

ATTENTION DEFICIT DISORDER AND THE YOUNG OFFENDER:
RELATIONSHIPS BETWEEN SYMPTOMOLOGY AND VARIATION IN CORRECTIONS
HISTORY

by

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ABSTRACT

Male adolescent offenders classified by retrospective or follow-back method as having Attention Deficit Disorder with Hyperactivity (ADDH) (N=24) and as non-ADDH (N=28) were compared on selected symptom, SES, familial and corrections history variables. Multiple measures of impulsive behaviour were used to examine cognitive tempo, preference for delayed versus immediate gratification, and risk taking for loss of a positive versus negative reward. Multivariate analyses revealed considerably more deviance in the ADDH group for symptom and corrections history variables. ADDH subjects experienced significantly more changes in living situation, but did not differ from non-ADDH subjects in age, IQ, rate of family intactness or SES. ADDH offenders demonstrated shock avoidance on a risk taking task but showed impulsive decision time. In contrast, offenders without ADDH did not show shock avoidance but demonstrated caution in decision time. Neither group exhibited a preference for immediate gratification. Factor analysis of the impulsivity data yielded three dimensions labelled Cognitive Tempo, Responsivity to Loss of a Positive but not Negative Reward, and Risk Taking. All possible subset regression analyses on symptom and familial variables for both groups combined identified diagnostic group and two of the three impulsivity factors as the predictors contributing to greatest variation in corrections history. Aggression and SES showed high to moderate relationships with antisocial outcome. The current findings substantiate prior

research but argue for studies which examine the specificity of ADDH symptoms as related to outcome. The results are discussed in terms of ADDH and the possible mediative role of impulsivity to delinquent outcome.

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A. Introduction

Interest in the outcome of behavioural and emotional disorders of childhood, and the relationship between childhood and adult psychopathology, has been considerable during the past decade in psychiatry and clinical psychology. In particular, the outcome of childhood Attention Deficit Disorder with Hyperactivity (ADDH) in adulthood has received increasing attention (Douglas, 1976; Ross & Ross, 1982). This interest stems in part from the high prevalence of the behaviour disorder which is estimated at three (DSM-III, 1980) to six (Lambert, Sandoval & Sassone, 1978) percent of school age children, primarily boys. ADDH further accounts for up to 50 percent of childhood behaviour problem referrals (Miller, Palkes & Stewart, 1973; Stewart, Pitts, Craig & Dieruf, 1966). Indications are that ADDH and its sequelae persist into adolescence and early adulthood (Amado & Lustman, 1982; Ross & Ross, 1982; Thorley, 1984; Weiss, 1975), and emerging theoretical and empirical evidence suggest a developmental association between ADDH and specific psychiatric disorders in adulthood (Amado et al., 1982; Cantwell, 1978; Goodwin, Schlusinger, Hermansen, Guze & Winokur, 1975; Tarter, McBride, Buonpane & Schneider, 1977).

Attention Deficit Disorder with Hyperactivity is the most recent of terms (DSM-III, 1980) used to describe a behavioural syndrome of childhood formerly referred to variously as Minimal

Brain Dysfunction (Clements, 1966), Minimal Brain Damage (MBD) (Still, 1902), Minimal Cerebral Dysfunction, Hyperkinetic Behaviour Syndrome and Hyperkinetic Impulse Disorder (Laufer & Denhoff, 1957; Laufer, Denhoff & Solomons, 1957), Hyperkinetic Reaction of Childhood (DSM-II, 1968) and Hyperactive Child Syndrome. ¹ The advent of the term ADDH was primarily based on the work of two research groups, that of Virginia Douglas at McGill University (Douglas, 1972; Douglas & Peters, 1979), and Dykman and associates at the University of Arkansas (Dykman, Ackerman, Clements & Peters, 1971; Dykman, Peter & Ackerman, 1973), which indicated that impaired attention, rather than a high level of inappropriate activity, was the central feature of the behaviour disorder. The DSM-III (1980) descriptor Attention Deficit Disorder with or without Hyperactivity stresses attentional difficulties as the central diagnostic concept which may or may not be accompanied by hyperactivity.

Although diverse labels have been applied, clinicians and researchers report consensus concerning primary and secondary symptomatology and exclusionary criteria (Cantwell, 1979; Douglas & Peters, 1979; Dubey, 1982, Minde, 1977; Rapoport & Zametkin, 1980; Satterfield, Cantwell & Satterfield, 1979; Whalen & Henker, 1980a). The most frequently cited primary or core symptoms of ADDH include short attention span, chronic hyperactivity, marked distractibility, impulsivity and emotional

¹The various diagnostic labels will be used interchangeably in this paper. Research on MBD is included when seeming to deal with the same disorder as ADDH.

lability. The syndrome is commonly defined as reflecting deficits in the following three areas: (1) the investment of attention and effort; (2) the inhibition of impulsive responding; and (3) the modulation of arousal level to meet situational or task demands (Douglas, 1980; DSM-III, 1980), all of which are likely to be characterized by cross-situational and cross-temporal variability (Campbell & Redfering, 1979; Langhorne, Loney, Paternite & Bechtoldt, 1976; Schleifer, Weiss, Cohen, Elman, Cvejic & Kruger, 1975). Among the secondary or complicating symptoms are deficits in academic performance and social competence, low self-esteem, and conduct disorder. The less salient aspects of the disorder are typically referred to as resultant symptoms since they are attributed to the ADHD child's flawed interactions with his social environment, although there is at present no empirical basis supporting this causal assumption (Milich & Loney, 1979).

Prior to 1970, clinical reports of childhood ADHD tended to emphasize that it was a time-limited condition, becoming less severe with age and disappearing in adolescence (Bakwin & Bakwin, 1966; Eisenberg, 1966; Laufer & Denhoff, 1957; Lytton & Knobel, 1958). However, some 30 retrospective and prospective studies published since then directly addressing the sequelae of ADHD, fail to support earlier claims of a benign prognosis. While the symptom of hyperactivity per se may diminish with age (Ackerman, Dykman & Peters, 1977; August, Stewart & Holmes, 1983; Loney, 1980; Weiss, 1975), disorders of attention,

concentration, impulsivity and irritability continue (Borland & Heckman, 1976; Laufer & Denhoff, 1962; Mendelson, Johnson & Stewart, 1971; Minde, Weiss & Mendelson, 1972; Weiss, Hechtman, Perlman, Hopkins & Wener, 1979; Weiss, Minde, Werry, Douglas & Nemeth, 1971). Serious emotional and educational sequelae may persist as well (Anderson & Plymate, 1962; Dykman, Peters & Ackerman, 1973; Hartocollis, 1968; Hechtman, Weiss, Finklestein, Werner & Benn, 1976; Hechtman, Weiss & Perlman, 1981; Laufer & Denhoff, 1957; Mendelson et al., 1971; Menkes, Rowe & Menkes, 1967; Milman, 1979; Minde, Lewin, Weiss, Lavigneur, Douglas & Sykes, 1971; Minde et al., 1972; Morrison, 1980; Morrison & Minkoff, 1975; Quitkin & Klein, 1969; Weiss et al., 1971).

Outcome studies further suggest that ADDH may continue into adulthood with symptomatic transformations. Within symptom modalities, the form of the behaviour changes through the developmental stages, paralleling changes in maturation and functioning (Ross & Ross, 1982). For example, deficient impulse control may manifest itself in infancy as impaired sphincter control (enuresis, encopresis) (Wender & Eisenberg, 1974), as accident-proneness during the preschool years (Stewart, Thach & Freidin, 1970), during middle childhood as low frustration tolerance, inability to delay gratification (Ross & Ross, 1982) and negative social interactions with peers (Klein & Young, 1979; Riddle & Rapoport, 1976), and during adolescence as antisocial behaviour (see Tables 1, 2, & 3.). The behaviour perceived as most serious and problematic also changes from one

age period to the next (Ross & Ross, 1982). Sleeping problems and crying are the most salient in infancy, hyperactivity is the most conspicuous problem in middle childhood, and rebelliousness and antisocial behaviour constitute the predominant problems in adolescence. In fact, antisocial behaviour is the major reason for referral during the preadolescent and adolescent years (Wender & Eisenberg, 1974), and outcome research on ADDH probands followed into adolescence and early adulthood report a marked increase in antisocial symptoms and delinquent acts found at follow-up.

Due to changing behavioural manifestations of the syndrome, core deficits that persist into adolescence and adulthood may attract a new set of diagnostic labels. Of importance is the diagnosis of antisocial personality disorder, which is a frequent finding at follow-up in outcome studies of ADDH children. (See Tables 1 & 2). A developmental association between childhood ADDH and psychopathy has been inferred (August et al., 1983; Cadoret & Gath, 1980; Cantwell, 1975, 1978; Freeman & Reznick, in press; Gorenstein & Newman, 1980; Morrison & Stewart, 1971, 1973; Satterfield, 1978; Tarter, 1979; Tupin, Mahar & Smith, 1973) from longitudinal, cross-sectional, retrospective and family research.

Retrospective and Follow-Back Studies of ADDH Children

A summary of outcome studies using the retrospective (post-facto) follow-up method, follow-back method and case study design is provided in Table 1. Retrospective diagnosis indicates that the assessment of childhood ADDH was derived from the recollections of the patient and/or family, or was construed from a reexamination of medical records. Follow-back assessment (Kohlberg, Lacrosse & Ricks, 1972) involves rating subjects as ADDH on the basis of past information such as data contained in medical records. Only one study discussed is of the follow-back design (Quitkin & Klein, 1964).

As illustrated in Table 1, several authors have contributed case studies of antisocial adults suggesting a significant percentage experienced childhood problems similar to those of ADDH children (Morrison & Minkoff, 1975). Hartocollis (1968) and Quitkin and Klein (1969) reported an association between a history of MBD in childhood, soft neurological signs, and adult antisocial character disorders. Similarly, Wood and coworkers (Wood, Reimherr, Wender, Bliss & Johnson, 1976) identified a variety of personality disorders, including antisocial personality, explosive personality and alcoholism among psychiatric patients with histories suggestive of childhood MBD. Four of the 15 patients so identified in Wood's study received a definite or probable diagnosis of antisocial personality.

Table 1

Retrospective & Follow-back Studies of ADHD Children

Authors	Diagnosis	Methodology	# ADHD Ss	Age Range	Controls	Outcome
Hartocollis (1968)	MBD	Case study - retrospective & current diagnosis	15	15-25	----	10 of the formerly MBD subjects demonstrated delinquent behaviour in adulthood
Quitkin & Klein (1969)	MBD-Hyperkinesis	Case study - follow-back diagnosis	18	under 25	----	Of the 18 patients with definite histories of childhood HA, 12 were among the 19 impulsive destructive patients
Morrison & Minkoff (1975)	Hyperactive Child Syndrome	Case study - retrospective diagnosis	3	Adulthood	----	Explosive personality and significant antisocial behaviour
Wood, Reimherr, Wender, Bliss, & Johnson (1976)	Hyperkinesis	Case study - retrospective diagnosis	15	Adulthood	----	4 of the 15 HA subjects received a diagnosis of anti-social personality disorder
Maletzky (1974)	Hyperactivity	Treatment study - retrospective diagnosis	28	13-18	----	Close link between a history of HA and teenage delinquency
Virkkunen & Nuutila (1976)	Hyperactive Child Syndrome	Follow-up diagnosis	224	15-20	Reading retardation group	Hyperactive symptoms were associated with criminal behaviour
Menkes, Rowe, & Menkes (1967)	Hyperkinetic with MBD	Retrospective diagnosis with 14-27 yr. follow-up	18	22-40	----	3 of the 11 non-retarded individuals were deemed delinquent or criminal
Borland & Heckman (1976)	Hyperactivity	Retrospective diagnosis with 20-25 yr. follow-up	20	24-36	Brothers	20% of the HA adults were diagnosed as sociopathic

Table 1 (cont'd)

Retrospective & Follow-back Studies of ADHD Children

Authors	Diagnosis	Methodology	# ADHD Ss	Age Range	Controls	Outcome
Morrison (1979)	Hyperactivity	Retrospective follow-up	48	28-30	Matched psychiatric controls	Formerly HA subjects showed significantly more sociopathy and alcoholism
Morrison (1980)	Hyperactivity	Retrospective follow-up	48	28-30	Matched psychiatric controls	Antisocial behaviour characterized 3 times as many HA subjects as controls
Offord, Sullivan, Allen, & Abrams (1979)	Hyperactive-Delinquent	Comparison study - retrospective diagnosis	31	11-14	Non-hyperactive delinquents	Hyperactives demonstrated significantly more antisocial symptoms with evidence of earlier onset and poorer prognosis

One of the earliest systematic retrospective follow-up studies that had direct access to childhood clinic records examined, at 24 year follow-up, the level of social functioning in 18 adults diagnosed as formerly hyperkinetic (Menkes, Rowe & Menkes, 1967). A clinical status of delinquent or criminal in 3 of the 11 non-retarded individuals was reported. In a similar study of 20 adult men who 20 to 25 years earlier conformed to diagnostic criteria of childhood hyperactivity on the basis of clinic records, Borland and Heckman (1976) reported a finding of sociopathy in 20 percent of the men assessed in adulthood.

