critique of the instruments used will be presented. Prediction results suggested that few single childhood variables could predict adolescent measures. However, academic and cognitive measures in adolescence were generally successfully predicted by similar childhood measures.

Demographic and Treatment Variables

Not surprisingly, the hyperactive and control groups were not equal on IQ at follow-up. The present findings confirmed previous reports that stated that hyperactive subjects generally do more poorly on intellectual assessments than normal control subjects (Barkley et al., 1990). A number of factors may account for these group differences including test-taking behaviour (e.g., lack of motivation, inattention), coexisting learning disabilities in a small percentage of subjects and actual differences in intelligence (Barkley, 1990). Because of the group differences, IQ was statistically controlled in the analyses.

The analyses of treatment variables indicated that the hyperactive subjects received significantly more treatment for behaviour problems. The fact that the groups did not significantly differ on other forms of treatment suggests that the youngsters and their families viewed behaviour problems as the most disturbing coexisting feature of the disorder. In fact,

hyperactive subjects with high levels of childhood aggressiveness (HA) had received significantly more sessions of individual therapy for behaviour problems than the HO or control groups. Moreover, significantly more HA subjects relative to the control subjects had received residential placement which is often requested in extreme cases of behaviour problems.

Psychiatric Diagnoses

1. Subject-Parent Agreement on Psychiatric Diagnoses:

As indicated earlier, subject/parent agreement in the present study was generally good for most diagnoses (mean=89%) except ADHD at follow-up and any time since age 13 years. Mannuzza and Gittelman (1986), who reported percentage agreement for diagnoses at follow-up only, reported similar agreement for all diagnoses except ADHD. Their rate of agreement for ADHD at follow-up was higher than the one found in the present study (74% vs. 56%). Verhulst and van der Ende (1992) also reported a low correlation (.48) between self-reports of 15-19-year-old males and their parents on the Attention Problem scores of the Child Behavior Checklist (Achenbach & Edelbrock, 1983). This is not surprising because subjects and their parents may find ADHD behaviours difficult to evaluate given that inattention and impulsiveness are often subtle and difficult to distinguish from other problems such as a lack of motivation or oppositional behaviour. Family exchanges, especially between teenagers and their parents, may not provide a forum where inattention and

impulsiveness can be adequately evaluated or where consensus as to their presence is achievable. These behaviours may be more evident in school or at work. Some parents or offspring may also downplay the hyperactive behaviours because some conduct problems appear more salient. The higher subject/parent agreement for CD/APD and SUD suggest that these disorders are more visible or clearly defined for parents and their adolescents. Finally, these reliability findings shed some light on parent-offspring agreement but they do not illustrate the accuracy of reporting or the validity of the reports (Mannuzza & Gittelman, 1986). Establishing the accuracy of these reports with other measures or informants may provide some indices of the validity.

2. Group Differences on Psychiatric Diagnoses:

As hypothesized, findings suggested that hyperactive children were at increased risk for ADHD, CD/APD, Drug Use Disorders, and dual diagnoses of CD/APD and SUD during adolescence, particularly during their early- to mid-teens. Contrary to expectations, proband subjects did not demonstrate more Alcohol Use Disorders than control subjects.

The rates of ADHD in the hyperactive group were consistent with those reported by others (Barkley et al., 1990; Gittelman et al., 1985). Findings suggested that the syndrome of ADDH/ADHD as defined by DSM-III/DSM-III-R criteria was stable until early to mid-adolescence in approximately 2/3 to 3/4 of cases diagnosed in childhood. By late adolescence, the present hyperactive group

still had significantly more ADHD than the control group but only half of the original sample of recruited male subjects were still diagnosed as ADHD. Gittelman et al. (1985) and Mannuzza et al. (1991) found rates of 40-43% of ADDH (DSM-III) at follow-up in same-age samples. Although the combined findings would suggest that 50-60% of hyperactive children outgrow their disorder by late adolescence, rates of ADPD at follow-up may be somewhat underestimated given that most hyperactive subjects have received some form of treatment for their hyperactivity and because the DSM-III-R criteria may be too strict to diagnose ADHD in adolescence (Barkley et al., 1990). When the usual criterion of 2 standard deviations above the mean was used by Barkley et al. (1990) to classify a young adolescent sample as ADHD, a cutoff of 6 rather than 8 of 14 DSM-III-R criteria was required. This suggested that the present 8 criteria cutoff recommended in DSM-III-R would likely produce many false negatives at the adolescent level. The results in the present study might thus be viewed as a conservative estimate of persistent ADHD.

The prevalence of CD/APD in adolescence was significantly higher in the hyperactive group (42%) relative to the normal control group (14%) by a factor of 3. The rates were comparable with those reported by Barkley et al. (1990) and those found by Gittelman et al. (1985). By late adolescence, group differences between the present hyperactive and control groups in the prevalence of CD/APD were no longer significant.

Gittelman et al. (1985) and Mannuzza et al. (1991) also reported a drop in their rates of CD/APD by late adolescence but group rates remained 2-3 times higher than those in the present study, and relative to control subjects, their hyperactive subjects continued to display significantly more CD/APD at follow-up. It is possible that the use of different diagnostic criteria (DSM-III/DSM-III-R) across studies would account for some of these variations. Moreover, the present study may have used more strict diagnostic criteria than Gittelman et al. (1985) and Mannuzza et al. (1991) by not including what these researchers termed "probable" diagnoses in addition to "definite" (meeting all DSM-III-R criteria) diagnoses in the rates. It is also likely that different levels of aggressiveness in the hyperactive samples, at intake, would account for the variations. Although it is unclear how much aggressiveness/CD was present initially in the Gittelman et al. (1985) sample, in the present investigation, only 17% (9/52 subjects) of the sample met the cutoff score for the A Factor. The low rate of aggressiveness at intake could account for the low rates of CD/APD in the present follow-up. In fact, the subgroup analyses suggested that childhood aggressiveness does play an important role in the presence of CD/APD in adolescence. Only the HA group had significantly more CD/APD than the normal control group at some time during adolescence. As many as 56% of this aggressive group received this diagnosis. Subjects with hyperactivity only

in childhood (HO) had a rate of CD/APD (38%) in between that of the HA and that of the control (14%) groups, and did not differ from either group. This would suggest that aggressiveness in childhood is a primary factor in the development of antisocial behaviour in hyperactive subjects.

The prevalence of Drug Use Disorders in adolescence was significantly higher in the hyperactive sample than in the control sample but rates of Alcohol Use Disorders were not significantly different for the two groups. By late adolescence, the hyperactive group as a whole no longer had significantly more Drug Use Disorders than the control group. At that point, only the HA subjects had significantly more Drug Use Disorders than the HO and control groups. Therefore, hyperactive children may have been at greater risk than control subjects for Drug Use Disorders in early to mid-adolescence, but only hyperactive children who were significantly aggressive in childhood (HA) displayed persistent Drug Use Disorders in late adolescence.

These findings brought some clarity to past research which failed to use a diagnostic system to assess the substance use problems and which produced discrepant results (Barkley et al., 1990; Blouin et al., 1978; Hechtman, Weiss, & Perlman, 1984). The present findings were consistent with those of other researchers who used DSM-III criteria and who also reported significantly more Drug Use Disorders in their hyperactive samples relative to normal control samples and no significant

group differences on Alcohol Use Disorders (Gittelman et al., 1985; Mannuzza et al., 1990). However, these latter studies and the present one differ on two points. First, their rates of Alcohol Use Disorders were considerably lower than the present one. The criteria for Alcohol Abuse in DSM-III criteria, which were used by the Gittelman and Mannuzza group, were less lenient than those introduced by DSM-III-R: "Recurrent use of alcohol in situations in which use is physically hazardous" is now sufficient to diagnose Alcohol Abuse (if duration criterion is met also). The repeated drinking and driving which was reported in the present study resulted in a considerable number of Alcohol Abuse cases, increasing the overall rate of Alcohol Use Disorders. Secondly, unlike the present findings, Gittelman et al. (1985) and Mannuzza et al. (1990) found that the hyperactive group, as a whole, continued to have significantly more Drug Use Disorders than the control group in late adolescence. These researchers did not attempt to disentangle the possible confounding role of childhood aggressiveness in the relation between hyperactivity and adolescent Drug Use Disorders. It is possible that children who later received a diagnosis of Drug Use Disorder in those studies were also more likely to be aggressive in childhood, as was the case in the present study. If the number of HA subjects was large enough, it may explain their significant group findings in late adolescence.

The role of childhood aggressiveness in the development of

comorbidity in adolescence was also explored. Comorbidity was examined only for the time period "any time since age 13" because by late adolescence, group differences for CD/APD/SUD were no longer significant. The HA subgroup had a significantly greater chance of having a dual diagnosis of CD/APD and SUD than the control group, by a factor of 4.5. The HO group had at least twice as much CD/APD/SUD than the control group but this difference did not reach significance. Therefore, for hyperactive subjects, being aggressive in childhood significantly increased their chances of developing concurrent CD/APD and SUD in adolescence.

Diagnoses were also examined concurrently in adolescence (age 13 to follow-up) to search for patterns of diagnostic clustering. A diagnosis of CD/APD alone (without ADHD) in adolescence was significantly related to a higher occurrence of SUD (67% co-occurrence). When both CD/APD and ADHD were present, the chances of having a concurrent diagnosis of SUD increased to a significant 90%. However, ADHD alone in adolescence was not significantly related to having SUD (only 22% of cases). These patterns of comorbidity suggested that the chances of receiving a diagnosis of SUD in adolescence increased substantially with the additive effects of having concurrent diagnoses of CD/APD and ADHD.

No significant group differences were found between the hyperactive and control groups on diagnoses of Mood, Anxiety, and

Thought Disorders. Although rates of Anxiety and Mood Disorders were different across studies, as a result of different diagnostic systems (DSM-III vs. DSM-III-R) or different groupings of behaviours, other researchers (Gittelman et al., 1985; Mannuzza et al., 1991) also failed to find group differences on these disorders. Therefore, there is considerable specificity in the type of psychiatric outcome that hyperactive subjects are likely to experience as they mature into late adolescence (Gittelman et al., 1985).

In summary, findings generally indicated few significant group differences in psychiatric disorders in late-adolescence. However, hyperactivity persisted throughout adolescence in at least half of a population of male subjects who were diagnosed as ADDH a dozen years previously. These rates would probably be higher if DSM-III-R criteria were adjusted for an adolescent population. The significant relationship between childhood hyperactivity and adolescent CD/APD and SUD may be attributable to a minority of HA subjects within the hyperactive group. Only the HA group had significantly more CD/APD and comorbidity (CD/APD and SUD) than the control group in early- to mid-adolescence and significantly more Drug Use Disorders than the HO and control groups in late adolescence. As suggested by Lillienfeld and Waldman (1990), HA children may have an increased tendency to engage in stimulus-seeking activities that are immediately rewarding, and may have a decreased fear of the

possible consequences of these activities. On the other hand, the HO group was more similar to the control group on psychiatric variables, except for their significantly higher rates of ADHD which persisted throughout adolescence. During adolescence, some disorders seemed to cluster in the hyperactive sample. Diagnoses of CD/APD with or without concurrent ADHD were significantly associated with SUD. However, ADHD alone in adolescence was not significantly associated with either CD/APD or SUD. Therefore, even in adolescence, the link between hyperactivity and SUD continued to be through the mediating effects of CD/APD.