Virkkunen and Nuutila (1976) reported an arrest rate of 12.1 per cent in hyperactive (HA) and learning disabled adolescents, and were able to rule out the learning disability as a contributing factor. They concluded the ADDH syndrome to significantly predict antisocial behaviour in adolescence.

More recently, Morrison (1979) compared 48 adult psychiatric patients retrospectively diagnosed as childhood hyperactive with matched psychiatric controls. A diagnosis of personality disorder proved to be the strongest differentiating factor between the groups, with the formerly HA patients showing significantly more sociopathy and alcoholism than controls. In addition, results from a companion paper (Morrison, 1980) revealed a higher rate of violence and legal problems among the adult hyperactives. Serious antisocial behaviour such as violence directed against persons characterized three times as many of the adult HA patients as it did the psychiatric

controls.

An interesting study conducted by Offord (Offord, Sullivan, Allen & Abrams, 1979) designed to examine the relationship between childhood hyperactivity and antisocial outcome, compared male adolescent delinquents retrospectively diagnosed as hyperactive with adolescent delinquents who were not hyperactive on selected family variables, pregnancy and birth histories, school performance and severity of antisocial symptomatology. The HA adolescents demonstrated significantly more antisocial symptoms with evidence of earlier onset than their non-HA counterparts. Hyperactivity was thus associated with greater severity of delinquency and a probable poor prognosis.

In order to arrive at sound conclusions from the various retrospective outcome studies, it is necessary to only consider research which used controls. Five of the 11 studies used controls of varying qualities. One study (Borland et al., 1976) used siblings of ADDH subjects as controls; however, these are considered to be poor controls (Thorley, 1984) since differences between the proband and control groups may have been minimized or conversely enhanced for certain variables (e.g. psychosocial experience). Of the four methodologically adequate retrospective outcome studies which employed psychiatric controls (Morrison, 1979, 1980; Offord et al., 1979; Virkkunen et al., 1976), all present a pattern of findings suggesting the ADDH child is at greater than average risk for antisocial behaviour in later life.

Methodological shortcomings of the retrospective study method such as the possibility of erroneously included non-ADDH subjects in the ADDH groups, must be considered however, in evaluating the findings. Prospective longitudinal and cross-sectional studies employing more rigorous subject sampling and diagnostic procedures provide a firmer basis for assessing the linkage between childhood ADDH and antisocial outcome.

Prospective Studies of ADDH Children

Prospective studies of ADDH children are summarized in Table 2 and are classified as longitudinal or cross-sectional follow-up methodology. The longitudinal approach requires a set of measures done at both initial referral and at follow-up, whereas the cross-sectional method involves only measures taken at follow-up.

These studies have reported serious delinquent behaviour of the type that often predicts adult criminal behaviour. For example, Satterfield and Cantwell (1975) and Satterfield (1978) have noted that the characteristics of ADDH children reported in the Stewart (Stewart, Pitts, Craig & Dieruf, 1966) and Mendelson (Mendelson, Johnson & Stewart, 1971) studies were identical to the majority of childhood symptoms found by Robins (1966) to be predictive of adult psychopathy. A comparative review of these studies is reproduced from Satterfield (1978) in Table 3 below.

Table 2

Prospective Studies of ADHD Children

Authors	Diagnosis	Methodology	# ADHD Ss	Age Range	Controls	Outcome
Mendelson, Johnson & Stewart (1971)	Hyperactivity	Cross-sectional 2-5 yr. follow-up	83	12-16	----	59% contact w/police 18% seen at juvenile court
Weiss, Minde, Merry, Douglas, & Nemeth (1971)	Hyperactivity	Longitudinal 4-6 yr. follow-up	64	10-18	Matched normals	25% history of antisocial beh. 15% referred to the courts
Hechtman, Weiss, Finklestein, Werner & Benn (1976)	Hyperactivity	Longitudinal 10 yr. follow-up	35	17-24	Matched normals	37% police records compared to 20% of controls; HA's committed significantly more thefts
Weiss, Hechtman, Perlman, Hopkins, & Wener (1979)	Hyperactivity	Longitudinal 10-12 yr. follow-up	75	17-24	Matched normals	Trend for more HA subjects to have had court referral in the past 5 yrs. but no difference within the past year
Hechtman, Weiss, & Perlman (1981)	Hyperactivity	Longitudinal 12 yr. follow-up	53	18-24	Matched normals	Trend for more HA subjects to have court referrals in 5 yr. prior to follow-up, but did not differ in the year prior to follow-up
Laufer (1971) Denhoff (1973)	Hyperactivity	Cross-sectional 10-11 yr. follow-up	66	15-26	----	Difficulty with the law was reported by 30% of sample
Milman (1979)	MBD	Longitudinal 10-20 yr. follow-up	73	15-23	----	23% of sample received a primary diagnosis of antisocial personality disorder

Table 2 (cont'd)

Prospective Studies of ADHD Children

Authors	Diagnosis	Methodology	# ADHD Ss	Age Range	Controls	Outcome
Loney, Whaley, Klahn, Kosier, & Conboy (1981)	Hyperactivity	Longitudinal 10-12 yr. follow-up	22	21	Brothers	40% of sample met the combined criteria for diagnosis of anti-social personality disorder
Huessy, Metoyer, & Townsend (1974)	Hyperactivity	Cross-sectional 8-10 yr. follow-up	84	9-24	Statistics based on general population	The group as a whole was 20 times more likely to be institutionalized in a facility for delinquent youths
Ackerman, Dykman, & Peters (1977)	Hyperactivity-Learning Disabled	Longitudinal 3-7 yr. follow-up	23	14	Normoactive & hypoactive learning disabled & norm. controls	One half the HA sample experienced major conflict with authority whereas none of the other groups showed such problems
Satterfield, Hoppe, & Schell (1982)	Attention Deficit Disorder (ADHD)	Longitudinal 8-10 yr. follow-up	102	14-21	Normal adolescents	ADHD adolescents had greater rates of single & multiple serious offenses & 19 times the institutionalization rate for delinquency
Morris, Escoll, & Wexler (1956)	"Aggressive Behaviour Disorder of Childhood"	Longitudinal 30 yr. follow-up	68	Adulthood	Children with "post-encephalitic behaviour disturbance"	7 had criminal records at follow-up

Table 3

Symptoms of Hyperactive Children and Children in Adulthood Diagnosed as
Psychopaths

Childhood symptoms significantly related to adult psychopathy ^a	Those showing symptom as children later diagnosed psychopathic personality ^a %	Adult psychopaths who had symptom in childhood ^a %	Hyperactive children showing symptom	
			Young HAC ^b %	Teenage HAC ^c %
Pathological lying	39	26	43	83
Lack of guilt	38	32	--	--
Sexual perversion	37	32	--	--
Impulsive	35	38	59	84
Truant	34	66	--	--
Runaway	33	65	--	18
Physical aggression	32	44	59	13
Premarital intercourse	31	28	--	--
Theft	31	28	--	--
Incorrigible	30	80	57	83
Stays out late	30	54	--	--
Bad associates	30	56	--	--
Reckless	29	35	49	22
Slovenly	34	32	--	--
Enuresis	29	32	43	13

^a Data from Robins (1966); 1966 The Williams & Wilkins Co., Baltimore

^b Data from Stewart et al. (1966)

^c Data from Mendelson et al. (1971); 1971 The Williams & Wilkins Co., Baltimore

Stewart, in a study of 37 HA children, observed a high frequency of 7 of Robin's 16 symptoms. Similarly, based on findings of 83 HA juveniles, 9 of the 10 antisocial symptoms reported by Mendelson are identical with 9 of Robin's childhood symptoms. Moreover, the frequency of antisocial symptoms found at follow-up in Mendelson's HA group was striking, and can be observed to be even higher than reported in Robin's study which was based on children who were later diagnosed as psychopathic in adulthood. For example, nearly 60 percent had had some contact with the law, 18 percent on three or more occasions. Close to a quarter of the sample had been referred to juvenile court. Over one third had threatened to kill their parents, 15 percent had set fires and seven percent carried weapons. Twenty-two percent of the HA children had long histories of such behaviour and seemed liable to be sociopathic as adults.

This finding of serious delinquent behaviour in a subset of teenage HA children is further supported by the longitudinal studies conducted by the Montreal group (Hechtman, Weiss, Finklestein, Werner & Benn, 1976; Hechtman, Weiss & Perlman, 1981; Minde, Weiss & Mendelson, 1972; Weiss, Hechtman, Perlman, Hopkins & Wener, 1979; Weiss, Minde, Werry, Douglas & Nemeth, 1971). Employing comprehensive interviews, rating scales and various psychometric evaluative techniques at initial and follow-up examinations, follow-up at four to five years (Weiss et al., 1971) revealed that fully one quarter of a sample of 64 HA children had a history of antisocial behaviour, with up to 15

percent having been referred to the courts. Later reports from this group (Hechtman et al., 1976; Weiss et al., 1979) indicated that the HA adolescent probands demonstrated significantly more impulsive personality traits, but that only a minority continued to be engaged in serious antisocial behaviour. The most recent data at 12 year follow-up (Hechtman et al., 1981) showed the HA adolescent group as having more court referrals in the five year period prior to follow-up, but this group did not differ from matched controls on this measure in the year immediately prior to follow-up. These later findings present a picture of antisocial behaviour problems as peaking in the high school period and dropping off thereafter, and is at variance with other prospective research suggesting that antisocial symptoms observed in adolescence continue into adulthood (Laufer, 1971; Denhoff, 1973; Loney, Whaley, Klahn, Kosier & Conboy, 1981; Milman, 1979). However, Hechtman and her coworkers note that a small subgroup of the HA children in their study seem to have more negative outcome with heavier involvement in drug use and antisocial behaviour.

Recently, Satterfield, Hoppe and Schell (1982) reported striking differences between the offender rates of ADDH adolescents and normal controls. The ADDH probands examined at 8 to 10 year follow-up had significantly greater rates of single and multiple serious offences, and 19 times the institutionalization rate for delinquency than controls. This latter finding is consistent with earlier research by Huessey,

Metoyer and Townsend (1974).

Similarly, Sassone, Lambert and Sandoval (1981) contributed findings of delinquency rates of 20 percent among 59 HA boys as compared to four percent of controls. In addition, 10 percent of the hyperactives, but virtually none of the controls, had been committed to a juvenile facility or were on probation.

Despite wide variations in composition of control groups, assessment procedures and methodological rigor, the various outcome studies on ADDH children followed into adolescence and early adulthood show a remarkable consistency in results. The weight of the evidence prompted Cantwell, in his comprehensive reviews of the outcome literature (1975, 1978), to conclude that up to 25 percent of ADDH children exhibit serious delinquent behaviour in adolescence, and that psychopathy is a frequent psychiatric outcome in adulthood.

Thorley (1984) recently reviewed 24 outcome studies on ADDH children, taking into careful consideration the presence or absence of adequate controls and sampling methodology. He reports similar conclusions of an association of adolescence and early adulthood with antisocial behaviour in ADDH probands. Thorley criticizes, however, the exclusive reliance on normal and "supernormal" control groups in prospective follow-up research, arguing that the available evidence does not enable conclusions as to whether the antisocial outcome observed in ADDH children reflects uniquely definitive features of the syndrome or whether such outcome is a function of associated

aspects of psychiatric pathology. Thorley fails to note, however, that the retrospective outcome studies employing matched psychiatric controls (Morrison, 1979, 1980; Offord et al., 1979; Virkkunen et al., 1976), consistently reported significantly more delinquent behaviour and sociopathy in ADDH adolescents and adults than in controls. Furthermore, when the psychiatric comparison groups included primary features of conduct disorder and/or unsociability found to be common complicating factors of the ADDH syndrome (DSM-III, 1980) and believed to play a major role in accounting for poor outcome (August, Stewart & Holmes, 1979; Milich & Loney, 1979), ADDH adolescents showed significantly greater severity of antisocial symptomatology with evidence of earlier onset of criminal acts as compared to non-ADDH delinquent counterparts (Offord et al., 1979). These findings suggest that within a group of adolescent delinquents, the identification of a subgroup on the basis of reported ADDH also identifies a subgroup with poorer outcome and prognosis.

In summary, although many outcome studies on hyperactive children may be criticized on methodological grounds, the convergence of findings of antisocial behaviour from research using different methodologies is overwhelming. Though the course of the ADDH syndrome seems to be variable, the various retrospective and prospective outcome evidence unequivocally identify childhood ADDH as a risk factor for antisocial outcome in adolescence and early adulthood. It is clear that the

increased risk is relative to normal peers, and further research is required to establish whether the risk is also relative to other psychiatric groups.

The present state of the field therefore argues for outcome studies which include psychiatric controls, preferably with primary features of delinquency and/or unsociability. The Offord research (Offord et al., 1979) indicate that HA-delinquent children have worse outcome than non-HA delinquent counterparts, and the important implications of this study invite further replication. The present research was therefore designed to study further the relationship between childhood ADDH and antisocial outcome by comparing ADDH adolescent offenders with adolescent offenders who do not have ADDH. The question of whether antisocial outcome in ADDH children is linked with the primary features of the ADDH syndrome, or whether it is a function of associated factors such as aggression or family support, was addressed. Recent research examining the association between childhood hyperactivity and antisocial behaviour has begun to address this issue.

Toward the Identification of Factors Associated With Antisocial Outcome

One strategy for elucidating the relationship between ADDH and poor outcome has been to examine which symptom dimensions of the syndrome are associated with criminal behaviour in later

life.

Ackerman, Dykman and Peters (1977) examined the relative contribution of learning disability versus hyperactivity to the development of antisocial behaviour. These authors studied learning disabled adolescents who differed with respect to the diagnosis of hyperactivity and observed that only the hyperactive subgroup experienced major conflict with the law. Similarly, Virkkunen and Nuutila (1976) found that symptoms of hyperactivity, rather than specific reading retardation, was associated with criminal conduct in adolescence. This data suggest that hyperactivity predicts delinquent outcome. However, other studies reviewed earlier which included attempts at identifying indicators of outcome (Mendelson et al., 1971; Weiss et al., 1971) found that childhood hyperactivity was generally unimportant as a prognostic indicator. Recent research seem to support this latter finding.

For example, Stewart and his coworkers (August & Stewart, 1982; August, Stewart & Holmes, 1983; Stewart, Cummings, Singer & DeBlois, 1981) have investigated the empirical and predictive validity of homogeneous subtype classification based on hyperactive and conduct disorder symptomatology. These authors (August et al., 1982) utilized a system of six different sources to identify a group of 125 hyperactive boys with pervasive problems of hyperactivity, and within this ADDH group, compared those with and without associated conduct disorder. Findings supported the distinction between the two groups. A later study

(August et al., 1983) examined the predictive utility of this subgroup classification by comparing 22 of the pure hyperactive boys with 30 of the hyperactive-unsocialized aggressive boys of the original sample after a four year time period. Results at follow-up showed that aggressive and antisocial problems continued in the hyperactive-conduct disordered group, whereas such problems were much less marked in the pure hyperactive group, who continued to demonstrate only inattentive and impulsive behaviours. The authors suggest that childhood aggression may operate as a mediator of antisocial outcome within the ADDH population, and that the criminal conduct observed in earlier follow-up studies may be a consequence of initial levels of associated aggression and unsociability rather than of hyperactivity. Further corroboration for this argument comes from family research; one study found the presence of antisocial personality in the parents of ADDH probands to be associated with the childrens' conduct disorder rather than with their hyperactivity (Stewart, DeBlois & Cummings, 1980), in contrast to the findings of earlier family studies which failed to include a hyperactivity-conduct disorder distinction (Cantwell, 1972; Morrison & Stewart, 1971, 1973).

The importance of childhood aggression to adolescent outcome for the ADDH child is further supported by the extensive research contributions of Loney and her associates (Langhorne & Loney, 1979; Loney, Kramer & Milich, 1981; Loney, Langhorne & Paternite, 1978; Loney, Langhorne, Paternite, Whaley-Klahn,

Blair-Broeker & Hacker, 1980; Paternite & Loney, 1980). This research group's focus on childhood aggression as a potential predictor variable stemmed from earlier factor analytic work of the primary and secondary symptomatology at referral of 135 hyperactive boys (Paternite, Loney & Langhorne, 1976; Loney et al., 1978). Factor analyses yielded two relatively independent symptom dimensions: the Hyperactivity/Inattention symptom factor which was found to correlate significantly with poor social competence, impulsivity, visual motor difficulties and favourable response to stimulant drug treatment, and the Aggression symptom factor which was observed to be systematically related to age, socioeconomic status, parenting styles and delinquent behaviour in adolescence. Milich, Loney and Landau (1982) have since replicated these findings on the independence of the hyperactivity and aggression symptom dimensions.

The next step involved a series of studies employing multiple regression analyses to determine the relative importance of identified symptom and environmental variables in predicting outcome at five to six year follow-up. The first report (Loney et al., 1976) identified the Aggression factor, socioeconomic status (SES) and paternal parenting style as the predictors making the greatest contribution to unsatisfactory outcome in terms of symptom severity at follow-up. Further analyses (Paternite & Loney, 1980) indicated that childhood aggression was the largest single predictor of aggressive and

hyperactive symptomatology at follow-up, and that environmental variables contributed further to a moderate degree. Core hyperactive symptomatology at referral, however, only predicted variation in academic achievement. Later findings (Loney et al., 1981) showed that aggression at referral combined with ecological (urban residence) and familial (family size and paternal parenting style) variables predicted delinquent outcome in adolescence. A preliminary report on the predictive potential of adolescent measures to adult outcome (Hechtman, Weiss, Perlman, & Ansel, 1980) also identified aggression as the largest single outcome predictor, but always in conjunction with other variables.

The Loney research data suggest that the influence of associated aggression is to a large degree empirically independent of primary ADDH symptomatology, with the expected links between ADDH and adolescent delinquency being absent. However, since the design did not include non-hyperactive comparison groups, it is possible, as Thorley (1984) noted, that there remained little for the Hyperactivity factor to predict. Since all subjects scored high on this dimension, the range of variability would have been severely curtailed, limiting its predictive power. Certainly, other research (Schachar, Rutter & Smith, 1981) has identified poor outcome to be associated with primary ADDH symptomatology, if pervasive, rather than with the factor of associated conduct disturbance per se.

Further research is needed to clarify the differential contributions of both primary and secondary ADDH symptom dimensions as they pertain to delinquent outcome. To date, both child symptom factors and socioecological environment measures (familial and SES variables) have shown predictive potential in the ADDH population. The purpose of the present study, therefore, was to examine the relative contribution of ADDH symptom variables, SES and familial variables in explaining variation in antisocial outcome in a sample of ADDH and non-ADDH delinquent adolescents.

Impulsivity: The Common Denominator Between ADDH and Antisocial Outcome?

Although the prominent role of deficient impulse control in the ADDH syndrome is now generally agreed upon (Douglas, 1972; Kinsbourne, 1975, 1977; Laufer, Denhoff & Solomons, 1957; Loney, 1980a, 1980b; Weiss & Hechtman, 1979) and recognized as a diagnostic criterion (DSM-111, 1980), examination of the outcome literature on ADDH children finds inadequate investigation of its possible role in predicting or explaining poor outcome. Core impulsivity symptoms are typically subsumed under broad symptom clusters or the general category of ADDH symptomatology. Outcome is subsequently attributed or not attributed to the sample's hyperactivity. This emphasis on hyperactivity is problematic in view of evidence that overactivity diminishes with age (Ackerman

et al., 1977; August et al., 1983; Bradley, 1957; Laufer & Denhoff, 1962; Routh, 1978; Rutter, 1968; Minde, Weiss & Mendelson, 1972; Weiss et al., 1971; Weiss & Hechtman, 1979), in contrast to findings that inattention and impulsivity remain stable over time (August et al., 1983; Borland et al., 1976; Hechtman et al., 1976; Mendelson et al., 1971; Minde, 1972; Weiss et al., 1971, 1978, 1979). It has been suggested elsewhere (Freeman, 1978; Freeman & Kinsbourne, under review; Freeman & Reznick, in press) that poor impulse control or disinhibition (Gorenstein et al., 1980) may be the common denominator between childhood ADDH and antisocial outcome, a suggestion which warrants further investigation.

The proposition that ADDH and antisocial behaviour may be related by virtue of a common core of impulsivity is based on clinical and experimental literature suggesting that childhood hyperactivity and adult psychopathy share, at the behavioural level of analysis, a basic mechanism of deficient impulse control. For example, the descriptive literature on childhood ADDH stresses the central role of impulsivity and judgement deficits (Blunder, Spring & Greenberg, 1974; Douglas, 1972; Kinsbourne, 1975; Renshaw, 1974; Wender & Eisenberg, 1974). Theoretical accounts have emphasized the hyperkinetic child's unresponsiveness to environmental constraints (Conners, 1969; Renshaw, 1974), inability to delay gratification (Denhoff, 1973; Laufer & Denhoff, 1957; Sandoval, Lambert & Yandell, 1976; Whalen & Henker, 1976), poor resistance to temptation (Douglas,

1972), failure to evaluate all aspects of a situation (Campbell, Schleifer, Weiss & Perlman, 1971), and risk taking or accident-proneness (Mannheimer & Mellinger, 1967; Stewart, Thach & Freidin, 1970). Moreover, clinical and empirical research on ADDH indicate that impulsivity has adverse effects on social (Douglas, 1972; Douglas & Peters, 1979; Green, Vosk, Forehand & Beck, 1980; Kinsbourne, 1975; Mendelson et al, 1971; Riddle & Rapoport, 1976; Weiss et al., 1971) and moral (Schleifer & Douglas, 1973) competence.

Similarly, the clinical view of antisocial behaviour supports the central role of impaired impulse control in this context (Craft, 1966; DSM-11, 1968; Maher, 1966; McCord & McCord, 1956; Millon, 1981). Impulsivity manifested as inability to plan and to delay gratification (Albert, Brigante & Chase, 1959; Cleckley, 1976; Hare, 1970), failure to learn from punishment (Cleckley, 1976; Eysenck, 1964; Gray & Hutchinson, 1964), inadequate attention to environmental consequences (Buss, 1966), and excessive risk taking (Noyes, 1955) have been cited as primary clinical features of antisocial personality disorder.

It has further been suggested that the multidimensional nature of both childhood ADDH and adult psychopathy may be best understood as manifestations of the same general mode of functioning: the impulsive style. Kinsbourne (1975) contends that excessive mobility in the hyperactive child syndrome is a variable and insignificant component that is secondary to the component of impulsivity. He offers the following:

"The basic mechanism, at the behavioural level, of organic hyperactivity is the impulsive style: impulsive style in movement, making for excessive motor activity which gives the condition its name; impulsive style in shifting attention, making for the distractibility which is actually much more important; an impulsive style in social relating, making for social ineptness, which is just as important" (p. 657).

Kinsbourne has since (Kinsbourne, 1977; Freeman & Kinsbourne, under review) extended his argument to include the relationship of impulsivity to antisocial behaviour in the ADDH population.

In the same vein, Shapiro (1965) has argued that the psychopath's antisocial behaviour is a consequence of the impulsive style.

"It seems likely that a good deal if not all of the "antisocial" behaviour of psychopaths may thus be understood not as the direct or simple consequence of a deficiency of moral values or conscience, but as following rather, together with that deficiency, from extreme and special forms of various features of the impulsive style - egocentric, concrete viewpoint, general lack of aims and values much beyond immediate, tangible gain, and quick, nondeliberate modes of action" (p. 168).

Impaired impulse control expressed as precipitous action, intractability to discipline or punishment, inability to delay gratification and risk taking has therefore been reported in the clinical literature on both childhood ADDH and adult psychopathy. The importance of impulsivity to both disorders is clearly recognized; it is therefore surprising that the empirical investigation of this phenomenon in both clinical groups has not been more thorough.

The most extensively studied of the various aspects of impulsivity in the ADDH population is the dimension of cognitive tempo. Kagan and his associates have introduced (Kagan, Rosman,

Day, Albert & Phillips, 1964) and studied (Kagan, 1965a, 1965b, 1966; Kagan, Moss & Sigel, 1963; Kagan, Pearson & Welch, 1966) a construct of cognitive style they call reflection-impulsivity, which is measured by Kagan's Matching Familiar Figures Test (MFFT) (Kagan et al., 1964). This cognitive dimension appears to contrast individuals who take adequate time and are cautious in decision making (reflectives) with individuals who act without taking sufficient pause to consider and evaluate alternatives (impulsives). Studies using the MFFT (Brown, 1982; Campbell, Douglas & Morgenstern, 1971; Juliano, 1974) have uniformly reported impulsive responding in hyperactive children relative to normal peers. Other work which has examined impulsive cognitive tempo in this clinical group (Gordon & Oshman, 1981; Loney, Comly & Simon, 1975; Mirsky & Rosvold, 1963; Palkes, Stewart & Freedman, 1971; Palkes, Stewart & Kahana, 1968; Sykes, 1969; Sykes, Douglas & Morgenstern, 1972; Sykes, Douglas, Weiss & Minde, 1971) corroborate this finding. Investigations of the cognitive tempo dimension in delinquent and psychopathic populations, which have typically examined performance on the Porteus Maze Test (Porteus, 1959), similarly report more carelessness and impulsiveness in decision-making as compared to controls (Docter & Winder, 1954; Fooks & Thomas, 1957; Schalling & Levander, 1964; Schalling & Rosen, 1968).