Group Differences on Cognitive Variables

Contrary to the hypotheses, the hyperactive subjects did not display significantly more inattention or impulsiveness than the control group as measured by their performance on the Delay, Vigilance or Distractibility tasks of the GDS. Subgroup comparisons between the HA, HO and control groups also yielded non-significant findings. Small sample size in the subgroup comparisons decreased the chances of finding significant differences. Moreover, results on the GDS were equivocal because ceiling effects were observed on all three tasks. Even when the parameters were lengthened to 12 minutes to increase task difficulty, as recommended by Fischer et al. (1990), hyperactive and control subjects who reached late adolescence (mean age 19 years) found the tasks too easy. Although no other researchers used the GDS with hyperactive subjects who have reached late

adolescence, recent research findings have not consistently revealed significant group differences between hyperactive and control children/adolescents using the GDS tasks (Fischer et al., 1990; Loge, Staton, & Beatty, 1990; Rynard, Firestone, Leiken, Pisterman, & Simeon, 1992). These discrepancies can be explained by two factors: (1) the GDS may not provide a sensitive measure of sustained-attention as defined by Fisk and Schneider (1981); (2) measures of impulsiveness on the GDS may be too heterogeneous and may require subtyping into 2 separate components.

Although sustained attention has been empirically defined as the maintenance of attention over time (Sergeant & van der Meere, 1990), and deficits in sustained attention have commonly been assessed through patterns of errors of omission on a CPT (including deterioration of performance over time), not all CPT tasks may provide accurate measures of sustained attention. According to Fisk and Schneider's (1981) research, sustained attention means the maintenance of controlled processing, as opposed to automatic processing, over time. Researchers have demonstrated that deficits of sustained attention occurred mainly when controlled processing was required (Borcherding et al., 1988; Fisk & Schneider, 1981). If the same target is presented over time, as is the case with the GDS Vigilance and Distractibility tasks (e.g., 1/9), a practice effect may occur, resulting in greater demands made on automatic processing than on controlled processing. The present findings suggested that

hyperactive subjects who have reached late adolescence were as skilled as control subjects in maintaining their attention when automatic processing was necessary to succeed. Had they been tested on a task which required more controlled processing, group differences may have emerged. In fact, the behavioural responses of hyperactive children to situational factors, including environmental manipulations (e.g., rewards) do suggest an effort-related cognitive problem (Borcherding et al., 1988). By continuously varying the target on a CPT, as would be the case if subjects were asked to respond to a target which constitutes any number or letter repetition (e.g., RR, PP, 44), subjects may be faced with a greater challenge because more demands would be made on controlled processing (Sergeant & van der Meere, 1990). This area needs to be explored with both young and mature hyperactive samples.

Recently, researchers have suggested that errors of commission on the CPT, which have been regarded as unitary measures of impulsiveness, may be measuring different underlying processes (Halperin et al., 1988; Sergeant & van der Meere, 1990). In a study involving non-referred school children, Halperin et al. (1988) identified at least two types of errors of commission on a CPT. The first type of errors had fast reaction times and were correlated with teacher ratings of impulsiveness, hyperactivity and conduct problems. The second type of commission errors had long reaction times and correlated with

teacher ratings of inattention. Unfortunately, a finer analysis of errors of commission was not possible in the present study because the number of commission errors was too low and reaction times were not available on the GDS to confirm the impulsive or inattentive nature of the errors. A task which assesses controlled processing abilities and which provides information on omission errors, and different types of commission errors as well as mean reaction times may be necessary to perform a thorough assessment of sustained attention and impulsiveness in hyperactive samples. A focus on effort-related variables such as affect, arousal, self-regulation and motivation may also be necessary to identify the psychological processes that may result in effortful deficits (Borcherding et al., 1988).

Future investigations will also need to compare more homogeneous groups of hyperactive subjects because the frequency of each type of commission errors may vary with the sample characteristics. For example, researchers found that the second type of commission errors, which reflected more inattention, were more prevalent among learning disabled subjects than matched control subjects (Beale, Matthew, Oliver, & Corballis, 1987; Kupietz, 1990). Similarly, HO subjects, who are often characterized as more inattentive and more at risk for learning disabilities (Lilienfeld & Waldman, 1990) may also display more commission errors reflecting inattention. On the other hand, HA subjects may commit more impulsive errors of commission given

that these errors correlated more with impulsiveness and conduct problems. Variations in the sample composition would likely result in different results on a CPT. This would explain the variable results found on the CPT across studies and points to the need to conduct finer analyses of subgroups of hyperactive subjects to determine more specifically the deficits of ADHD.

Group Differences on Academic/School Variables

Results on the WRAT-R and PIAT-R subtests confirmed the hypotheses that hyperactive males would have significantly lower spelling, arithmetic and reading comprehension abilities than normal control males. These hypotheses held true even when IQ was covaried. This suggests that group differences cannot be explained entirely by differences in intelligence level. The achievement deficits may be related to a long history of attention impairments (Douglas, 1980). Prediction findings in the present study seemed to support this assumption. Greater childhood inattention was significantly predictive of poorer performance on the reading comprehension subtests in adolescence. The off-task behaviour commonly seen in hyperactive subjects from preschool age (Campbell, Szumowski, Ewing, Gluck, & Breau, 1982; Schleifer et al., 1975) to early adolescence (Fischer et al., 1990), as well as the oppositional nature of more than half of hyperactive children (Hinshaw, 1987) may also interfere with the child's ability and willingness to do academic work, leading to negative interactions with teachers and to academic

underachievement. Academic achievement scores in the hyperactive group were in the Low Average to Average range. Ceiling effects were observed for some of the hyperactive and control subjects on the Reading Comprehension subtest of the PIAT-R (especially control subjects) which could have attenuated the group differences on this measure. Group differences between the hyperactive and control groups on the 3 subtests were generally less than 1 standard deviation, suggesting that the deficits in the hyperactive group were significant but not considerable. Other researchers also found similar results on WRAT/WRAT-R tests with younger hyperactive adolescent populations (Blouin et al, 1978; Fischer et al., 1990) and group differences were comparable to those in the current study (Fischer et al., 1990).

In the present study, no significant subgroup differences were found between the HA, HO and control groups on these subtests. Small sample sizes may have decreased statistical power necessary to find group differences. The reading problems which were prominent in a 2-year follow-up of 9-year-old HA subjects in the McGee et al. (1984b) study were not observed in the present HA group who had reached late adolescence. Therefore, the contention that aggressiveness is associated with specific reading retardation (Graham, 1978; McGee et al., 1984b) was not supported, at least not on a long-term basis. The association between aggressive/antisocial behaviour and learning disabilities which has been reported by others as well (e.g.,

Brickman, McNamus, Grapentine, & Alessi, 1984) may be attributable to the low IQ, low SES and/or low motivation which are frequently characteristic of children with aggressive conduct problems (August & Garfinkel, 1989). In the present study, subgroup differences on IQ and SES were not significant; therefore, they did not produce a bias in the academic achievement results.

As predicted, hyperactive subjects also experienced significantly more problems in High School as evidenced by the lower number of High School grades completed, the greater number of subjects who failed High School courses and of those who failed, the greater number of courses failed, the larger number of subjects who received special services in High School and the smaller number of subjects who had ever attended post-secondary school in comparison with the control group. Past research with younger and same-age hyperactive subjects also found that relative to the control group, hyperactive subjects failed more courses (Weiss et al., 1979) and grades (Fischer et al, 1990; Weiss et al., 1971), more of them quit school and they had more suspensions and expulsions (Fischer et al, 1990). In the present study, the hyperactive group lagged behind the control group in the number of completed High School grades by 1 year. This delay may partially explain why, in comparison with the control group, fewer hyperactive subjects had ever attended post-secondary school. Given that a number of students were still in school,

some of these hyperactive subjects may eventually catch up in their education. Subjects would have to be re-assessed later in life to clarify this issue. However, given that 44% of the hyperactive group needed special services in High School, it is possible that the lack of similar services in the present post-secondary schools would deter a number of subjects from completing a college or university degree.

Subgroup findings suggested that HO subjects were at a significantly greater risk than control subjects for failing more courses in High School. They failed approximately 3 times more courses than the control group. This may be due to greater levels of inattention typically found in HO children relative to other hyperactive or same-age peers (August et al., 1983; McGee et al., 1984b) or to the high rates of learning problems in HO samples (August & Garfinkel, 1989; August & Stewart, 1983). Both the HA and HO subjects had a greater chance than the control group of being placed in a resource or special education class some time in High School. Approximately half of all HA and HO subjects received some of these special services at some time in High School, whereas only 2% of the control group received these services. The similarity between the HA and HO subgroups on this High School variable suggests that both groups were at risk for long-term academic problems that required some form of remediation in adolescence. Significant childhood hyperactivity may be the most important common denominator explaining the

history of academic problems in the two groups.

Group Differences on Self-Reports of Hostility/Aggressiveness

The hyperactive group, and the HA and HO subgroups did not report significantly more hostility/aggressiveness than the normal control group. All groups had total scores below the recommended cutoff of 38 (Buss & Durkee, 1957). These findings suggest that the hyperactive group does not feel more hostile/aggressive in late adolescence or that they are more hostile/aggressive but do not perceive themselves as such. Based on teacher reports, Weiss et al. (1971) found that hyperactive subjects who had reached early adolescence were significantly more aggressive than a normal control group. Parents of HA children have also reported significantly more aggressiveness in these children when they reached early adolescence (August et al., 1983; Langhorne & Loney, 1979). Long-term follow-ups involving older hyperactive subjects have used self-reports of hostile/aggressive behaviour. These studies found that hyperactive subjects who reached late adolescence (Weiss et al., 1979) and adulthood (Weiss et al., 1985) did not report more hostility or physical or verbal aggressiveness in themselves than did normal control subjects. No known study has used both self-reports and parental or teacher ratings to assess hostility/aggressiveness in hyperactive subjects who were followed up into late adolescence or adulthood. Teacher ratings are rarely used in late adolescent populations because a number

of subjects have left/finished school, rendering teacher ratings unreliable or simply unavailable. At this time, self-report findings from hyperactive adolescents and adults suggest that hostility/aggressiveness decreases by late adolescence. It is possible that overt signs of aggressiveness (e.g., fighting), as seen in younger populations of HA children, do decrease with time. Even the hyperactive group that was once perceived as aggressive (HA) did not perceive itself as more hostile/aggressive at follow-up. Although aggressive individuals may lack the insight necessary to recognize their aggressive characteristics, their self-reports were partially validated by the considerable decreases in CD/APD between the mean ages of 13-19 years in both the overall hyperactive group and the HA subgroup. Although CD/APD does not always imply aggressiveness, it does include a number of items referring to aggressiveness. Given that the diagnoses of CD/APD were counted as present if the parents reported them, they offer some validation support to the self-reports of hostility/aggressiveness.