The impulse control dimension has also been addressed from the perspective of the outcome of an action or decision rather than from the latency and accuracy of the response. One

situation, labelled the failure to delay gratification (Mischel, 1958), occurs when an individual chooses an immediately available, smaller reward over a delayed but larger reward. What experimental documentation exists on this feature of impulsivity in both ADDH and psychopathic groups is equivocal. Mann (1973) observed a strong relationship between impulsivity as measured by the MFFT and failure to delay gratification; Ward (1973), by contrast, reported no such relationship for impulsive and reflective preschoolers. Similarly, a review of the experimental literature on antisocial behaviour yielded only four studies (Blanchard, Bassett & Koshland, 1977; Gluck, 1972; Unikel & Blanchard, 1973; Widom, 1977) which show inconsistent results. Adequate empirical investigation of the failure to delay gratification in both clinical groups is thus so far lacking.

Impulsivity manifested as the inability to avoid or learn from punishment has also not received adequate attention in the experimental literature on ADDH. Of the three relevant studies conducted in this area (Freeman, 1978; Freeman & Kinsbourne, under review; Firestone, 1975; Firestone & Douglas, 1975; Worland, 1974), two are methodologically weak and fail to support clinical accounts of this phenomenon in hyperkinetic children (Firestone, 1975; Firestone & Douglas, 1975; Worland, 1974). Freeman (Freeman, 1978; Freeman et al., in review), however, attempted to quantify avoidance learning performance in ADDH children using a variant of the Lykken Maze (Lykken, 1957) originally designed for the study of antisocial populations. The

results of both studies strongly supported the view that ADDH children are less responsive to the negative consequences of their actions relative to normal peers. In contrast to the field of childhood hyperactivity, an avoidance learning deficit has been well documented in psychopaths (Lykken, 1957; Schacter & Latane, 1964; Schoenherr, 1964; Schmauk, 1970), though data suggest that diminished responsiveness to punishment is influenced by the probability and type of reinforcement (Fairweather, 1954; Painting, 1961; Schmauk, 1970; Siegel, 1978).

Another aspect of impulsive behaviour which involves features of the inability to delay gratification and insensitivity to negative outcome is risk taking. A review of the empirical research on risk taking in ADDH children located only three relevant studies (Freeman, 1978; Freeman & Reznick, in press; Mannheimer & Mellinger, 1967; Stewart, Thach & Freidin, 1970), two of which suggest an association between accident-proneness, risk taking and hyperactive symptomatology (Mannheimer et al, 1967; Stewart et al, 1970). The research by Freeman (1978; Freeman et al., in press) is the only experimental demonstration of risk taking in the ADDH population. On the basis of Payne's (1973) model of risk taking which proposes that individuals take risks as a function of the probability and magnitude of expected negative and positive outcomes, Freeman hypothesized that hyperactive children, if they are less responsive to aversive consequences, should take

greater risks than normal peers. Allowing for the possibility that the nature of the aversive event plays a role in risk taking behaviour, Freeman compared the risk taking of hyperactive children to normal controls under two conditions: threat of loss of monetary reward and threat of electric shock. Findings indicated a significant effect for type of risk; the risk taking behaviour of both groups did not differ in the loss of reward condition, however, the hyperactive subjects showed significantly less shock avoidance than did normal controls. Interestingly, this pattern of findings is congruent with the results of a similar study of impulse control in antisocial adults (Schmauk, 1970), in which subjects were less sensitive to the threat of aversive shock but increased their avoidance behaviour toward normal levels in the monetary loss condition. Other data support this finding of increased risk taking in psychopaths (Gluck, 1972; Kraus, Robinson & Cauthen, 1972; Stefanowicz & Hunnuna, 1971; Steiner, 1972).

The clinical and experimental literature reviewed thus far on the various manifestations of impulsivity that are common to ADDH and sociopathy are congruent with findings of outcome research suggesting a developmental association between the two disorders. The data further suggest that it is the impulsivity component of the ADDH syndrome that is linked to antisocial outcome. To date, adequate experimental documentation of impulsivity in ADDH children is lacking, and the potential importance of this variable in accounting for delinquent outcome

has not been examined. Investigation in this area was therefore warranted.

The present study thus included, as part of the overall design, multiple measures of impulsive behaviour to identify the contexts in which impaired impulse control plays a role in ADDH and antisocial behaviour. In specific, three features of impulsivity were examined: (1) cognitive tempo, (2) failure to delay gratification, and (3) risk taking behaviour. Subsequent factor analysis of the impulsivity data was planned as a means of reducing the number of predictors to be used in multiple regression analyses, and to determine whether the various aspects of impulsivity would cluster together in ways which could be meaningfully related to severity of antisocial outcome in ADDH and non-ADDH delinquents.

Childhood ADDH has been discussed as a risk factor for the development of antisocial behaviour in later life. Factors which may influence antisocial outcome in the ADDH population have been addressed. The purpose of the present study was to explore sources of variation in the observed relationship between ADDH and antisocial behaviour. The design allowed for the investigation of selected child symptom variables, SES, and familial variables identified in previous research as associated with delinquent outcome in adolescence. At present, the possible mediative role of impulsivity has not been linked to ADDH and poor outcome; the inclusion of a separate impulsivity factor in this study is novel. The aim of the present investigation was

two-fold: (1) to compare ADDH delinquent and non-ADDH delinquent groups on selected symptom, familial, and corrections history variables; and (2) to identify and differentiate the relative importance of selected variables in accounting for variation in corrections history.

B. Method

Subjects

Subjects were male adolescents drawn from current caseloads of juvenile probation officers at Corrections Offices in the greater Vancouver and Fraser Valley regions. All subjects had to meet the following criteria: (a) age between 12 and 18 years; (b) an IQ score greater than 75 on a standardized intelligence test; (c) absence of significant neurological or psychiatric disorders outside the ADDH spectrum, such as epilepsy or major psychosis; (d) not presently receiving psychoactive medication; (e) no sex offenses; (f) a parent or guardian had ongoing contact with the child for a minimum of five years time and was available for interviewing; and (g) informed consent from parent or guardian and child.

One hundred and five subjects met criteria for inclusion in the study. A letter describing the nature and purpose of the study was sent to each family. The letter was followed up with a phone call to those families who had not informed their respective corrections office that they chose not to participate. From the pool of 105 male adolescents who met criteria, 52 parents or guardians were subsequently interviewed, 15 families were not located, and 36 families (41%) refused to

participate. The 36 non-participating adolescents did not significantly differ from the 28 participating non-ADDH adolescents on all data variables available to the researcher from the juvenile court records, namely, age and corrections history variables (see Corrections History section). This group was therefore excluded from subsequent analyses.

Data Collection

Diagnosis

A structured interview was administered to the parent or guardian of each subject by the present investigator. The diagnosis of ADDH depended on behavioural criteria identical to those specified in DSM-111 (1980), reproduced in Table 4 below. The symptoms were covered by questions which posed three alternatives to the parent. For example, the parent was asked to compare his child to the average child his age and for each item, to answer whether the behaviour was not true, sometimes or somewhat true, or was very or often true of the child. If the deviant alternative was chosen, the interviewer then asked the parent to explain how much of a problem the behaviour was for the family and the child. The item was rated as deviant only if the parent gave evidence of severity and persistence of the problem. The retrospective assessment of ADDH involved parents

Table 4

Diagnostic Criteria for Attention Deficit Disorder with Hyperactivity

The child displays, for his or her mental and chronological age, signs of developmentally inappropriate inattention, impulsivity, and hyperactivity. The signs must be reported by adults in the child's environment, such as parents and teachers. Because the symptoms are typically variable, they may not be observed directly by the clinician. When the reports of teachers and parents conflict, primary consideration should be given to the teacher reports because of greater familiarity with age-appropriate norms. Symptoms typically worsen in situations that require self-application, as in the classroom. Signs of the disorder may be absent when the child is in a new or a one-to-one situation.

The number of symptoms specified is for children between the ages of eight and ten, the peak age range for referral. In younger children, more severe forms of the symptoms and a greater number of symptoms are usually present. The opposite is true of older children.

- A. Inattention. At least three of the following:
- (1) often fails to finish things he or she starts
 - (2) often doesn't seem to listen
 - (3) easily distracted
 - (4) has difficulty concentrating on schoolwork or other tasks requiring sustained attention
 - (5) has difficulty sticking to a play activity
- B. Impulsivity. At least three of the following:
- (1) often acts before thinking
 - (2) shifts excessively from one activity to another
 - (3) has difficulty organizing work (this not being due to cognitive impairment)
 - (4) needs a lot of supervision
 - (5) frequently calls out in class
 - (6) has difficulty awaiting turn in games or group situations
- C. Hyperactivity. At least two of the following:
- (1) runs about or climbs on things excessively
 - (2) has difficulty sitting still or fidgets excessively
 - (3) has difficulty staying seated
 - (4) moves about excessively during sleep
 - (5) is always "on the go" or acts as if "driven by a motor"
- D. Onset before the age of seven.
- E. Duration of at least six months.
- F. Not due to Schizophrenia, Affective Disorder, or Severe or Profound Mental Retardation.

rating their child's behaviour when the child was between the ages of four and 10 years. The current assessment of ADDH involved reposing the questions to the parent with the instructions to focus on the child's behaviour now and within the past six months.

Data on the psychiatric histories of the subjects was also gathered during the interview. Only subjects who met the operational criteria for both the retrospective and current assessments of ADDH, or who had previously received a diagnosis of childhood hyperactivity by a physician or child psychiatrist, were rated as having ADDH. The present study therefore employed a combination of current, retrospective and follow-back assessment methods for the diagnosis of ADDH in a delinquent population.

Subjects were later divided into ADDH and non-ADDH groups. Twenty-four of the 52 probands were rated as ADDH and 28 were rated as non-ADDH. Complete data was obtained on 15 of the 24 ADDH subjects and the total number of non-ADDH subjects.

The reliability of the diagnosis was tested by comparing the interview data to the subject's score on the Hyperactivity scale of the CBCL filled out by the parent or guardian prior to the interview. Complete agreement between interview and questionnaire results was 67 per cent. The corresponding figures for complete disagreement were 33 per cent. The level of agreement was statistically significant for this comparison.

Symptom Variables

Symptom variable measures of delinquency, aggressiveness, hyperactivity, social competence, suicidal ideation and general behaviour problem were drawn from subjects' ratings on the Youth Self-Report and the Parent-Report forms of the Child Behaviour Checklist (CBCL) (Achenbach & Edelbrock, 1983). In the present study, a composite involvement score for each symptom variable was derived by considering the maximum involvement reported by either informant to be valid. For example, if the parent reported frequent stealing outside the home (item number 82) and the adolescent reported no or occasional stealing, the subject was scored as stealing frequently. Conversely, if the adolescent reported frequent stealing and the parent reported no or occasional stealing, the subject was scored as stealing frequently. The subject's scores on the relevant profile scales of the CBCL were then used as the index of symptom severity. Suicidal ideation was measured as the total score of ratings on the Youth Self-Report and Parent-Report forms for item 91 which reads "I think (or talks) about killing myself (himself)".

The symptom variable of impulsivity was measured from three perspectives. First, subjects were individually administered the Matching Familiar Figures Test (MFFT) (Kagan, Rosman, Day, Albert & Phillips, 1964) as a measure of conceptual tempo. The MFFT is a 12-item match-to-sample task which presents the subject with one standard figure and six fascimiles differing in

one or more details. The subject is required to select from the alternatives the figure that exactly matches the standard, and latency to first response and number of errors overall are recorded. The MFFT shows test-retest reliability correlations ranging from .92 to .98 (see Messer, 1976 for a review).

Risk taking behaviour was measured using a Marble Machine apparatus developed by Freeman (1978), which consists of a marble dispenser, a predetermining counter, a trigger mechanism and a simulated shock generator with two finger electrodes attached. The subject sat facing the apparatus which is housed in a rectangular wooden case, the bottom third of which is a transparent glass hopper. Connected to the machine is a trigger button held by the subject, which when pressed, caused a marble to be released into the hopper. The marbles themselves were not visible to the subject until dispensed into the hopper. The trigger pulse also activates a predetermining counter which was hidden from the subject's view. On top of the machine was a non-functional shock generator prominently labelled DANGER: SHOCK APPARATUS.

Subjects participated individually. The task was described as a gambling or risk taking game in which the object was to drop as many marbles as possible into the hopper since the subject would receive 5 cents for each marble remaining in the hopper at the end of the session. Subjects were told that whenever the trigger button was pressed, a marble would drop into the hopper, and that they would be receiving two trials of

the machine, each under a different set of conditions.

In the threat of loss of monetary reward condition, subjects were told that a number between zero and 20 would be set into the machine and that if the number of their trigger presses exceeded this limit, the machine would automatically withdraw the marbles. This was then demonstrated by the present experimenter. The instructions emphasized that no money would be received for this condition if the subject exceeded the set limit. Subjects were told that they determined the end of the session by deciding when to stop pressing the trigger button. So as to ensure subjects of the randomness of the number set into the machine, each subject selected his own limit for each condition by choosing one out of five envelopes, each containing a card with a number written between zero and 20. The experimenter then pretended to set the counter, which was hidden from the subject's view, to the number written on the card.

In the threat of shock condition, the experimenter explained that the machine would operate in essentially the same way, with the exception that if the subject's number of trigger presses exceeded the numerical limit, he would now receive an electric shock delivered through electrodes attached to his fingers. The experimenter then drew the subject's attention to the shock generator labelled DANGER: SHOCK APPARATUS. The effect of the shock was demonstrated by the experimenter when she 'accidentally' shocked herself prior to attaching the electrodes to the subject's fingers. The envelope selection process was

repeated and the numerical limit set into the machine.

Both the threat of loss of monetary reward and threat of shock contingencies were fictitious. In both conditions, the subject could receive marbles indefinitely without incurring the purported negative contingency. For each subject, the response time for each condition and the latency of last response was recorded. The dependent variables under study were (1) the number of times the subject pressed the trigger button, each trigger press being thought of as a behavioural risk, and (2) response latency as an index of decision time. Order of condition was randomized so that one half of the subjects received the shock condition first and one half of the subjects received the money condition first.

Delay of gratification was measured using Mischel's (1958) delay of gratification paradigm. This involves a simple, direct behavioural choice situation in which the subject is confronted with the option of a less desired, less valued but immediately available outcome as opposed to a more valued and larger outcome which is delayed until a later time. Specifically, subjects were told at the end of the experimental session that they had the option of immediately receiving 5 cents for each marble remaining in the hopper for both trials combined, or that they could receive double the total amount of money if they waited one week and received the money in the mail.

Intelligence

Subjects were individually administered the Quick Test (QT) (Ammons & Ammons, 1962) as a measure of verbal-ceptual IQ. The QT involves the simple matching of stimulus words to achromatic pictures in a multiple card format. This test has been demonstrated to be a reliable estimate of intellectual capacity and to correlate highly with the Full-Range Picture Vocabulary Test (Ammons & Ammons, 1962) and the Weschler Scales (Abidin & Byrne, 1967; Davis & Dizzone, 1970). The QT also shows significant concurrent validity with a variety of aptitude tests for delinquent samples (Gendreau, Wormith, Kennedy & Wass, 1975).

Familial Variables and Family Socioeconomic Status

The structured interview also covered basic demographic data of the family. Family SES was based on the occupation of the parent or guardian with whom the subject was living at the time of participation in the study. When both parents or guardians had jobs, the higher job was used as the SES index. The Pineo and Porter (1967) eight-point socioeconomic scale based on a Canadian sample was used for class ranking.

Data on the types and lengths of various living arrangements of the subject was also gathered. Four family variables were seen as reflecting important changes in the

subject's living situation and are similar to the criteria used in the Loney research series (Kramer & Loney, 1978; Paternite & Loney, 1980). The first variable involves the intactness of the family unit at the time of participation in the study and was operationalized as a simple dichotomy of broken (absence of at least one biological parent) versus intact home (Rankin, 1983). Broken or reconstituted homes were defined as those in which a stepparent(s) or foster parent(s) had replaced a biological parent(s), or those homes in which a child had been adopted at an interval of time following birth. Adoptive parents were rated as biological if the child was adopted at birth. A separate measure of adoptive verses biological family was included.

A third family variable labelled length of time family triad intact enumerates the number of months that all members of the biological or adoptive (adopted at birth only) triad (father, mother and child) lived continuously together.

The fourth family variable specifies the number of intervening changes in living situation for the subject from the time the original family triad was intact to the time of the subject's participation in the study. Changes in living situation were defined in terms of specific adults (e.g. biological parent, stepparent, foster parent, relative or adoptive parent) with whom the child resided and living situation interruptions of more than one month's duration.

Corrections History

Severity of antisocial conduct was measured using subjects' official corrections history. Computerized offense records covering childhood through to the age of the subject as recorded by the Corrections Branch Department, Ministry of the Attorney General, Province of British Columbia, were obtained with the written blanket consent of the administrative youth court judge responsible for the area of study.

The corrections data was analyzed in terms of (a) age of first offense, (b) type of offense, (c) frequency of offenses, (d) number of court appearances, (e) total amount of disposition time in terms of supervised probation and community service hours ordered by the court, and (f) type and total amount of institution time ordered by the court.

Type of offense was classified into two broad-band categories: serious and non-serious offenses. Classification of offense was based on the criteria of Satterfield (Satterfield et al., 1982) and the listing of offenses as either summary or indictable in the Criminal Code (1982). Non-serious offenses included alcohol intoxication, negligent and/or impaired driving, taking an auto without consent, breach of probation, possession of marijuana, vandalism, possession of stolen property, and theft under \$200. Serious offenses included robbery, breaking and entering, theft over \$200, escaping lawful custody, federal arrest for drug trafficking, public fraud,

extortion, arson, possession of a weapon, assault and assault with a weapon and/or intention to harm.

Two narrow-band categories of offense were also included: offenses against persons and offenses against property. The category offenses against persons encompassed a variety of aggressive acts including assault, assault with a weapon and/or intention to harm, and possession of a weapon. Offenses against property included such acts as theft, vandalism, possession of stolen property, arson, and breaking and entering.

C. Results

All data analysis was carried out using BMDP Statistical Software programs (University of California Press, 1981).

Multivariate Analyses

Subject Characteristics

A one-way analysis of variance (ANOVA) was computed for age and IQ scores. No significant differences between the ADDH and non-ADDH groups was observed on these variables. As is shown in Table 5, each group averaged about 16 years of age at the time of participation in the study, and their IQ scores averaged 100. The variable N's in this and the following tables are due to missing data.

Symptom Variables: CBCL

Results of the multivariate analysis of variance (MANOVA) on subject's profile scores on the CBCL are presented in Table 6. A significant multivariate main effect ($F(6,39)=8.26, p<.001$) was obtained. Subsequent univariate analyses indicated that the ADDH subjects displayed considerably more pathology on the CBCL

Table 5

Subject Characteristics¹

Variable	N	Non-ADDH	N	ADDH	Test
Age	28	16.1 \pm 1.4	24	15.7 \pm 1.4	$F(1,50) = 0.70$
IQ	28	99.1 \pm 11.7	16	99.9 \pm 10.4	$F(1,42) = 0.06$

¹ Expressed in means and standard deviations

Table 6

CBCL Symptom Variables¹

Variable ²	N	Non-ADDH	N	ADDH	Test
Delinquency	28	77.9 ± 7.1	18	85.4 ± 6.1	F(1,44) = 13.07***
Aggression	28	67.9 ± 6.2	18	76.3 ± 7.5	F(1,44) = 16.69***
Hyperactivity	28	70.5 ± 6.9	18	75.8 ± 4.9	F(1,44) = 52.18***
Social Competence ³	28	36.3 ± 8.9	15	28.6 ± 4.8	F(1,37) = 9.30**
Behaviour Problem	28	69.5 ± 7.1	18	77.6 ± 6.0	F(1,44) = 15.93***
Suicidal Ideation	28	.25 ± .59	18	.78 ± .88	F(1,44) = 6.01*

¹ Expressed in means and standard deviations

² Expressed in T scores

A T score of 70 represents approximately the 98th percentile.
T scores above 70 are considered to be in the clinical range.

³ T scores below 30 are considered to be in the clinical range.

* $p < .05$

** $p < .005$

*** $p < .001$

than the non-ADDH subjects. Though both groups scored in the deviant range for the delinquency items, the ADDH subjects showed a significantly higher frequency of antisocial symptoms ($p < .001$). The ADDH group reported significantly more suicidal ideation ($p < .05$) on the CBCL than their non-ADDH counterparts. ADDH subjects also showed considerably more disturbance on the Aggression ($p < .001$), Social Competence ($p < .005$) and Total Behaviour Problem ($p < .001$) scales. Perhaps the most salient difference between the diagnostic groups was in the presence of associated aggression. Seventy-eight percent of the ADDH subjects as compared to 18 percent of the non-ADDH subjects scored in the clinical range of the Aggression scale ($X^2 = 16.22$, $p < .001$). The CBCL supported the distinction between the two groups, with subjects rated as ADDH scoring significantly higher on the Hyperactivity scale than subjects rated as non-ADDH ($p < .001$).

Symptom Variables: Impulsivity

A chi square analysis of group scores on choice of delayed versus immediate gratification was not significant. Only 25 percent on the ADDH subjects and 46 percent of the non-ADDH subjects chose the immediate reward. The expectation that the group as a whole, and in particular the ADDH subjects, would choose immediate over delayed gratification was not supported. Group means and standard deviations are presented in Table 7.

Table 7

Impulsivity Symptom Variables¹

Variable	N	Non-ADDH	N	ADDH	Test
Delay of Gratification	28	0.46 \pm 0.5	16	0.25 \pm 0.4	$\chi^2(1) = 1.97$
MFFT Errors	28	6.0 \pm 3.4	16	4.3 \pm 2.1	$F(1,42) = 3.57$
MFFT Latency	28	151 \pm 65	16	166.9 \pm 57	$F(1,42) = 0.66$
MFFT Impulsivity ²	28	.302 \pm 1.9	16	-.529 \pm 1.4	$F(1,42) = 2.36$
MFFT Efficiency ³	28	.116 \pm 1.01	16	-.203 \pm .85	$F(1,42) = 1.13$

¹ Expressed in means and standard deviations

² High, positive scores indicate impulsive performance and high, negative scores indicate reflective performance.

³ High, positive scores indicate inefficient performance and high, negative scores indicate efficient performance.

A one-way ANOVA computed for MFFT error and latency scores yielded no significant differences between the two groups. To further evaluate MFFT performance, impulsivity and efficiency scores were calculated for each subject using the model of Salkind and Wright (1977). Problems with the traditional median-split method of assessment with the MFFT have been discussed elsewhere (Block, Block & Harrington, 1974; Egeland & Weinberg, 1976; Miyakawa, 1981; Salkind et al., 1977). Impulsivity as defined by Salkind et al. is a dimension of individual differences ranging from fast-inaccurate (impulsive) to slow-accurate performance (reflective). Efficiency is defined as a dimension conceptually orthogonal to impulsivity, along which individual differences range from slow-inaccurate (inefficient) to fast accurate (efficient) performance. Impulsivity and efficiency scores were generated from raw latency and error scores by the following formulas:

$$\text{Impulsivity} = Z_i \text{ total errors} - Z_i \text{ mean latency}$$

$$\text{Efficiency} = Z_i \text{ total errors} + Z_i \text{ mean latency}$$

Where Z_i total errors = a standard score for the i th individual's total errors, and Z_i mean latency = a standard score for the i th individual's mean latency.

Univariate analyses calculated for MFFT Impulsivity and Efficiency scores did not reveal significant differences between the two groups. Table 7 which displays this data shows that the non-ADDH subjects tended toward impulsive and inefficient performance relative to the performance of the ADDH subjects. In

contrast, the ADDH group tended toward reflective and efficient performance relative to the non-ADDH group. However, considerable within-group variability is present and the absence of population norms with which to compare these groups precludes classification of performance.

The data of the risk taking experiment was analyzed using a one-between and two-within factor split plot MANOVA, with diagnostic group as the between-group factor and type of risk (loss of monetary reward, threat of electric shock) and type of dependent measure (number of trigger presses, total response time, latency of last response) as the repeated measures. A multivariate main effect for type of dependent measure ($F(2,40)=178.5, p < .001$) and a risk x group interaction ($F(1,41)=6.49, p < .05$) were obtained. The multivariate test of the risk x measure x group interaction was not significant.