Predictive Analyses

Predictors consisted of intake measures derived from a multitude of sources, including teacher ratings (IO, A Factors), parent self-ratings (MLW), parent interviews (lgINC, MED, STIMU, PARTRAIN, BEHther), and objective child measures (IQ, lgMRT, DGMRT-Voc, DMAT-Math). Given that adolescent outcome measures have generally been found to interact with a combination of

child, family, and treatment variables, an interactional model was adopted in choosing the predictors. The results will be presented by the following categories of outcome measures: Psychiatric diagnoses received any time since age 13 years, cognitive functioning, academic functioning, and self-reports of hostility/aggressiveness. Given the correlational nature of the predictions, the relationships between the intake and treatment variables and the outcome variables are not seen as causal in nature. Moreover, given that the subjects-to-predictors ratio was low for most predictions (approximately 4:1), these findings must be considered as tentative.

1. Psychiatric Diagnoses:

The hypotheses which stated that a higher childhood IQ, more favourable familial conditions and less childhood aggression would predict better outcome for most psychiatric outcomes were not supported. Only 2 intake variables were found to have some discriminating power in accounting for psychiatric outcome: Child's age and therapy for behaviour problems (BEHther).

Subjects with and without diagnoses of CD/APD/SUD and Alcohol Use Disorders in adolescence were successfully distinguished from subjects without these diagnoses based on their age at intake and the number of therapy sessions they had received for behaviour problems. In fact, correct classification for these diagnoses was 88% for both diagnoses. Children who were older at intake had significantly more CD/APD/SUD and

Alcohol Use Disorders in adolescence. This predictor may be an artifact because children who were older at referral were also older at follow-up and more likely to have reached the high risk period of developing these disorders. If all subjects had been followed up to the same age, age may not have been a significant predictor.

The association between the number of sessions of therapy for behavioural problems and diagnoses of CD/APD/SUD and Alcohol Use Disorders may be due to the fact that families who experienced greater difficulties with their youngsters in these areas were more likely to seek professional help. This also provides evidence of how intractable some childhood behaviour problems are, and how difficult it is to change them even through prolonged therapy.

Membership in 3/5 diagnostic categories, ADHD, CD/APD, and Drug Use Disorders could not be predicted. Given that a number of hyperactive subjects who did not receive the diagnosis in adolescence probably still had some residues of hyperactive behaviours, the group differentiation may have been insufficient to yield significant predictors of diagnoses of ADHD. In addition, the lack of variance in the intake measures, particularly childhood hyperactivity variables, may have reduced the statistical power of the analysis because all subjects were diagnosed as ADDH in childhood. Similarly, in a 10-year follow-up, Mannuzza et al. (1990) were unsuccessful in finding intake

variables that would differentiate subjects with ADHD only at follow-up from a no disorder group and from a group with CD/APD (with/without SUD).

Successful prediction of ADHD in adolescence, and possibly of CD/APD and Drug Use Disorders as well, may require that another non-hyperactive clinical group or normal control group be followed-up simultaneously with the hyperactive group and that intake variables for the combined group be examined as predictors of these diagnoses at follow-up. This would produce greater variance in the intake variables and also increase sample size which would result in greater statistical power. Loney et al. (1981) found that predicting specific hyperactive and antisocial behaviours, as opposed to diagnoses, yielded significant predictors. However, given that individual behaviours do not imply functional impairment, the clinical significance of these predictions is difficult to establish.

Loney et al. (1981) emphasized the role of aggressiveness in predicting adolescent outcome, including hyperactive behaviour, antisocial behaviour and substance use. The importance of childhood aggressiveness, as a single predictor, was not confirmed in the present investigation. This may seem contradictory with the finding that HA subjects were found to have the most problems in the psychiatric realm. However, unlike the group comparisons (HA, HO, control groups) which considered patterns of problems, the linear regression model only focused on

single problem indicators (e.g., aggressiveness) (Magnusson & Bergman, 1990). The presence of strong interactions between a particular variable under study (e.g., aggressiveness) and other variables entered into the linear regression models may cloud the results (Magnusson & Bergman, 1990). For example, childhood aggression alone may not lead to adolescent maladjustment but when combined with high levels of hyperactivity, or with a low SES level, may lead to considerable maladjustment. Variable-oriented research should not be abandoned because it does yield valuable information on how variability in the predictor (e.g., level of severity) affects the outcome measure, but it needs to be complemented with research in which people (e.g., HA subjects) are the main unit of analysis (Magnusson & Bergman, 1990). In the present study, aggressiveness had little predictive power on its own, however, a high level of aggressiveness played an important role when combined with significant levels of hyperactivity, as indicated by the subgroup findings in the psychiatric domain.

Unlike Loney et al.'s (1983) results, childhood IQ was not a significant predictor of psychiatric diagnoses in the present study. Given that Loney et al. (1983) adopted a lower cutoff score for IQ as an inclusion criterion at intake than the one used in the present study (70 and 80, respectively), their greater range of IQ scores may have increased their chances of finding significant results with that variable.

Overall, predictions of psychiatric outcome variables have not confirmed previous studies that attempted to predict discrete behavioural indicators of outcome (Hechtman, Weiss, Perlman, & Amsel, 1984; Loney et al., 1983). However, the present difficulties in finding meaningful predictors of psychiatric diagnoses were comparable in other studies that also attempted to predict the diagnostic group membership of hyperactive adolescents (Loney et al., 1983; Mannuzza et al., 1990). The lack of similar diagnostic measures in childhood may preclude successful predictions. The present findings suggest that as hyperactive subjects matured into adolescence, they became at greater risk for developing antisocial behaviours including substance use problems. Subjects who suffered from Alcohol Use Disorders or a combination of CD/APD and SUD in adolescence had received more professional help in childhood and adolescence to deal with behavioural problems. However, it is important to emphasize that the few significant single predictors explained less than one fifth of the outcome variability, leaving considerable room for other intervening factors in the development of psychiatric disorders.

Cognitive Variables:

Few longitudinal studies in hyperactivity have examined objective laboratory measures of inattention/distractibility and impulsiveness. It was hypothesized that childhood inattention would predict cognitive performance in adolescence. Cognitive

performance, as measured on the GDS, may lack definitional clarity, especially errors of commission which, because of ceiling effects, precluded a reliable separation of the impulsiveness/inattention components. However, the results suggested that adolescent impulsiveness/inattention (errors of commission on the Vigilance task) and distractibility (errors of omission on the Distractibility task) could be significantly predicted by childhood inattention, as measured in the laboratory (mean reaction time) or as rated by elementary school teachers (IO Factor). However, age at intake appeared as useful in predicting adolescent impulsiveness/inattention as the laboratory measure of childhood inattention and because it is simpler to assess than the latter, it may be a more economical predictor of adolescent impulsiveness/inattention. On the other hand, the level of adolescent distractibility seemed independent of age effects but was successfully predicted by the laboratory measure of childhood inattention. Therefore, age, and inattention, as measured in the laboratory and as rated by teachers remained the best predictors of adolescent cognitive performance. Unlike Loney et al.'s (1981) findings, childhood aggressiveness was not a significant predictor of adolescent inattention, impulsiveness, or distractibility when laboratory measures were used at follow-up.

Only 12-29% of the outcome variance of the adolescent cognitive measures was explained by the significant childhood

predictors (age, mean reaction time, teacher ratings). The results suggest that other variables not yet identified also affected the cognitive processes of hyperactive children as they matured. Taking into account the 12 years that elapsed since intake, the low percentages probably reflected both cognitive changes which occurred as the subjects matured and differences in the measures used at each time period. Overall, these findings, although preliminary, support the speculation that ADHD behaviours are stable from childhood to late adolescence in a significant number of hyperactive children, and they suggest that greater symptom severity (i.e., inattention) in childhood significantly predicted greater symptom severity in adolescence. However, due to small sample sizes, more research is needed to confirm these findings.

Academic variables:

The hypotheses that stated that childhood IQ, inattention, and academic scores would significantly predict academic performance were confirmed in the present investigation. However, contrary to predictions, familial variables assessed at intake were not predictive of any academic variables at outcome. This latter finding may reflect low variance in the family measures given that the sample was mainly composed of middle class families. The mostly demographic nature of the present family variables may also be limited in its scope. Future research could include more measures which assess family

dynamics.

As predicted, children who scored higher on a childhood reading task (DGMRT-Voc) also scored higher on the WRAT-R Spelling task at follow-up. Fourteen percent of the outcome variance was predicted by childhood scores. Childhood academic achievement scores did not predict any other academic variable measured at follow-up. Adolescent scores on the PIAT-R Reading Comprehension task were significantly predicted by childhood inattention (mean reaction time scores) as well as childhood IQ. The importance of IQ in predicting educational achievement has been shown by others (e.g., Hechtman, Weiss, Perlman, & Amsel, 1984). The Reading Comprehension task required some degree of attention because subjects had to read a verbal passage and remember it long enough to find a picture that described the passage. It also required a certain level of vocabulary as subjects advanced in the task. Therefore, it is not surprising that children who had better attention skills in childhood and who had a better reading vocabulary were at an advantage on the Reading Comprehension task in adolescence. The results are consistent with those of Hechtman, Weiss, Perlman, & Amsel (1984) who found that childhood hyperactive symptoms (i.e., inattention) had greater predictive power than measures of aggression for educational outcome variables. Loney et al. (1981) found that WRAT-R Reading scores were significantly predicted by the subject's early response to stimulant medication but that length

of treatment with stimulant medication was not predictive. In the present study, length of treatment with stimulants was also not predictive of follow-up scores on the WRAT-R Spelling, Arithmetic and PIAT-R Reading Comprehension scores.

Unlike previous research that found that the number of grades that hyperactive subjects had completed in High School was significantly predicted by childhood IQ, SES, antisocial behaviour, and certain child-rearing practices (Hechtman, Weiss, Perlman, & Amsel, 1984) or by childhood PIAT scores (Lambert, 1988), no intake variables could significantly predict this outcome variable in the present study. The number of failed courses in High School was also not significantly predicted by intake or treatment variables. No other study attempted to predict the number of courses failed, but Hechtman et al. (1984) reported that SES, childhood antisocial behaviour and child-rearing practices significantly predicted the number of grades failed. The latter problem is more serious and may be easier to predict than a more common phenomenon like failing courses.

Overall, academic findings suggest that hyperactive subjects with better childhood reading abilities, IQs and attention skills were likely to be more adept academically in adolescence. These findings underscore the importance of early diagnosis and treatment of ADHD and reading problems in the prevention of long-term academic problems. Family and treatment measures were not significant predictors of academic achievement. Educational

attainment and the passing of courses in High School were not predicted by intake measures which suggests that other factors, not addressed in the present study, may be involved (e.g., motivation, parental support).

Self-reports of Hostility/Aggressiveness:

The hypotheses which stated that childhood IQ and aggressiveness, and familial variables would predict self-reports of hostility/aggressiveness were not confirmed. Self-reports of hostility/aggressiveness in adolescence were not significantly predicted by the selected child or family intake variables or by treatment variables. Given that outcome scores were generally within the average range, the lack of self-reported pathology which produced low variability on this measure probably would account for the non-significant predictions. No other studies attempted to predict hostility or aggressiveness scores in hyperactive subjects followed-up to late adolescence.

Summary

Overall, findings revealed a more optimistic adolescent outcome for hyperactive children as a group than previously reported. As hypothesized, the hyperactive group was significantly more at risk for persistent ADHD, as well as for CD/APD, Drug Use Disorders and comorbidity between CD/APD and SUD at some time during adolescence, but by late adolescence, these group differences were all non-significant except for the

diagnosis of ADHD. However, by addressing the confounding role of childhood aggressiveness in the outcome of hyperactive children, it became apparent that a subset of hyperactive children who were also aggressive in childhood (HA) were at a significantly increased risk for subsequent antisocial behaviours. Although they did not perceive themselves as more hostile/aggressive than other hyperactive subjects in late adolescence, they displayed significantly more CD/APD, and comorbidity in early to mid-adolescence and in late adolescence, they were the only group that had persistent Drug Use Disorders.