The risk x group interaction was analyzed using one-way ANOVA's with repeated measures computed for each dependent variable. Analyses revealed a significant group main effect for latency of last response ($F(1,41)=4.00, p < .05$) and a group x trigger press interaction ($F(1,41)=8.33, p < .01$). A group x total response time interaction that approached significance was also observed, $F(1,41)=3.45, p < .07$. T tests comparing group means on these dependent measures indicated that no significant differences due to group occurred under the threat of loss of monetary reward condition. Under the threat of shock condition, however, ADDH subjects exhibited a significantly shorter latency

of last response ($p < .05$) and a tendency toward shorter response time ($p < .08$) than non-ADDH subjects. Within group differences were also observed. The ADDH group exhibited a significant reduction in the number of risks taken during the threat of shock condition ($p < .025$) in comparison to the loss of reward condition. Similarly, the non-ADDH group displayed a reduction in total response time under the threat of shock condition as compared to the threat of loss of monetary reward condition, though this finding only approached significance ($p < .08$). This data indicate that under the threat of loss of reward condition, both groups of delinquent subjects took approximately the same number of risks and displayed similar decision time. Under the threat of shock condition, ADDH subjects reduced their risk taking, but were more impulsive than non-ADDH subjects in decision time. In contrast, the non-ADDH subjects did not show shock avoidance in terms of the number of risks taken, but were more reflective and cautious in their decision-making than their ADDH counterparts. These results are presented in Table 8 and Figures 1, 2 and 3.

Familial Variables and Family SES

The MANOVA calculated for familial variables yielded a significant multivariate main effect, $F(5,46)=4.61$, $p < .005$). Subsequent univariate analyses indicated that ADDH subjects experienced significantly more intervening changes in living

Table 8

Number of Risks Taken and Response Time¹

	Non-ADDH		ADDH	
	Money	Shock	Money	Shock
Number Risks	14.4 \pm 4.4	15.7 \pm 5.2	16.0 \pm 3.8	12.9 \pm 7.6
Total Response Time	30.6 \pm 15.9	38.0 \pm 19.9	29.7 \pm 20.3	27.1 \pm 2
Latency of Last Response	3.1 \pm 3.0	4.0 \pm 4.1	2.3 \pm 1.4	1.7 \pm 1

¹ Expressed in means and standard deviations

of last response ($p < .05$) and a tendency toward shorter response time ($p < .08$) than non-ADDH subjects. Within group differences were also observed. The ADDH group exhibited a significant reduction in the number of risks taken during the threat of shock condition ($p < .025$) in comparison to the loss of reward condition. Similarly, the non-ADDH group displayed a reduction in total response time under the threat of shock condition as compared to the threat of loss of monetary reward condition, though this finding only approached significance ($p < .08$). This data indicate that under the threat of loss of reward condition, both groups of delinquent subjects took approximately the same number of risks and displayed similar decision time. Under the threat of shock condition, ADDH subjects reduced their risk taking, but were more impulsive than non-ADDH subjects in decision time. In contrast, the non-ADDH subjects did not show shock avoidance in terms of the number of risks taken, but were more reflective and cautious in their decision-making than their ADDH counterparts. These results are presented in Table 8 and Figures 1, 2 and 3.

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Figure 2

Mean Response Time
as a Function of
Diagnostic Group and Type of Risk

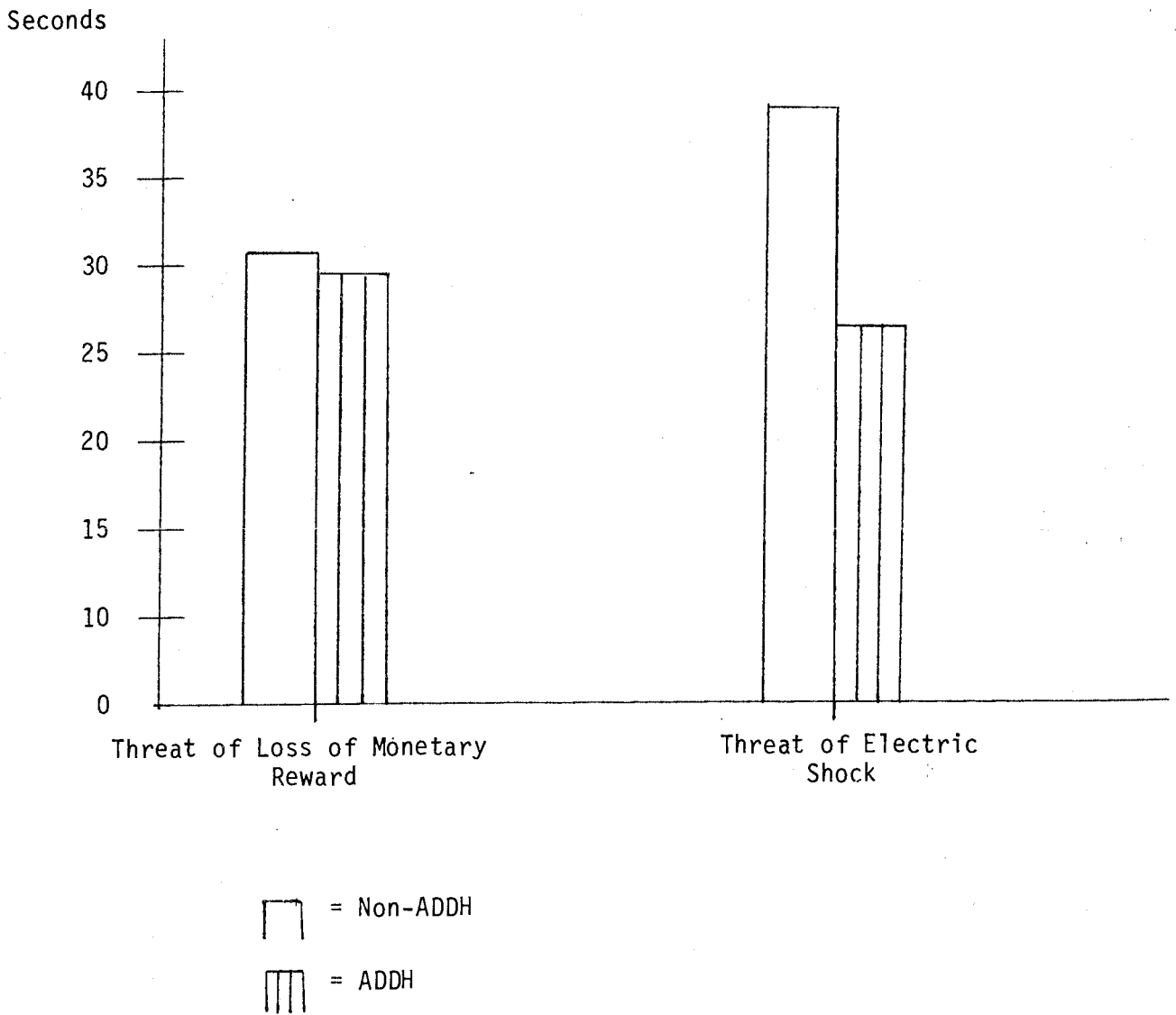
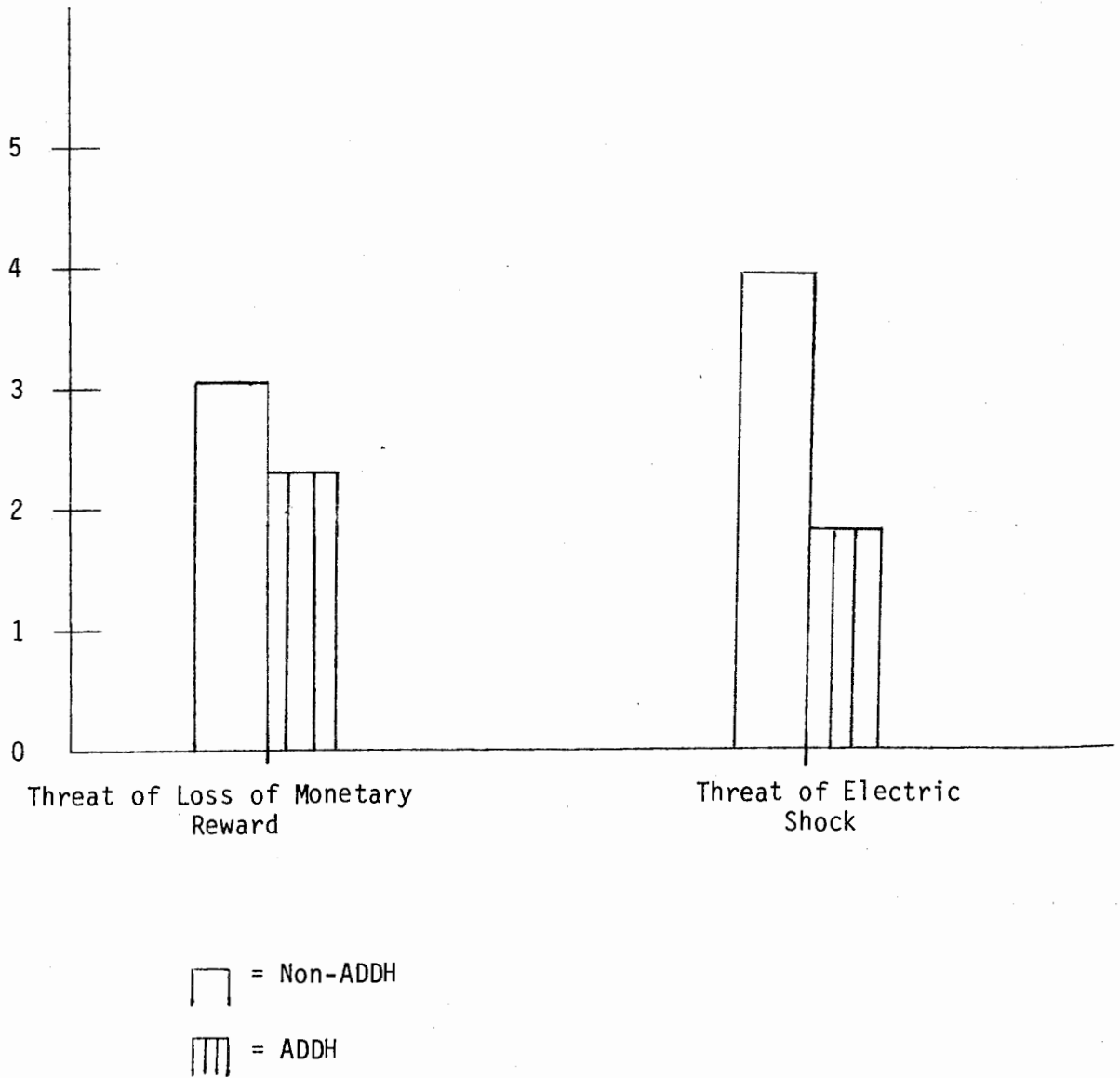


Figure 3

Mean Latency of Last Response as a Function
of Diagnostic Group and Type of Risk

Seconds



situation ($p < .001$), and had families who lived continuously together for significantly fewer months ($p < .05$) than did non-ADDH subjects. No significant differences between the two groups were observed for the adoptive verses biological family, intactness of the family unit, and family SES variables. The average SES ranking for each group fell near the mid-point of the scale. Table 9 summarizes this data.

Corrections History

Table 10 provides the comparison of official corrections history between the ADDH and non-ADDH groups. Multivariate analysis of this data yielded a significant multivariate main effect, $F(9,42) = 2.69$, $p < .05$. The univariate tests revealed group differences on each corrections history variable, with the exception of the offense against persons and amount of jailed time categories. The ADDH delinquents committed, on average, over three times more non-serious ($p < .01$) and serious offenses ($p < .001$), as well as three times more offenses against property ($p < .001$) than did the non-ADDH delinquents. Similarly, subjects in the ADDH group averaged three times more court appearances ($p < .005$) and twice the amount of disposition time ($p < .001$) than subjects in the non-ADDH group. Most striking are the differences in rate of institutionalization for delinquent behaviour. ADDH delinquents averaged eight more times total institution time ($p < .005$) than their non-ADDH counterparts. This

Table 9

Familial Variables and Family SES¹

Variable	N	Non-ADDH	N	ADDH	Test
Adoptive vs. Biological	28	.07 ± .26	24	.17 ± .38	$F(1,50) = 1.13$
Intactness of Family Unit	28	.36 ± .49	24	.29 ± .46	$F(1,50) = 0.24$
Number of Living Changes	28	1.04 ± 1.32	24	4.08 ± 3.75	$F(1,50) = 16.19^{**}$
Length of Time Triad Intact ²	28	137.08 ± 70.35	24	91.45 ± 72.9	$F(1,50) = 5.25^*$
SES	28	3.9 ± 1.8	24	3.6 ± 2.4	$F(1,50) = 0.42$

¹ Expressed in means and standard deviations
² Expressed in months

* $p < .05$

** $p < .001$

Table 10

Corrections History Variables¹

Variable	N	Non-ADDH	N	ADDH	Test
Nonserious Offenses	28	1.15 ± 1.3	24	3.9 ± 3.5	F(1,50) = 7.30*
Serious Offences	28	1.11 ± 1.0	24	3.5 ± 3.2	F(1,50) = 13.87***
Total Offenses	28	2.25 ± 1.7	24	6.6 ± 5.8	F(1,50) = 13.71***
Offenses Against Persons	28	0.2 ± .95	24	0.4 ± .88	F(1,50) = 0.39
Offenses Against Property	28	1.4 ± .79	24	4.1 ± 3.3	F(1,50) = 16.81***
Court Appearances	28	1.9 ± 1.4	24	4.5 ± 3.9	F(1,50) = 11.32**
Disposition Time ²	28	20.4 ± 14.0	24	43.4 ± 30.6	F(1,50) = 12.73***
Remand Time ³	28	0.25 ± 1.3	24	18.1 ± 31.1	F(1,50) = 9.24**
Jailed Time ³	28	3.0 ± 8.3	24	8.9 ± 20.3	F(1,50) = 1.97
Total Institution Time ³	28	3.3 ± 8.3	24	26.9 ± 41.9	F(1,50) = 8.60**
Age First Offense ⁴	28	15.7 ± 1.13	24	14.5 ± 1.5	F(1,50) = 9.01**

¹ Expressed in means and standard deviations

² Expressed in number of months

³ Expressed in number of days

⁴ Expressed in number of years

* p < .01

** p < .005

*** p < .001

difference was accounted for by 700 times the amount of remand time ($p < .005$) in the ADDH group. ADDH subjects were also significantly younger ($p < .005$) (mean age 14.5 years) than non-ADDH subjects (mean age 15.7 years) at the time of their first court appearance.

Factor Analyses

Familial Variables

A principal component analysis of the familial variables was performed as a means of reducing the number of predictor variables to be used in subsequent multiple regression analyses. Only subjects with complete data on variables used in regression analyses ($N=43$) were analyzed. From the four familial variables, two factors were extracted. Of these, the first had an eigenvalue greater than 2.0 while the eigenvalue for the second factor was 1.0. Therefore, only the first factor, which accounted for 55 percent of the total variance, was retained for rotation to a varimax solution. The rotated one-factor solution is presented in Table 11.

The factor loadings indicated that the factor-defining variables were intactness of the family unit, number of living changes, and length of time triad was intact. The adoptive versus biological family variable bore no relationship to this factor. Intactness of the family unit and length of time triad

Table 11

Principal Components of Familial Data

Variable	Factor 1
Adoptive vs. Biological	.01
Intactness of Family Unit	.88
Number of Living Changes	-.80
Length of Time Triad Intact	.88
Variance explained	2.19
Cumulative proportion of total variance	.55

was intact each had positive loadings in excess of .87, while number of living changes was negatively related with a loading of -.80. This factor appeared to be describing a dimension of family stability. The combining weights of this factor were observed to be close to the optimal factor score weights. Subject's normalized standard scores on the variables with significant loadings on this factor were therefore summated to obtain factor scores. A composite score labelled Family Stability was thus derived.

Impulsivity Variables

A principal component analysis with varimax rotation of the impulsivity data yielded four factors, three with eigenvalues greater than 1.0. Therefore, only the first three factors were retained. The rotated-three factor solution, which accounted for 67 percent of the total variance, is presented in Table 12.

On the first factor, response latency variables had high, positive loadings ranging from .32 to .80. Subjects who displayed longer decision time on the risk taking experiment and the MFFT scored high on this factor. Risk taking, gratification preference and MFFT error variables were not associated with this factor, which appeared to be describing a dimension of cognitive tempo. Factor 1 was therefore labelled "Cognitive Tempo".

Table 12

Principal Components of Impulsivity Data

Variable	Factor 1	Factor 2	Factor 3
Immediate Gratification	.13	-.10	.14
Number Trigger Presses - Money Condition	.12	-.05	.84
Number Trigger Presses - Shock Condition	.02	.24	.84
Total Response Time - Money Condition	.81	.02	.35
Total Response Time - Shock Condition	.80	-.13	.08
Latency Last Response - Money Condition	.60	.61	.02
Latency Last Response - Shock Condition	.77	-.19	-.15
MFFT Errors	.01	.80	.18
MFFT Latency	.32	-.84	-.01
Variance explained	2.4	1.8	1.6
Cumulative proportion of total variance	.29	.24	.14

Factor 2 appeared to be describing a more complex inter-relationship among the variables. Response latency during the loss of monetary reward condition had a high positive loading on this factor, in contrast to shock condition and MFFT response time which had negative moderate to negative high loadings. Subjects scoring high on this factor appeared to be cautious in decision time for loss of a positive reward (money), but not for a negative (shock) or neutral (MFFT) reward. Similarly, risk taking for loss of a monetary reward and choice of immediate gratification for a monetary reward loaded negatively on this factor, whereas risk taking for a negative (shock) and neutral (MFFT error score) reward had high, positive loadings. Factor 2 was therefore labelled "Responsivity to Loss of a Positive but not Negative Reward".

The factor-defining variables for Factor 3 were the number of risks taken during the money and shock conditions. Latency variables and gratification preference did not tend to load on this factor. Factor 3 was hence labelled "Risk Taking".

Factor 4, which was not retained, appeared to describe preference for delayed versus immediate gratification. Only gratification preference loaded high (.90) on this factor. Subject's original gratification score was therefore used in later multiple regression analyses as the measure of gratification preference. This variable appears with the label immediate gratification (IGRAT) in the regression analyses.

Group Comparisons on Impulsivity Factors

Results of the one-way ANOVA comparing group scores on the three impulsivity factors are presented in Table 13. Only group differences on Factor 2 approached significance, $F(1,41)=3.73$, $p<.07$. This suggested that the non-ADDH subjects tended to be more responsive to loss of the positive reward than the negative or neutral rewards as compared to the ADDH subjects.

Multiple Regression Analyses

The all possible subset regression technique was used to identify which predictors accounted for variation in corrections history. Due to small sample size, regression analyses were performed on subjects with complete data in the ADDH and non-ADDH groups combined ($N=43$). All possible regressions were performed for each of the 11 corrections history variables, using scores on group, aggression (AGG), hyperactivity (HA), SES, Family Stability (Family), immediate gratification preference (IGRAT), and the three previously obtained impulsivity factors as independent variables. The 10 best subsets were tabulated for each dependent variable, where best was defined as the equation which maximized the adjusted R^2 . The adjusted R^2 takes into consideration the ratio of the number of independent variables to sample size.

Table 13

Group Comparisons on Factor Scores¹

Factor	N	Non-ADDH	N	ADDH	Test
Factor 1	28	.14 ± 1.0	15	-.25 ± .96	F(1,41) = 1.46
Factor 2	28	.21 ± 1.1	15	-.39 ± .58	F(1,41) = 3.73*
Factor 3	28	-.07 ± .97	15	.13 ± 1.1	F(1,41) = 0.35

¹ Expressed in means and standard deviations

* p < .07

Table 14 presents the simple correlation of each independent variable with the corrections history variables. The signs of the correlation reflect the direction of the relationships between each predictor variable and the criterion.

The results of the all possible subset regression analyses are summarized in Tables 15 through 26. Reported in the tables, in order of magnitude, are the 10 best subsets for each dependent variable. Table 26 presents the relationships between the predictor variables and the corrections history variables combined. The total number of times each predictor appeared in the 10 best subsets, and the total number of times each predictor appeared in the final best subsets is tabulated.

Considering the ADDH and non-ADDH subjects as a single group, analyses indicated that a combination of diagnostic group and the Risk Taking factor was best in explaining variation in corrections history. The number of times each variable appeared in the best subsets was high. The next frequently occurring predictor was the Cognitive Tempo factor which appeared in the best subsets approximately 50 percent of the time. This factor seemed to have a strong to moderate relationship with corrections history. Next best were aggression and SES which appeared with moderate frequency in the best subsets. Factor 2 (Responsivity to Loss of Positive but not Negative Reward), hyperactivity and Family Stability showed up in the best subsets about one third of the time, indicating a moderate to low relationship with corrections history. Finally, preference for

Table 14

Simple Correlations of Predictors with Corrections History Variables

Corrections History	Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3
Nonserious Offenses	.34	.14	.19	.02	.00	-.03	-.22	-.15	.13
Serious Offenses	.32	.32	.26	-.09	-.23	-.08	.007	.05	.30
Total Offenses	.38	.26	.26	-.04	-.13	-.07	.13	-.06	.25
Against Persons	-.09	-.50	-.23	-.08	.13	-.12	-.11	-.04	-.005
Against Property	.48	.33	.40	.04	-.14	-.02	-.10	-.14	.22
Court Appearances	.18	.07	.09	-.04	-.06	-.07	-.20	.14	.06
Disposition Time	.39	.36	.31	-.20	-.21	.01	.05	.006	.33
Remand Time	.29	-.01	.19	.12	-.07	.04	-.31	.07	.11
Jailed Time	-.06	-.14	-.09	-.17	.16	.09	-.25	-.06	.18
Total Institution Time	-.07	-.13	.005	-.10	.11	.10	-.35	-.02	.20
Age of First Offense	-.35	-.27	-.34	.003	-.05	-.05	-.06	.15	-.25

Table 15

All Possible Subset Regressions: Relationships Between Predictor Variables and Number of Nonserious Offenses

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
Group						Factor 1			.094465
Group									.089765
Group						Factor 1		Factor 3	.082201
Group								Factor 3	.077100
Group	AGG					Factor 1			.077025
Group						Factor 1	Factor 2		.075757
Group				Family		Factor 1			.075666
Group		HA							.075283
Group					IGRAT	Factor 1			.073867
Group				Family					.072240

Table 16

All Possible Subset Regressions: Relationships Between Predictor Variables and Number of Serious Offenses

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
Group	AGG						Factor 2	Factor 3	.154377
Group	AGG		SES				Factor 2	Factor 3	.150905
Group	AGG							Factor 3	.141382
Group	AGG			Family			Factor 2	Factor 3	.140105
Group	AGG		SES					Factor 3	.137703
Group	AGG	HA					Factor 2	Factor 3	.137519
Group								Factor 3	.137470
Group							Factor 2	Factor 3	.136868
Group	AGG		SES	Family			Factor 2	Factor 3	.135769
Group	AGG	HA	SES				Factor 2	Factor 3	.135309

Table 17

All Possible Subset Regression: Relationships Between Predictor Variables and Total Number of Offenses

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
Group								Factor 3	.146844
Group			SES					Factor 3	.130024
Group						Factor 1	Factor 2		.129647
Group	AGG							Factor 3	.128394
Group							Factor	Factor 3	.126841
Group					IGRAT			Factor 3	.125802
Group		HA						Factor 3	.125207
Group				Family				Factor 3	.125047
Group	AGG					Factor 1		Factor 3	.122030
Group									.121842

Table 18

All Possible Subset Regressions: Relationships Between Predictor Variables and Number of Offenses Against Persons

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 1	Factor 3	Adjusted R ²
	AGG	HA				Factor 1	Factor 1		.039467
	AGG	HA		Family		Factor 1	Factor 1		.039389
	AGG	HA							.032754
	AGG	HA	SES	Family		Factor 1	Factor 1		.029722
		HA							.029620
	AGG	HA	SES			Factor 1	Factor 1		.029123
Group	AGG	HA							.028097
Group	AGG	HA		Family					.027643
	AGG	HA		Family					.025945
Group		HA							.021772

Table 19

All Possible Subset Regressions: Relationships Between Predictor Variables
and Number of Offenses Against Property

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
Group								Factor 3	.220393
Group		HA						Factor 3	.209978
Group	AGG							Factor 3	.207891
Group									.205678
Group					IGRAT			Factor 3	.202760
Group						Factor 1		Factor 3	.200666
Group							Factor 2	Factor 3	.200571
Group				Family				Factor 3	.200512
Group			SES					Factor 3	.200405
Group	AGG								.197021

Table 20

All Possible Subset Regressions: Relationships Between Predictor Variables
and Number of Court Appearances

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
	AGG					Factor 1	Factor 2		.044244
Group						Factor 1	Factor 2		.030536
Group							Factor 2		.028836
	AGG		SES			Factor 1	Factor 2		.026006
Group	AGG					Factor 1	Factor 2		.025605
	AGG					Factor 1			.020089
	AGG					Factor 1	Factor 2	Factor 3	.019434
	AGG	HA				Factor 1	Factor 2		.019325
	AGG			Family		Factor 1	Factor 2		.019136
	AGG				IGRAT	Factor 1	Factor 2		.019101

Table 21

All Possible Subset Regressions: Relationships Between Predictor Variables and Amount of Disposition Time

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
Group	AGG		SES			Factor 1	Factor 2	Factor 3	.267099
Group	AGG		SES					Factor 3	.260509
Group	AGG	HA	SES				Factor 2	Factor 3	.254886
Group	AGG		SES	Family			Factor 2	Factor 3	.248744
Group	AGG		SES		IGRAT		Factor2	Factor 3	.248229
Group	AGG		SES			Factor 1	Factor 2	Factor 3	.246942
Group	AGG		SES				Factor 2	Factor 3	.244394
Group	AGG		SES	Family				Factor 3	.243284
Group			SES					Factor 3	.241214
Group	AGG		SES		IGRAT			Factor 3	.240640