Given that HA children were significantly more at risk for adolescent psychiatric problems, it is imperative that this subgroup be identified as early as possible and be the focus of intervention efforts which aim at diminishing the childhood aggressiveness and associated conduct problems. In contrast, children who were hyperactive only were not significantly different from control subjects in adolescence except for their persistent ADHD and their significantly greater number of failed courses in High School. These children may require more remedial help in the schools to deal with their academic problems.

Therefore, the association between childhood hyperactivity and adolescent antisocial behaviours, including substance overuse, may reflect the persistence of antisocial behaviour from childhood to adulthood in a high risk subgroup. Given that childhood aggressiveness alone, as rated by teachers, was not

sufficient to predict CD/APD and SUD, the interaction between aggressive and hyperactive behaviours may produce an even greater risk for later antisocial behaviours than the presence of either childhood disorder alone.

Academic problems were evident in the hyperactive group, and although the HO group had a significantly greater number of failed courses than the control group, the HA and HO groups did not significantly differ on any of these variables. Hyperactive subjects had significant deficits in spelling, arithmetic, and reading comprehension, and despite having received significantly more school services in High School, their scholastic delays and course failures suggested more problems in High School than matched control subjects.

Findings in the prediction analyses suggested that childhood reading problems, greater inattention and low IQ scores were significant precursors of some of the academic problems in adolescence. Course failures and educational attainment were not successfully predicted and may be related to other factors such as motivation.

The picture regarding the cognitive deficits of the hyperactive subjects in adolescence was not clear because of ceiling effects on the GDS. Greater childhood inattention was significantly predictive of adolescent distractibility and impulsiveness/inattention, supporting the assumption that core symptoms of hyperactivity are chronic in a significant number of

hyperactive children. Therefore, the negative effects of childhood inattention on the development of certain skills (e.g., academic achievement skills) may continue to plague a number of hyperactive adolescents in their school or work environments if attention skills are required. A more thorough assessment of hyperactivity in adolescence awaits the development of reliable, valid and age-appropriate diagnostic (DSM-III-R criteria) and assessment tools.

Limitations of the Current Study and Future Directions

This study has a few limitations that have implications for future long-term investigation in the area of hyperactivity. The first issue concerns the generalizability of the results. Due to attrition, 38% of probands could not be recruited at follow-up. These attrition rates were comparable to those of other studies that involved extensive in-lab testing. For example, Fischer et al. (1990) lost 37% of their sample in an 8-year follow-up, and Weiss et al. (1985) lost 41% of subjects in a 15-year follow-up. It is not possible to determine whether the non-recruited subjects may have differed from those recruited on follow-up measures. However, comparisons between the two groups on intake measures suggested that those lost to follow-up were fairly representative of the group as a whole.

Generalizability of results may also be affected by the exclusion of females from the analyses. However, their inclusion would have also affected generalizability of results to male

subjects because sex differences were noted on some of the outcome measures. The small number of females in the sample (13%) did not permit gender to be considered as a separate variable. Outcome findings may also be biased by the fact that most subjects had received some form of psychological or pharmacological treatment by the time they reached follow-up. Although this is not unusual in clinical samples (Barkley, 1990), it does introduce a confounding variable in the investigation of the natural development of hyperactive children. Therefore, the results in the present investigation may not be generalizable to female hyperactive subjects or to untreated hyperactive subjects.

Attrition, the exclusion of female subjects and a number of unclassifiable cases using the IOWA classification scheme produced small sample sizes for the HA, HO, control group comparisons and the predictions, which resulted in a reduction of statistical power. This may explain why few predictors of adolescent psychiatric outcome emerged from the analyses. Therefore, the predictions must be viewed as tentative and they await replication with larger sample sizes. On the other hand, despite the reduced chances of finding group differences between the HA, HO and control groups, some valuable distinctions were made between these groups, suggesting possible fruitful avenues of investigation for future follow-up studies with larger sample sizes. Additional specificity of the adolescent outcome of hyperactive children could be achieved by simultaneously

following matched children of other diagnostic categories (Weiss et al., 1985).

Finally, some measures used in the present investigation may lack some specificity in detecting group differences. For example, although standard DSM-III-R guidelines were used in the present investigation to allow some comparability with previous research, Barkley et al. (1990) found that these guidelines may need some adjustments to be used with adolescents. Therefore, conservative estimates of psychiatric disorders were presented. The GDS, which yielded non-significant group differences, may have presented an insufficient challenge for most subjects because automatic processing was well developed in both hyperactive and control subjects by late adolescence. Research that focuses on effortful or controlled processing and effort-related variables (e.g., arousal, motivation) may be more fruitful in the search for primary deficits in young and mature ADHD samples.

REFERENCES

- Achenbach, T. M., & Edelbrock, C. S. (1983). Manual for the Child Behaviour Checklist and Revised Child Behaviour Profile. Burlington VT: T. M. Achenbach.
- American Psychiatric Association (1968). Diagnostic and statistical manual of mental disorders, (2nd ed.). Washington, DC: Author.
- American Psychiatric Association (1980). Diagnostic and statistical manual of mental disorders, (3rd ed.). Washington, DC: Author.
- American Psychiatric Association (1987). Diagnostic and statistical manual of mental disorders, (3rd ed., rev.). Washington, DC: Author.
- August, G. J., & Garfinkel, B. D. (1989). Behavioral and cognitive subtypes of ADHD. Journal of the American Academy of Child and Adolescent Psychiatry, 28(5), 739-748.
- August, G. J., & Stewart, M. A. (1983). Familial subtypes of childhood hyperactivity. The Journal of Nervous and Mental Disease, 171(6), 362-368.
- August, G. J., Stewart, M. A., & Holmes, C. S. (1983). A four-year follow-up of hyperactive boys with and without conduct disorder. British Journal of Psychiatry, 143, 192-198.

- Barkley, R. A. (1987). Child behaviour rating scales and checklists. In M. Rutter, H. Tuma, & I. Lann (Eds.), Assessment and diagnosis in child psychopathology (pp. 113-155). New York: Guilford Press.
- Barkley, R. A. (1988). Attention Deficit Disorder with Hyperactivity. In E. J. Mash, & L. G. Terdal (Eds.), Behavioral assessment of childhood disorders, (2nd ed.) (pp. 69-104). New York: Guilford Press.
- Barkley, R. A. (1990). Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment. New York: The Guilford Press.
- Barkley, R. A., Copeland, A. P., & Sivage, C. (1980). A self-control classroom for hyperactive children. Journal of Autism and Developmental Disorders, 10, 75-89.
- Barkley, R. A., DuPaul, G. J., McMurray, M. B. (1990). Comprehensive evaluation of attention deficit disorder with and without hyperactivity as defined by research criteria. Journal of Consulting and Clinical Psychology, 58(6), 775-789.
- Barkley, R. A., Fischer, M., Edelbrock, C. S., & Smallish, L. (1990). The adolescent outcome of hyperactive children diagnosed by research criteria: I. An 8-year prospective follow-up study. Journal of the American Academy of Child and Adolescent Psychiatry, 29(4), 546-557.

- Barkley, R. A., Fischer, M., Edelbrock, C. S., & Smallish, L. (1991). The adolescent outcome of hyperactive children diagnosed by research criteria: III. Mother-child interactions, family conflicts, and maternal psychopathology. Journal of Child Psychology and Psychiatry, 32(2), 233-255.
- Barkley, R. A., Fischer, M., Newby, R. F., & Breen, M. J. (1988). Development of a multimethod clinical protocol for assessing stimulant drug response in children with attention deficit disorder. Journal of Clinical Child Psychology, 17, 14-24.
- Battle, E. S., & Lacey, B. (1972). A context for hyperactive children over time. Child Development, 43, 757-773.
- Beale, I. L., Matthew, P. J., Oliver, S., & Corballis, C. (1987). Performance of disabled and normal readers on the continuous performance test. Journal of Abnormal Child Psychology, 15, 229-238.
- Befera, M. S., & Barkley, R. A. (1985). Hyperactive and normal girls and boys: Mother-child interactions, parent psychiatric status, and child psychopathology. Journal of Child Psychology and Psychiatry, 26, 439-452.
- Berry, C. A., Shaywitz, S. E., & Shaywitz, B. A. (1985). Girls with attention deficit disorder: A silent minority? A report on behavioral and cognitive characteristics. Pediatrics, 76, 801-809.
- Biaggio, M. K. (1980). Assessment of anger arousal. Journal of Personality Assessment, 44(3), 289-298.

- Biaggio, M. K., Supplee, K., & Curtis, N. (1981). Reliability and validity of four anger scales. Journal of Personality Assessment, 45(6), 639-648.
- Blouin, A. G. A., Bornstein, R. A., & Trites, R. L. (1978). Teenage alcohol use among hyperactive children: A five year follow-up study. Journal of Pediatric Psychology, 3, 188-194.
- Bond, C. R., & McMahon, R. J. (1984). Relationships between maternal distress and child behaviour problems, maternal personal adjustment, maternal personality, and maternal parenting behaviour. Journal of Abnormal Psychology, 93, 348-351.
- Borcherding, B., Thompson, K., Kruesi, M., Bartko, J., Rapoport, J. L., & Weingartner, H. (1988). Automatic and effortful processing in attention deficit/hyperactivity disorder. Journal of Abnormal Child Psychology, 16(3), 333-345.
- Bosco, J. J. & Robin, S. S. (1980). Hyperkinesis: Prevalence and treatment. In C. K. Whalen & B. Henker (Eds.), Hyperactive children: The social ecology of identification and treatment (pp. 173-187). New York: Academic Press.
- Brickman, A. S., McNamus, M., Grapentine, W. L., & Alessi, N. (1984). Neuropsychological assessment of seriously delinquent adolescents. Journal of the American Academy of Child Psychiatry, 23, 453-457.

- Brody, G. H., & Forehand, R. (1986). Maternal perceptions of child maladjustment as a function of the combined influence of child behaviour and maternal depression. Journal of Consulting and Clinical Psychology, 54, 237-240.
- Brown, R. T., & Borden, K. A. (1986). Hyperactivity at adolescence: Some misconceptions and new directions. Journal of Clinical Child Psychology, 15, 194-209.
- Buss, D. M. (1981). Predicting parent-child interactions from children's activity level. Developmental Psychology, 17, 59-65.
- Buss, A. H., & Durkee, A. (1957). An inventory for assessing different kinds of hostility. Journal of Consulting Psychology, 21, 343-349.
- Buss, A. H., Fischer, H., & Simmons, A. J. (1962). Aggression and hostility in psychiatric patients. Journal of Consulting Psychology, 26, 84-89.
- Cairns, E., & Cammock, T. (1978). Development of a more reliable version of the Matching Familiar Figures Test. Developmental Psychology, 14, 555-560.
- Campbell, S. B., Breaux, A. M., Ewing, L. J., & Szumowski, E. K. (1986). Correlates and predictors of hyperactivity and aggression: A longitudinal study of parent-referred problem preschoolers. Journal of Abnormal Child Psychology, 14(2), 217-234.

- Campbell, S. B., & Ewing, L. J. (1990). Follow-up of hard-to-manage preschoolers: Adjustment at age 9 and predictors of continuing symptoms. Journal of Child Psychology and Psychiatry, 31(6), 871-889.
- Campbell, S. B., Szumowski, E. K., Ewing, L. J., Gluck, D. S., & Breaux, A. M. (1982). A multidimensional assessment of parent-identified behaviour problem toddlers. Journal of Abnormal Child Psychology, 10(4), 569-592.
- Clements, S. D., & Peters, J. E. (1962). Minimal brain dysfunction in the school-age child. Archives of General Psychiatry, 6, 185-197.
- Cohen, N. J., & Douglas, V. I. (1972). Characteristics of the orienting response in hyperactive and normal children. Psychophysiology, 9, 238-245.
- Conners, C. K. (1969). A teacher rating scale for use in drug studies with children. American Journal of Psychiatry, 126, 152-156.
- Conners, C. K. (1970). Symptom patterns in hyperkinetic, neurotic, and normal children. Child Development, 41, 667-682.
- Conners, C. K. (1973). Rating scales for use in drug studies with children. Psychopharmacology Bulletin: Special Issue, Pharmacotherapy with Children, 24-84.

- de Haas, P. A., & Young, R. D. (1984). Attention styles of hyperactive and normal girls. Journal of Abnormal Child Psychology, 12, 531-546.
- Douglas, V. I. (1972). Stop, look, and listen: The problem of sustained attention and impulse control in hyperactive and normal children. Canadian Journal of Behavioural Science, 4, 259-282.
- Douglas, V. I. (1980). Treatment and training approaches to hyperactivity: Establishing internal or external control. In: C. K. Whalen & B. Henker (Eds.), Hyperactive children (pp. 283-318). New York: Academic Press.
- Douglas, V. I. (1983). Attention and cognitive problems. In M. Rutter (Ed.), Developmental neuropsychiatry (pp. 280-329). New York: Guilford Press.
- Douglas, V. I. & Parry, P. A. (1983). Effects of reward on delayed reaction time task performance of hyperactive children. Journal of Abnormal Child Psychology, 11, 313-326.
- Draeger, S., Prior, M., & Sanson, A. (1986). Visual and auditory attention performance in hyperactive children: Competence or compliance. Journal of Abnormal Child Psychology, 14, 411-424.
- Dunn, L. M. (1965). Expanded manual for the Peabody Picture Vocabulary Test. Circle Pines, Minn.: American Guidance Service, Inc.

- Dunn, L. M., & Markwardt, F. C., Jr. (1970). Peabody Individual Achievement Test. Circle Pines, Minn.: American Guidance Service.
- Everitt, B. S. (1977). The analysis of contingency tables. London: Chapman & Hall.
- Firestone, P. (1982). Factors associated with children's adherence to stimulant medication. American Journal of Orthopsychiatry, 52(3), 447-456.
- Firestone, P., Crowe, D., Goodman, J. T., & McGrath, P. (1986). Vicissitudes of follow-up studies: differential effects of parent training and stimulant medication with hyperactives. American Journal of Orthopsychiatry, 56, 184-194.
- Firestone, P., & Douglas, V. I. (1975). The effects of reward and punishment on reaction times and automatic activity in hyperactive and normal children. Journal of Abnormal Child Psychology, 3, 201-216.
- Firestone, P., Kelly, M. J., Goodman, J. T., Davey, J. (1981). Differential effects of parent training and stimulant medication with hyperactives. Journal of the American Academy of Child Psychiatry, 20, 135-147.
- Firestone, P., & Martin, J. E. (1979). An analysis of the hyperactive syndrome: A comparison of hyperactive, behaviour problem, asthmatic, and normal children. Journal of Abnormal Child Psychology, 7, 261-273.

- Firestone, P., & Witt, J. E. (1982). Characteristics of families completing and prematurely discontinuing a behavioral parent-training program. Journal of Pediatric Psychology, 7(2), 209-222.
- Fischer, M., Barkley, R. A., Edelbrock, C. S., & Smallish, L. (1990). The adolescent outcome of hyperactive children diagnosed by research criteria: II. Academic, attentional, and neuropsychological status. Journal of Consulting and Clinical Psychology, 58(5), 580-588.
- Fisk, A. D., & Schneider, W. (1981). Control and automatic processing during tasks requiring sustained attention: A new approach to vigilance. Human Factors, 23, 737-750.
- Fleiss, J. L. (1981). Statistical methods for rates and proportions, (2nd ed.). New York: John Wiley and Sons.
- Fyer, A. J., Endicott, J., Mannuzza, S., & Klein, D. F. (1985). Schedule for Affective Disorders and Schizophrenia - Lifetime Version (Modified for the Study of Anxiety Disorders). New York: Anxiety Disorders Clinic, New York State Psychiatric Institute.
- Gittelman, R., & Mannuzza, S. (1979). Teenager Or Young Adult Schedule. Glen Oaks, New York: Child Development Clinic, Long Island Jewish-Hillside Medical Center.
- Gittelman, R., Mannuzza, S., Shenker, R., & Bonagura, N. (1985). Hyperactive boys almost grown up. I. Psychiatric status. Archives of General Psychiatry, 42, 937-947.

- Gordon, M. (1979). The assessment of impulsivity and mediating behaviors in hyperactive and non-hyperactive children. Journal of Abnormal Child Psychology, 7, 317-326.
- Gordon, M. (1982). The Gordon Diagnostic System. DeWitt, New York: Gordon Systems, Inc.
- Gordon, M. (1983). The Gordon Diagnostic System. Boulder, CO: Clinical Diagnostic Systems.
- Gordon, M., & Bilinski Mettelman, B. (1988). The assessment of attention: I. Standardization and reliability of a behaviour-based measure. Journal of Clinical Psychology, 44(5), 682-690.
- Gordon, M., McClure, F. D., & Post, E. M. (1986). Interpretive guide to the Gordon Diagnostic System. Syracuse: Gordon Systems, Inc.
- Goyette, C. H., Conners, C. K., & Ulrich, R. F. (1978). Normative data on revised Conners Parent and Teacher Rating Scales. Journal of Abnormal Child Psychology, 6, 221-236.
- Graham, P. H. (1978). Epidemiologic perspectives on maladaptation in children. Journal of the American Academy of Child Psychiatry, 17, 197-208.
- Guilford, J. P. (1954). Psychometric methods, (2nd ed.). New York: McGraw-Hill.

- Halperin, J. M., Wolf, L. E., Pascualvaca, D. M., Newcorn, J. H., Healey, J. M., O'Brien, J. E., Morganstein, A., & Young, J. G. (1988). Differential assessment of attention and impulsivity in children. Journal of the American Academy of Child and Adolescent Psychiatry, 27(3), 326-329.
- Hathaway, S. R., & McKinley, J. C. (1966). The Minnesota Multiphasic Personality Inventory. New York: The Psychological Corporation.
- Haynes, S. N., Follingstad, D. R., & Sullivan, J. C. (1979). Assessment of marital satisfaction and interaction. Journal of Consulting and Clinical Psychology, 47, 789-791.
- Hechtman, L., Weiss, G., & Perlman, T. (1984). Hyperactives as young adults: Past and current substance abuse and antisocial behaviour. American Journal of Orthopsychiatry, 54(3), 415-425.
- Hechtman, L., Weiss, G., Perlman, T., & Amsel, R. (1984). Hyperactives as young adults: Initial predictors of adult outcome. Journal of the American Academy of Child Psychiatry, 23, 250-260.
- Helzer, J. E., Robins, L. N., McEvoy, L. T., Spitznagel, E. L., Stoltzman, R. K., Farmer, A., & Brockington, I. F. (1985). A comparison of clinical and Diagnostic Interview Schedule diagnoses. Archives of General Psychiatry, 42, 657.

- Hinshaw, S. P. (1987). On the distinction between attentional deficits/hyperactivity and conduct problems/aggression in child psychopathology. Psychological Bulletin, 101, 443-463.
- Holland, B. S., & DiPonzio Copenhaver, M. (1988). Improved Bonferroni-type multiple testing procedures. Psychological Bulletin, 104(1), 145-149.
- Holley, J. W., & Guilford, J. P. (1984). A note on the G index of agreement. Educational and Psychological Measures, 32, 281-288.
- Hollingshead, A. B., & Redlich, F. C. (1958). Social class and mental illness: A community study. New York: John Wiley & Sons, Inc.
- Hopkins, J., Perlman, T., Hechtman, L., Weiss, G. (1979). Cognitive style in adults originally diagnosed as hyperactives. Journal of Child Psychology and Psychiatry, 20, 209-216.
- Horn, W. F., Wagner, A. E., & Ialongo, N. (1989). Sex differences in school-aged children with pervasive attention deficit hyperactivity disorder. Journal of Abnormal Child Psychology, 17, 109-125.
- Jastak, J. S., & Jastak, S. R. (1976). The Wide Range Achievement Test Manual. Wilmington: Guidance Associates.
- Jastak, S., & Wilkinson, G. S. (1984). The Wide Range Achievement Test - Revised Edition. Wilmington: Jastak Associates, Inc.

- Kagan, J. (1966). Reflection-impulsivity: The generality and dynamics of conceptual tempo. Journal of Abnormal Psychology, 71, 17-24.
- Kashani, J., Chapel, J. L., Ellis, J., & Shekim, W. D. (1979). Hyperactive girls. Journal of Operational Psychiatry, 10, 145-148.
- Kilian, J. B., & Hughes, L. C. (1978). A comparison of short forms of the Wechsler Intelligence Scale for Children-Revised in the screening of gifted referrals. Gifted Child Quarterly, 22, 111-115.
- Kimmel, D., & Van der Veen, F. (1974). Factors of marital adjustment in Locke's Marital Adjustment Test. Journal of Marriage and the Family, 36, 57-63.
- Kupietz, S. S. (1990). Sustained attention in normal and in reading disabled youngsters with and without ADDH. Journal of Abnormal Child Psychology, 18(4), 357-372.
- Lahey, B. B., Green, K. D., & Forehand, R. (1980). On the independence of ratings of hyperactivity, conduct problems, and attention deficits in children: A multiple regression analysis. Journal of Consulting and Clinical Psychology, 48, 566-574.

- Lambert, N. M. (1988). Adolescent outcomes for hyperactive children - Perspectives on general and specific patterns of childhood risk for adolescent educational, social, and mental health problems. American Psychologist, 43(10), 786-799.
- Lambert, N. M., & Hartsough, C. S. (1987). The measurement of attention deficit disorder and hyperactivity with behaviour ratings of parents. American Journal of Orthopsychiatry, 57, 361-370.
- Langhorne, J. E., & Loney, J. (1979). A four-fold model for subgrouping the Hyperkinetic/MBD syndrome. Child Psychiatry and Human Development, 9, 153-159.
- Lilienfeld, S. O., & Waldman, I. D. (1990). The relation between childhood attention-deficit hyperactivity disorder and adult antisocial behaviour reexamined: The problem of heterogeneity. Clinical Psychology Review, 10, 699-725.
- Locke, H. J., & Wallace, K. M. (1959). Short marital-adjustment and prediction tests: Their reliability and validity. Journal of Marriage and Family Living, 21(3), 251-255.
- Loge, D. V., Staton, R. D., & Beatty, W. W. (1990). Performance of children with ADHD on tests sensitive to frontal lobe dysfunction. Journal of the American Academy of Child and Adolescent Psychiatry, 29(4), 540-545.

- Loney, J. (1987). Hyperactivity and aggression in the diagnosis of attention deficit disorder. In B. B. Lahey, & A. E. Kazdin (Eds.), Advances in clinical child psychology, (Vol 10, pp. 99-135). New York: Plenum.
- Loney, J., Kramer, J., & Milich, R. S. (1981). The hyperactive child grows up: Predictors of symptoms, delinquency and achievement at follow-up. In: K. D. Gadow & J. Loney, (Eds.), Psychosocial aspects of drug treatment for hyperactivity (pp. 381-415). Boulder, Colorado: Westview Press.
- Loney, J., Langhorne, J. E., & Paternite, C. E. (1978). An empirical basis for subgrouping the hyperkinetic/minimal brain dysfunction syndrome. Journal of Abnormal Psychology, 87, 431-441.
- Loney, J., Langhorne, J. E., Jr., Paternite, C. E., Whaley-Klahn, M. A., Broeker, C., & Hacker, M. (1976). The Iowa HABIT: Hyperkinetic/aggressive boys in treatment. Paper presented at the meeting of the Society for Life History Research in Psychopathology, Ft. Worth, Texas.
- Loney, J. & Milich, R. (1982). Hyperactivity, inattention, and aggression in clinical practice. In M. Wolraich & D. K. Routh (Eds.), Advances in developmental and behavioral pediatrics, (vol. 3, pp. 113-147). Greenwich, CT: JAI Press.

- Loney, J., Whaley-Klahn, M. A., Kosier, T., & Conboy, J. (1983). Hyperactive boys and their brothers at 21: Predictors of aggressive and antisocial outcomes. In K.T. Van Dusen & S. A. Mednick (Eds.), Prospective studies of crime and delinquency (pp. 181-207). Boston: Kluwer-Nijhoff Publishing.
- Lothstein, L. M., & Jones, P. (1978). Discriminating violent individuals by means of various psychological tests. Journal of Personality Assessment, 42, 237-243.
- Magnusson, D., & Bergman, L. R. (1990). A pattern approach to the study of pathways from childhood to adulthood. In: L. N. Robins & M. Rutter (Eds.), Straight and devious pathways from childhood to adulthood (pp. 101-115). New York: Cambridge University Press.
- Mannuzza, S., Fyer, A. J., Klein, D. F., & Endicott, J. (1986). Schedule for Affective Disorders and Schizophrenia - Lifetime Version (Modified for the Study of Anxiety Disorders): Rationale and conceptual development. Journal of Psychiatric Research, 20, 317-325.
- Mannuzza, S., & Gittelman, R. (1986). Informant variance in the diagnostic assessment of hyperactive children as young adults. In J. E. Barrett, & R. M. Rose (Eds.), Mental disorders in the community (pp.243-254). New York: The Guilford Press.

- Mannuzza, S., & Gittelman Klein, R. (1987). Schedule for the Assessment of Conduct, Hyperactivity, Anxiety, Mood, and Psychoactive Substances. Unpublished manuscript. New York: Long Island Jewish Medical Center.
- Mannuzza, S., & Gittelman Klein, R. (1989). Diagnostic narrative summaries to accompany CHAMPS training tapes. Unpublished manuscript, New York: Long Island Jewish Medical Center.
- Mannuzza, S., Gittelman Klein, R., Horowitz Konig, P., & Giampino, T. L. (1989). Childhood predictors of psychiatric status in the young adulthood of hyperactive boys: A study controlling for chance associations. In: L. N. Robins, & M. Rutter (Eds.). Straight and devious pathways from childhood to adulthood (pp. 279-299). New York: Cambridge University Press.
- Mannuzza, S., Klein, R. G., Bonagura, N., Malloy, P., Giampino, T. L., & Addalli, K. A. (1991). Hyperactive boys almost grown up. V. Replication of psychiatric status. Archives of General Psychiatry, 48, 77-83.
- Markwardt, F. C. (1989). Peabody Individual Achievement Test-Revised. Minnesota: American Guidance Service, Inc.
- Mauger, P. A., & Adkinson, D. R. (1980). The Interpersonal Behaviour Survey: a handbook. Los Angeles, California: Western Psychological Services.

- Maxwell, A. E. (1977). Coefficients of agreement between observers and their interpretation. British Journal of Psychiatry, 130, 79-83.
- McClure, F. D., & Gordon, M. (1984). Performance of disturbed hyperactive and nonhyperactive children on an objective measure of hyperactivity. Journal of Abnormal Child Psychology, 12, 561-572.
- McGee, R., & Silva, P. A. (1982). A thousand New Zealand children: Their health and development from birth to seven. (Special Report Series, No.8). Auckland: Medical Research Council of New Zealand.
- McGee, R., Williams, S., & Silva, P. A. (1984a). Background characteristics of aggressive, hyperactive, and aggressive-hyperactive boys. Journal of the American Academy of Child Psychiatry, 23(3), 280-284.
- McGee, R., Williams, S., & Silva, P. (1984b). Behavioral and developmental characteristics of aggressive, hyperactive, and aggressive-hyperactive boys. Journal of the American Academy of Child Psychiatry, 23, 270-279.
- McGee, R., Williams, S., & Silva, P. A. (1985). Factor structure and correlates of ratings of inattention, hyperactivity, and antisocial behaviour in a large sample of 9-year-old children from the general population. Journal of Consulting and Clinical Psychology, 53, 480-490.

- McGee, R., Williams, S., & Silva, P. A. (1987). A comparison of girls and boys with teacher-identified problems of attention. Journal of the American Academy of Child and Adolescent Psychiatry, 26, 711-717.
- Merrill, K. H. (1985). Analysis: The new WRAT-R compared with Woodcock-Johnson achievement and WISC-R. Unpublished manuscript, Mesa Public Schools, Mesa, AZ.
- Milich, R., & Fitzgerald, G. (1985). Validation of inattention/overactivity and aggression ratings with classroom observations. Journal of Consulting and Clinical Psychology, 53, 139-140.
- Milich, R., & Kramer, J. (1985). Reflections on impulsivity: An empirical investigation of impulsivity as a construct. In K. Gadow & I. Bialer (Eds.), Advances in learning and behavioral disabilities (Vol 3, pp.117-150). Greenwich, CT: JAI Press.
- Milich, R., & Landau, S. (1988). Teacher ratings of inattention/overactivity and aggression: Cross-validation with classroom observations. Journal of Clinical Child Psychology, 17(1), 92-97.
- Milich, R., & Loney, J. (1979). The role of hyperactive and aggressive symptomatology in predicting adolescent outcome among hyperactive children. Journal of Pediatric Psychology, 4, 93-112.

- Milich, R., Loney, J., & Landau, S. (1982). Independent dimensions of hyperactivity and aggression: a validation with playroom observation data. Journal of Abnormal Psychology, 91, 183-198.
- Moed, G., Wight, B., & James, P. (1963). Intertest correlations of the Wechsler Intelligence Scale for Children and two picture vocabulary tests. Educational and Psychological Measurement, 23, 359-363.
- Otis, A. S., & Lennon, R. T. (1979). The Otis-Lennon School Ability Test. Cleveland, Ohio: The Psychological Corporation.
- Patterson, G. R. (1982). Coercive family processes. Eugene, OR: Castalia.
- Pelham, W. E., Milich, R., & Murphy, D. A. (1985). Normative data on the IOWA Conners Teacher Rating Scale. Unpublished Manuscript. Florida State University.
- Ramanaiah, N. V., Conn, S. R., & Schill, T. (1987). On the content saturation of the Buss-Durkee hostility inventory scales. Psychological Reports, 61, 591-594.
- Raskin, L. A., Shaywitz, S. E., Shaywitz, B. A., Anderson, G. M., & Cohen, D. J. (1984). Neurochemical correlates of attention deficit disorder. Pediatric Clinics of North America, 31, 387-396.

- Regier, D. A., Myers, J. K., Kramer, J., Robins, L. N., Blazer, D. G., Hough, R. L., Eaton, W. W., & Locke, B. Z. (1984). The NIMH Epidemiologic Catchment Area Program. Archives of General Psychiatry, 41, 941.
- Robins, L. N., Helzer, J. E., Croughan, J., & Ratcliff, K. S. (1981). The NIMH Diagnostic Interview Schedule: Its history, characteristics, and validity. Archives of General Psychiatry, 38, 381-389.
- Robins, L. N., Helzer, J. E., Ratcliff, K. S., & Seyfried, W. (1982). Validity of the Diagnostic Interview Schedule, version II: DSM-III diagnoses. Psychological Medicine, 12, 855-870.
- Rosenthal, R. H., & Allen, T. W. (1978). An examination of attention, arousal, and learning dysfunctions of hyperkinetic children. Psychological Bulletin, 85, 689-715.
- Ross, D. M., & Ross, S. A. (1976). Hyperactivity: Research, theory, and action. New York: Wiley.
- Rutter, M., Tizard, J., & Whitmore, K. (1970). Education, health and behaviour. London: Longmans.
- Rynard, D. W., Firestone, P., Leiken, L., Pisterman, S., Simeon, J. (1992). Sustained attention, impulsivity, and semantic processing in hyperactive, aggressive, and control boys. Manuscript submitted to Behaviour Disorders.
- Sattler, J. M. (1982). Assessment of children's intelligence and special abilities, (2nd ed.). Boston: Allyn and Bacon, Inc.

- Satterfield, J. H., Hoppe, C. M., & Schell, A. M. (1982). A prospective study of delinquency in 110 adolescent boys with attention deficit disorder and 88 normal adolescent boys. American Journal of Psychiatry, 139, 795-798.
- Schachar, R., Rutter, M., & Smith, A. (1981). The characteristics of situationally and pervasively hyperactive children: Implications for syndrome definition. Journal of Child Psychology and Psychiatry, 22, 375-392.
- Schleifer, M., Weiss, G., Cohen, N., Elman, M., Cvejic, H., & Kruger, E. (1975). Hyperactivity in preschoolers and the effect of methylphenidate. American Journal of Orthopsychiatry, 45(1), 38-50.
- Sergeant, J., & van der Meere, J. (1990). Convergence of approaches in localizing the hyperactivity disorder. In: B. B. Lahey, & A. E. Kazdin (Eds.), Advances in clinical psychology, (Vol. 13, pp. 207-246). New York: Plenum Press.
- Spitzer, R. L., Williams, J. B. W., & Gibbon, M. (1986). Structured clinical interview for DSM-III-R - Patient Version. Biometrics Research Department. New York: State Psychiatric Institute.
- Spruill, J., & Beck, B. (1986). Relationship between the WAIS-R and Wide Range Achievement Test - Revised. Educational and Psychological Measurement, 46, 1037-1040.

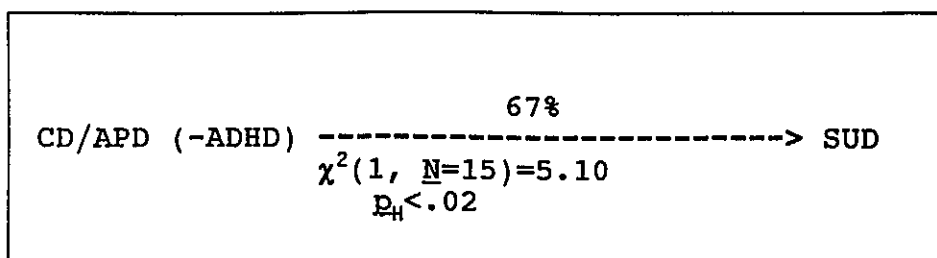
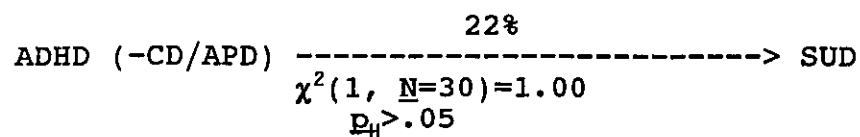
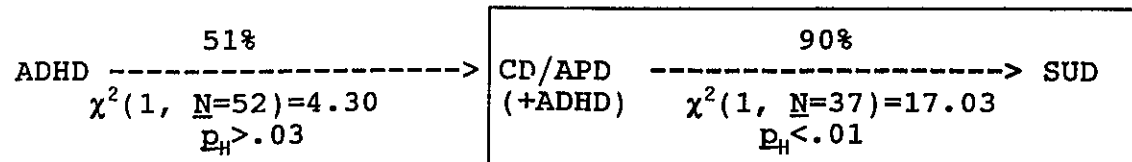
- Sroufe, L. A. (1975). Drug treatment of children with behaviour problems. In F. Horowitz (Ed.), Review of child development research, (Vol 4, pp. 347-408). Chicago: University of Chicago Press.
- Steinkamp, M. W. (1980). Relationships between environmental distractions and task performance of hyperactive and normal children. Journal of Learning Disabilities, 13, 40-45.
- Strauss, A. A., & Lehtinen, L. E. (1947). Psychopathology and education of the brain-injured child. New York: Grune & Stratton.
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. Journal of experimental psychology, 18, 643-662.
- Taylor, E. (1988). Attention deficit and conduct disorder syndromes. In: M. Rutter, A. H. Tuma, & I. S. Lann (Eds.). Assessment and diagnosis in child psychopathology (pp. 377-408). New York: Guilford Press.
- Tellegen, A., & Briggs, P. F. (1967). Old wine in new skins: Grouping Wechsler subtests into new scales. Journal of Consulting Psychology, 31(5), 499-506.
- Thorley, G. (1984). Review of follow-up and follow-back studies of childhood hyperactivity. Psychological Bulletin, 96, 16-132.
- Thurstone, T. G., & Thurstone, L. L. (1973). The SRA Verbal Form. Chicago: Science Research Associates.

- Trites, R. L., & Laprade, K. (1983). Evidence for an independent syndrome of hyperactivity. Journal of Child Psychology and Psychiatry, 24, 573-586.
- Verhulst, F. C., & van der Ende, J. (1992). Agreement between parents' reports and adolescents' self-reports of problem behaviour. Journal of Child Psychology and Psychiatry, 33(6), 1011-1023.
- Vincent, J. P., Williams, B. J., Harris, G. E., & Duvall, G. (1977). Classroom observations of hyperactive children: a multiple validation study. Paper presented at the meeting of the American Psychological Association, San Francisco.
- Webster-Stratton, C. (1988). Mothers' and fathers' perceptions of child deviance: Roles of parent and child behaviors and parent adjustment. Journal of Consulting and Clinical Psychology, 56, 909-915.
- Wechsler, D. (1974). Manual for the Wechsler Intelligence Scale for Children - Revised. New York: Psychological Corporation.
- Wechsler, D. (1981). Manual for the Wechsler Adult Intelligence Scale - Revised. New York: Psychological Corporation.
- Weiss, G., Hechtman, L., Milroy, T., & Perlman, T. (1985). Psychiatric status of hyperactives as adults: A controlled prospective 15-year follow-up of 63 hyperactive children. Journal of the American Academy of Child Psychiatry, 24(2), 211-220.

- Weiss, G., Hechtman, L. T., Perlman, T., Hopkins, J., & Wener, A. (1979). Hyperactives as young adults: A controlled prospective ten-year follow-up of 75 children. Archives of General Psychiatry, 36, 675-681.
- Weiss, G., Minde, K., Werry, J. S., Douglas, V., & Nemeth, E. (1971). Studies on the hyperactive child. Five-year follow-up. Archives of General Psychiatry, 24, 409-414.
- Woodcock, R. W. (1977). Woodcock-Johnson Psycho-Educational Battery: Technical report. Boston: Teaching Resources.
- Zelin, M. L., Alder, G., & Myerson, P. G. (1972). Anger self-report: An objective questionnaire for the measurement of aggression. Journal of Consulting and Clinical Psychology, 39, 340.

Figure Caption

Figure. Patterns of Comorbidity in the Hyperactive Group Among
Disorders Diagnosed in Adolescence (Any Time Since Age 13 Years).



Appendix A

Information Letter to Hyperactive Subjects or their Parents

Dear Subject/Parent

This letter is to inform you of a project currently being conducted by Dr. Philip Firestone and Drs. S. Pisterman and J.T. Goodman from the Department of Psychology at the Children's Hospital of Eastern Ontario (CHEO). Dr. Firestone and his colleagues are interested in assessing how former patients like yourself/your child have developed as adolescents and young adults.

Participants will be individually assessed on carefully developed tasks that measure various aspects of social and psychological functioning. The tasks are varied and have been used previously with many adolescents and adults. They will in all probability provide an interesting and, at times, mildly challenging experience. The assessments will involve one session of approximately three hours. All testing will be carried out by staff members who have received extensive training in psychological assessment. One parent will be interviewed in one session of approximately one hour to further clarify the adolescent's or young adult's development. Personal feedback regarding the results will be provided to all participants.

All information in this study will be held in confidence in keeping with CHEO hospital policies. All test results will be

combined with those obtained from other participants for the purpose of summarizing the research findings. For this purpose, no identifying names or personal characteristics will be made available to anyone other than the investigators. Please understand that you are in no way obliged to participate and may choose to withdraw from the study at any time without affecting service from the Department of Psychology at CHEO. The investigators will be in contact with you by telephone to further explain the project and to set up an appointment time should you decide to participate. Thank you.

Sincerely,

.....

Philip Firestone, Ph.D. C. Psych.,
Department of Psychology
Children's Hospital of Eastern Ontario

For any questions, please contact:
Diane Claude
(613) 737-2492

Appendix B

Parental Informed Consent

The present investigation is being conducted by Dr. Philip Firestone from the University of Ottawa, and Drs. S. Pisterman and J. T. Goodman from the Department of Psychology at the Children's Hospital of Eastern Ontario (CHEO). Dr. Firestone and his colleagues are interested in assessing how former patients have developed as adolescents and young adults.

Participants will be individually assessed on carefully developed tasks that measure various aspects of social and psychological functioning. The tasks are varied and have been used previously with many adolescents and young adults. They will in all probability provide an interesting and, at times, mildly challenging experience. The assessments will involve one session of approximately three hours, and will include breaks. One parent will be interviewed in one session of approximately 1 hour to further clarify the adolescent's or young adult's development. All testing will be carried out by staff members who have received extensive training in psychological assessment.

All individual information will be held in confidence in keeping with CHEO hospital policies. All test results will be combined with those obtained from other participants for the purpose of summarizing the research findings. For this purpose, no identifying names or personal characteristics will be made

available to anyone other than the investigators. Please understand that you are in no way obliged to participate and may choose to withdraw from the study at any time without affecting service from the Department of Psychology at CHEO.

I have read and understood the above statement regarding the research project being carried out by Dr. Philip Firestone in conjunction with the Department of Psychology at the Children's Hospital of Eastern Ontario and the University of Ottawa.

I hereby give my permission for my son/daughter..... to participate in the study. I have discussed this with my son/daughter and believe that s/he is participating voluntarily. I realize that I may withdraw my son/daughter from participating in the study at any time, without affecting service from the Department of Psychology at CHEO, and that the results of the study will be held in the strictest of confidence.

Date Parent's signature

Witness

I have explained the nature of the study to and believe he/she has understood it.

Name Position.....

Signature..... Date.....

Appendix C

Adult Informed Consent

The present investigation is being conducted by Dr. Philip Firestone from the University of Ottawa, and Drs. S. Pisterman and J. T. Goodman from the Department of Psychology at the Children's Hospital of Eastern Ontario (CHEO). Dr. Firestone and his colleagues are interested in assessing how former patients have developed as adolescents and young adults.

Participants will be individually assessed on carefully developed tasks that measure various aspects of social and psychological functioning. The tasks are varied and have been used previously with many adolescents and young adults. They will in all probability provide an interesting and, at times, mildly challenging experience. The assessments will involve one session of approximately three hours, and will include breaks. One parent will be interviewed in one session of approximately 1 hour to further clarify the adolescent's or young adult's development. All testing will be carried out by staff members who have received extensive training in psychological assessment.

All individual information will be held in confidence in keeping with CHEO hospital policies. All test results will be combined with those obtained from other participants for the purpose of summarizing the research findings. For this purpose, no identifying names or personal characteristics will be made

available to anyone other than the investigators. Please understand that you are in no way obliged to participate and may choose to withdraw from the study at any time without affecting service from the Department of Psychology at CHEO.

I have read and understood the above statement regarding the research project being carried out by Dr. Philip Firestone in conjunction with the Department of Psychology at the Children's Hospital of Eastern Ontario and the University of Ottawa. I hereby wish to participate in the study. I realize that I may withdraw from the study at any time, without affecting service from the Psychology Department at CHEO, and that the results of the study will be held in the strictest of confidence.

Date Subject's signature

Witness

I have explained the nature of the study to and believe he/she has understood it.

Name Position.....

Signature..... Date.....

Appendix D
Buss-Durkee Hostility Inventory

224

Name:

Date:

task number:

DECIDE IF EACH OF THE STATEMENTS IS TRUE (T) OR FALSE (F) AS IT PERTAINS TO YOU.

1. Unless somebody asks me in a nice way, I won't do what they want. T / F
2. I don't seem to get what's coming to me. T / F
3. I sometimes spread gossip about people I don't like. T / F
4. Once in a while, I cannot control my urge to harm others. T / F
5. I know that people tend to talk about me behind my back. T / F
6. I lose my temper easily but get over it quickly. T / F
7. When I disapprove of my friends' behaviour, I let them know it. T / F
8. When someone makes a rule I don't like, I am tempted to break it. T / F
9. Other people always seem to get the breaks. T / F
10. I never get mad enough to throw things. T / F
11. I can think of no good reason for ever hitting anyone. T / F
12. I tend to be on my guard with people who are somewhat more friendly than I expected. T / F
13. I am always patient with others. T / F
14. I often find myself disagreeing with people. T / F
15. When someone is bossy, I do the opposite of what he asks. T / F
16. When I look back on what's happened to me, I can't help feeling mildly resentful. T / F

17. When I am mad, I sometimes slam doors. T / F
18. If somebody hits me first, I let him have it. T / F
19. There are a number of people who seem to dislike me very much. T / F
20. I am irritated a great deal more than people are aware of. T / F
21. I can't help getting into arguments with people when they disagree with me. T / F
22. When people are bossy, I take my time just to show them. T / F
23. Almost every week I see someone I dislike. T / F
24. I never play practical jokes. T / F
25. Whoever insults me or my family is asking for a fight. T / F
26. There are a number of people who seem to be jealous of me. T / F
27. It makes my blood boil to have somebody make fun of me. T / F
28. I demand that people respect my rights. T / F
29. Occasionally when I am mad at someone I will give him the "silent treatment". T / F
30. Although I don't show it, I am sometimes eaten up with jealousy. T / F
31. When I am angry, I sometimes sulk. T / F
32. People who continually pester you are asking for a punch in the nose. T / F
33. I sometimes have the feeling that others are laughing at me. T / F
34. If someone doesn't treat me right, I don't let it annoy me. T / F
35. Even when my anger is aroused, I don't use "strong language". T / F
36. I don't know any people that I downright hate. T / F
37. I sometimes pout when I don't get my own way. T / F

38. I seldom strike back, even if someone hits me first. T / F
39. My motto is "Never trust strangers". T / F
40. Sometimes people bother me by just being around. T / F
41. If somebody annoys me, I am apt to tell him what I think of him. T / F
42. If I let people see the way I feel, I'd be considered a hard person to get along with. T / F
43. Since the age of ten, I have never had a temper tantrum. T / F
44. When I really lose my temper, I am capable of slapping someone. T / F
45. I commonly wonder what hidden reason another person may have for doing something nice for me. T / F
46. I often feel like a powder keg ready to explode. T / F
47. When people yell at me, I yell back. T / F
48. At times I feel I get a raw deal out of life. T / F
49. I can remember being so angry that I picked up the nearest thing and broke it. T / F
50. I get into fights about as often as the next person. T / F
51. I used to think that most people told the truth but now I know otherwise. T / F
52. I sometimes carry a chip on my shoulder. T / F
53. When I get mad, I say nasty things. T / F
54. I sometimes show my anger by banging on the table. T / F
55. If I have to resort to physical violence to defend my rights, I will. T / F
56. I have no enemies who really wish to harm me. T / F
57. I can't help being a little rude to people I don't like. T / F
58. I could not put someone in his place, even if he needed it. T / F

59. I have known people who pushed me so far that we came to blows. T / F
60. I seldom feel that people are trying to anger or insult me. T / F
61. I don't let a lot of unimportant things irritate me. T / F
62. I often make threats I don't really mean to carry out. T / F
63. Lately, I have been kind of grouchy. T / F
64. When arguing, I tend to raise my voice. T / F
65. I generally cover up my poor opinion of others. T / F
66. I would rather concede a point than get into an argument about it. T / F
67. The few times I have cheated, I have suffered unbearable feelings of remorse. T / F
68. I sometimes have bad thoughts, which make me feel ashamed of myself. T / F
69. People who shirk on the job must feel very guilty. T / F
70. It depresses me that I did not do more for my parents. T / F
71. I am concerned about being forgiven for my sins. T / F
72. I do many things that make me feel remorseful afterward. T / F
73. Failure gives me a feeling of remorse. T / F
74. When I do wrong, my conscience punishes me severely. T / F
75. I often feel that I have not lived the right kind of life. T / F

Appendix E

ANOVA of Age at Follow-up of Hyperactive/Aggressive, Hyperactive Only and Normal Control Males

Source of Variation	SS	D.F.	MS	F	p
Group	338.52	2	169.26	.27	.77
Residual	51907.79	82	633.02		
Total	52246.31	84	621.98		

ANOVA of IQ estimate of Hyperactive/Aggressive, Hyperactive Only and Normal Control Males

Source of Variation	SS	D.F.	MS	F	p
Group	1076.29	2	538.15	3.51	.035
Residual	12580.13	82	153.42		
Total	13656.42	84	162.58		

Appendix F

ANOVA of SES of Hyperactive/Aggressive, Hyperactive Only and Normal Control Males

Source of Variation	SS	D.F.	MS	F	p
Group	2.85	2	1.42	1.09	.342
Residual	107.16	82	1.31		
Total	110.00	84	1.31		

Appendix G

MANCOVA of GDS Scores of Hyperactive and Normal Control Males
with IQ as a CovariateRegression Analysis for Covariate IQ

Dependent Var.	t	p
Efficiency Ratio Delay Task	2.03	.045
Total Omissions Vigilance Task	- 3.81	.000
Total Commissions Vigilance Task	2.38	.019
Total Omissions Distractibility Task	- 4.43	.000
Total Commissions Distractibility Task	1.05	.298

MANCOVA (S=1, M=1 1/2, N=47)

Pillai Trace	Exact F	Hypoth. DF	Error DF	p
.04	.77	5.00	96.00	.571

Appendix G (continued)

ANCOVA (1, 100) D.F.

Dependent Var.	Hypoth. MS	Error MS	F	p
Efficiency Ratio Delay Task	.00007	.02970	.002	.962
Total Omissions Vigilance Task	.18056	.06227	2.90	.092
Total Commissions Vigilance Task	.15764	.10793	1.46	.230
Total Omissions Distractibility Task	.00341	.11850	.03	.866
Total Commissions Distractibility Task	.00895	.10666	.08	.773

Appendix H

MANCOVA of GDS Scores of Hyperactive/Aggressive, Hyperactive Only
and Normal Control Males with IQ as a Covariate

Regression Analysis for Covariate IQ

Dependent Var.	t	p
Efficiency Ratio Delay Task	1.51	.135
Total Omissions Vigilance Task	- 3.36	.001
Total Commissions Vigilance Task	2.02	.047
Total Omissions Distractibility Task	- 3.77	.000
Total Commissions Distractibility Task	.94	.352

MANCOVA (S=2, M=1, N=37)

Pillai Trace	Exact F	Hypoth. DF	Error DF	p
.07	.56	10.00	156.00	.841

Appendix H (continued)

ANCOVA (2, 80) D.F.

Dependent Var.	Hypoth. MS	Error MS	F	p
Efficiency Ratio Delay Task	.01031	.02709	.38	.685
Total Omissions Vigilance Task	.08282	.06726	1.23	.297
Total Commissions Vigilance Task	.07192	.10883	.66	.519
Total Omissions Distractibility Task	.00916	.13157	.07	.933
Total Commissions Distractibility Task	.06282	.10518	.60	.553

Appendix I

Pearson Product Moment Correlation of the WRAT-R Reading,
Spelling and Arithmetic Subtests and the PIAT-R Reading
Comprehension Subtest

	WRAT-R Spell.	WRAT-R Arith.	PIAT-R Read.
WRAT-R Reading	.83**	.47**	.53**
WRAT-R Spelling		.46**	.42**
WRAT-R Arithmetic			.52**

Note: Given that PIAT-R Reading Comprehension scores were transformed (reflect & square root), all correlations with PIAT-R scores were negative. These were omitted from the table to prevent confusion.

**p<.01

Appendix J

MANCOVA of Academic Achievement Test Scores of Hyperactive and Normal Control Males with IQ as a CovariateRegression Analysis for Covariate IQ

Dependent Var.	t	p
WRAT-R Spelling	3.55	.001
WRAT-R Arithmetic	7.10	.000
PIAT-R Reading Comprehension	- 7.30	.000

MANCOVA (S=1, M=1/2, N=48 1/2)

Pillai Trace	Exact F	Hypoth. DF	Error DF	p
.15	6.02	3.00	99.00	.001

ANCOVA (1, 101) D.F.

Dependent Var.	Hypoth. MS	Error MS	F	p
WRAT-R Spelling	2256.89	178.32	12.66	.001
WRAT-R Arithmetic	1370.95	130.49	10.51	.002
PIAT-R Reading Comprehension	6.67	.86	7.74	.006

Appendix K

ANCOVA of High School Level Completed of Hyperactive and Normal Control Males with IQ as a Covariate

Source of Variation	SS	D.F.	MS	F	p
IQ (covariate)	45.46	1	45.46	25.63	.000
Group	15.19	1	15.19	8.56	.004
Residual	179.12	101	1.77		
Total	239.76	103	2.33		

ANCOVA of Number of Courses Failed of Hyperactive and Normal Control Males with IQ as a Covariate

Source of Variation	SS	D.F.	MS	F	p
IQ (covariate)	64.47	1	64.47	7.76	.007
Group	43.86	1	43.86	5.28	.025
Residual	490.27	59	8.31		
Total	598.60	61	9.81		

Appendix L

MANCOVA of Academic Achievement Test Scores of
Hyperactive/Aggressive, Hyperactive Only and Normal Control Males
with IQ as a Covariate

Regression Analysis for Covariate IQ

Dependent Var.	t	p
WRAT-R Spelling	3.17	.002
WRAT-R Arithmetic	6.31	.000
PIAT-R Reading Comprehension	- 6.17	.000

MANCOVA (S=2, M=0, N=38 1/2)

Pillai Trace	Exact F	Hypoth. DF	Error DF	p
.11	1.48	6.00	160.00	.190

ANCOVA (2, 81) D.F.

Dependent Var.	Hypoth. MS	Error MS	F	p
PIAT-R Reading Comprehension	2.93	.89	3.29	.042
WRAT-R Spelling	430.35	158.48	2.72	.072
WRAT-R Arithmetic	243.74	119.57	2.04	.137

Appendix M

ANCOVA of High School Level Completed of Hyperactive/Aggressive,
Hyperactive Only and Normal Control Males with IQ as a Covariate

Source of Variation	SS	D.F.	MS	F	p
IQ (covariate)	39.93	1	39.93	22.18	.000
Group	7.62	2	3.81	2.12	.127
Residual	145.86	81	1.80		
Total	193.41	84	2.30		

Appendix N

ANCOVA of Number of Courses Failed of Hyperactive/Aggressive,
Hyperactive Only and Normal Control Males with IQ as a Covariate

Source of Variation	SS	D.F.	MS	F	p
IQ (covariate)	38.50	1	38.50	7.23	.010
Group	50.42	2	25.21	4.73	.014
Residual	218.33	41	5.33		
Total	307.24	44	6.98		

Tukey's HSD Post-Hoc Analysis of Number of Courses Failed Between
the Hyperactive/Aggressive, Hyperactive Only and Normal Control
Group with IQ as a Covariate

Group	Means Adjusted for IQ	Mean Differences		
		HA	HO	C
HA	3.40		0.6	1.7
HO	4.02			2.4*
C	1.67			

*p<.05

HSD=2.4

D.F.=41

p=.05

N=45

HA= Hyperactive/aggressive; HO= Hyperactive only; C= Normal control

Appendix O

ANCOVA of Self-Reports of Hostility/Aggressiveness on Buss-Durkee Hostility Inventory between the Hyperactive and Normal Control Group with IQ as a Covariate

Source of Variation	SS	D.F.	MS	F	p
IQ (covariate)	938.72	1	938.72	12.51	.001
Group	171.04	2	85.52	1.14	.325
Residual	6075.94	81	75.01		
Total	7185.69	84	85.54		

ANCOVA of Self-Reports of Hostility/Aggressiveness on Buss-Durkee Hostility Inventory between the Hyperactive/Aggressive, Hyperactive Only and Normal Control Group with IQ as a Covariate

Source of Variation	SS	D.F.	MS	F	p
IQ (covariate)	1138.44	1	1138.44	13.36	.000
Group	27.55	1	27.55	.32	.571
Residual	8607.92	101	85.23		
Total	9773.91	103	94.89		