Table 22

All Possible Subset Regressions: Relationships Between Predictor Variables and Amount of Remand Time

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
Group					IGRAT	Factor 1	Factor 2		.111181
Group						Factor 1			.109896
Group						Factor 1	Factor 2		.109180
		HA				Factor 1			.108894
Group					IGRAT	Factor 1			.104082
		HA				Factor 1	Factor 2		.102590
Group			SES		IGRAT	Factor 1	Factor 2		.099909
		HA				Factor 1		Factor 3	.099724
Group			SES			Factor 1			.097265
Group			SES			Factor 1	Factor 2		.096903

Table 23

All Possible Subset Regressions: Relationships Between Predictor Variables and Amount of Jailed Time

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
			SES	Family		Factor 1		Factor 3	.084716
				Family		Factor 1		Factor 3	.069720
			SES	Family	IGRAT	Factor 1		Factor 3	.067713
Group			SES	Family		Factor 1		Factor 3	.067070
			SES	Family		Factor 1	Factor 2	Factor 3	.065725
			SES			Factor 1		Factor 3	.064319
		HA	SES	Family		Factor 1		Factor 3	.060102
	AGG		SES	Family		Factor 1		Factor 3	.060078
			SES	Family		Factor 1			.054877
Group			SES			Factor 1		Factor 3	.054812

Table 24

All Possible Subset Regressions: Relationships Between Predictor Variables and Total Amount of Institution Time

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
				Family		Factor 1		Factor 3	.130119
						Factor 1		Factor 3	.125282
			SES	Family		Factor 1		Factor 3	.124012
				Family	IGRAT	Factor 1		Factor 3	.120847
			SES			Factor 1		Factor 3	.119683
					IGRAT	Factor 1		Factor 3	.118723
		HA		Family		Factor 1		Factor 3	.114515
			SES	Family	IGRAT	Factor 1		Factor 3	.112938
			SES			Factor 1		Factor 3	.111287
		HA	SES	Family		Factor 1		Factor 3	.108912

Table 25

All Possible Subset Regressions: Relationships Between Predictor Variables and Age of First Offense

Group	AGG	HA	SES	Family	IGRAT	Factor 1	Factor 2	Factor 3	Adjusted R ²
		HA						Factor 3	.143397
Group		HA						Factor 3	.131186
Group								Factor 3	.127832
		HA					Factor 2	Factor 3	.126923
		HA		Family				Factor 3	.124234
		HA	SES					Factor 3	.122361
	AGG	HA						Factor 3	.122042
		HA				Factor 1		Factor 3	.121559
		HA			IGRAT			Factor 3	.121438
Group						Factor 1		Factor 3	.120346

All Possible Subset Regressions: Relationships Between Predictor Variables
and Corrections History Variables Combined

Variable	Total Number of Times Appeared in 10 Best Subsets	Total Number of Times Appeared in Final Best Subset
Factor 3 (Risk Taking)	69	7
Group	68	6
Factor 1 (Cognitive Tempo)	55	6
Aggression	40	4
SES	37	2
Factor 2 (Responsivity to Loss of Positive But Not Negative Reward)	33	4
Hyperactivity	31	2
Family Stability	28	2
Immediate Gratification	15	1

immediate gratification appeared comparably unimportant in accounting for variation in antisocial outcome.

D. Discussion

Follow-up studies have identified ADDH children to be at a greater than average risk for antisocial behaviour in later life relative to normal peers. One purpose of the present study was to address whether adolescent offenders who have ADDH would show worse outcome than controls with primary features of delinquency and unsociability. The results of the present investigation support the earlier data of Offord et al. (1979) that the presence of ADDH within a sample of male adolescent offenders identifies a subgroup with poorer outcome and prognosis. Subsequent regression analyses further revealed that the ADDH syndrome and impulsivity were associated with greater severity of delinquency. Aggression and SES showed moderate to high relationships with corrections history.

Comparisons of ADDH and Non-ADDH Offenders

Clinical or symptom variables which have been previously found to distinguish between ADDH children and normal peers, were observed in this study to differentiate ADDH delinquents from non-ADDH delinquent controls. Considerably more overall behavioural disturbance among the ADDH probands was observed. These adolescents seemingly engage in more suicidal ideation, tend to have poorer social relations and more severe antisocial

and aggressive symptomology than their non-ADDH delinquent counterparts. The diagnosis of ADDH was further associated with more behavioural difficulties as rated by parents. This pattern of findings from the CBCL suggests that the antisocial behaviour of the ADDH offenders appears concurrent with severe disturbance in several areas, whereas the non-ADDH offenders generally display more severe disturbance in the area of delinquent behaviour.

Seventy-eight percent of the ADDH offenders as compared to 18 percent of the non-ADDH offenders in the present study scored in the clinical range on the Aggression scale of the CBCL. High scores on the aggression scale of the CBCL are considered to indicate conduct disorder (Achenbach & Edelbrock, 1983). It is estimated that one-third of all children labelled hyperactive also exhibit conduct disorder (Quay, 1979; Rutter, 1976). The current findings therefore suggest, along with the work of Loney et al. (1978, 1981) and August (August et al., 1983), that aggressive symptomology and/or associated conduct disorder present more frequently among ADDH adolescents who show delinquent outcome.

The present research did not find significant differences between the two groups of delinquents in SES or in the rate of family non-intactness, though considerable difference was observed in the number of intervening changes in living situation. ADDH offenders had experienced, on average, up to four times more living changes than the non-ADDH offenders.

These living changes most often comprised court-ordered confinement and voluntary moves to and from group homes. Recent studies have implicated stressful life change in criminal activity (Levinson & Ramsay, 1979; Masuda, Cutler, Hein & Holmes, 1978; Vaux & Ruggiero, 1983). The present regression analyses did not identify life change as related to family stability to be an important factor in predicting variation in corrections history. Rather, the current findings indicate that other variables account for the observed correlation between life change and criminal activity.

A major finding of the present study pertains to the relationship between ADDH and severity of corrections history, where differences in the offense rates between the ADDH and non-ADDH groups were striking. Among the ADDH adolescents, the rate of non-serious and serious offences was three times higher than for controls. This difference in offense rate held true only for offenses against property. Concordant with these findings were differences of up to three times the number of court appearances and twice the amount of probation and community service time in the ADDH group. Rate of institutionalization for criminal behaviour further differentiated the two groups, with ADDH delinquents averaging eight times more institution time than their non-ADDH counterparts. Most striking was the finding of 700 times the amount of remand time served by the ADDH group. ADDH offenders further showed an earlier age of onset of criminal acts relative

to the non-ADDH controls.

Persistent delinquent behaviour, early age of onset, aggression and poor social competence in antisocial adolescents have been found to be poor prognostic indicators of subsequent adjustment in adulthood (Robins, 1970). The present evidence of severe delinquency, in association with the findings of more pronounced symptomology, suggest a poorer adult prognosis for the ADDH group.

The current investigation thus provides additional evidence of a link between childhood ADDH and the development of antisocial behaviour in later life. Moreover, the present data, in conjunction with earlier findings (Morrison, 1979, 1980; Offord et al., 1979; Virkkunen et al., 1976) indicate that the increased risk for antisocial outcome is relative to other psychiatric groups as well as to normal peers.

Impulsivity: It's Role in ADDH and Antisocial Behaviour

The present investigation explored the role of impaired impulse control in ADDH and antisocial behaviour. Contrary to expectation, the overall group of adolescent offenders, and in particular the ADDH offenders, did not demonstrate a preference for immediate as opposed to delayed gratification on a behavioural choice task. What experimental documentation exists on this phenomenon in both clinical groups is equivocal. For example, Unikel and Blanchard (1973) reported findings similar

to the present study using Mischel's (1958) behavioural choice measure in which cigarettes and candy comprised the reinforcement. However, studies examining choice preference as a function of the length of the delay interval (Blanchard et al., 1977; Gullick, Sutker & Adams, 1976; Unikel et al., 1973) have obtained findings more in keeping with clinical reports. Length of the delay interval may therefore be a more sensitive measure of willingness to delay gratification than the behavioural choice measure used in this study. The temporal delay variable may also prove to be more strongly associated with recidivism given that it taps an aspect of impulsivity which involves future time perspective.

It is further likely that choice preference patterns are highly influenced by the probability and type of reinforcement as well as by the demand characteristics of the situation. Previous work on the generality-specificity of preference patterns indicate considerable variability as a function of situational conditions and reward values (Mischel, 1979; Mischel & Metzner, 1962; Widom, (1977)). It is possible that the two populations presently studied can and will delay gratification if the motivational and situational demands are perceived as sufficiently strong. Experimental studies examining the consistency and stability of choice preference patterns which manipulate situational conditions, the temporal delay period, and reward values, may prove fruitful in defining the context in which impulsivity can be predicted given the type and timing of

rewards.

On the risk taking task, the different types of reinforcement contingencies used in this investigation produced changes in response time and risk taking behaviour, indicating changes in the perceived incentive or reinforcement value of the situation. Under the threat of loss of monetary reward condition, both groups of offenders showed similar risk taking behaviour and similar decision time. Differences emerged, however, with the threat of shock contingency. The ADDH group significantly reduced their risk taking in this condition relative to levels of risk taking under the threat of loss of reward condition, but were significantly more impulsive than the non-ADDH group in decision time. In contrast, the non-ADDH delinquents did not show diminished risk taking in response to the threat of aversive shock, but were more reflective and cautious in their decision-making than their ADDH counterparts.

These results suggest that the ADDH offenders were responsive to the possible negative consequences of their actions, and are inconsistent with the earlier findings of Freeman (1978) and Freeman and Reznick (in press). However, Freeman (1978) observed excessive risk taking behaviour with a threat of shock contingency in only those hyperactive children found to be favourably responsive to stimulant medication. Adverse responders demonstrated shock avoidance as did the normal controls. The differences in subject selection criteria between this study and Freeman's therefore precludes meaningful

comparison of results.

It is important to emphasize the extreme impulsive response time in the performance of the ADDH delinquents on the risk taking task involving the threat of shock contingency. Though the ADDH subjects demonstrated punishment avoidance, their responding was noticeably impulsive and erratic. It is precisely this disorganized, impulsive nature of their responding that is believed to interfere with their responsiveness to environmental constraints. The findings of the present investigation are thus not entirely inconsistent with clinical reports, though the data do not suggest a simple negative relationship between impulsive cognitive tempo and punishment avoidance.

The results from the risk taking experiment raise the interesting notion that the ability to be responsive to environmental constraints is within the repertoire of ADDH children, but that they are failing to deploy this ability at specific times. Previous work indicate that the performance of hyperactive children (Douglas, 1972; Friebergs & Douglas, 1969; Parry, 1973) as well as of psychopaths (Painting, 1961; Schmauk, 1970; Siegel, (1978) is severely impaired under remote stimulus-response and partial reinforcement schedules, but not under continuous and immediate reinforcement conditions. The present study examined risk taking as a function of an immediate, though fictitious, reinforcement schedule. It is possible that ADDH offenders show reduced risk taking for a threat of aversive shock under immediate reinforcement

contingencies, but would show increased risk taking (or less punishment avoidance) as the probability of punishment becomes increasingly uncertain. Should this be the case, it would further explain the incompatibility of the current findings of punishment avoidance but higher rates of recidivism in the ADDH group, assuming that recidivism represents a failure to modify risk taking behaviour in view of punishment, and involves the relationship between present behaviour and the uncertain, long-term consequences of present actions.

Thus, a more powerful test of the relationship between risk taking and antisocial outcome in the ADDH population might include the effects of remote stimulus-response and partial reinforcement schedules, both of which are better approximations of naturally occurring relationships. Future studies of risk taking behaviour should examine the effects of increasing the magnitude of the possible loss or gain, and of varying the types and probabilities of expected negative reinforcers.

An alternative interpretation of these results which assumes a close relationship between sustained attention and inhibitory control (Douglas, 1980), is that the impulsive decision time exhibited by the ADDH offenders reflected attentional and concentration difficulties characteristic of this clinical group. The shorter response time and the shorter latency to last response displayed by this group under the threat of shock condition, suggest a lack of care and concentrated attention to the task, in marked contrast to the

non-ADDH offenders who were noticeably reflective, if not systematic and organized, in their decision-making. Zimring (1971) has proposed that the subjective appreciation of the probability or credibility of punishment is positively related to deterrence. An appreciation of the probability of punishment may well involve attentional mechanisms, and as the offenders with ADDH showed significantly higher rates of recidivism, studies which address the role of attentional mechanisms in risk taking behaviour seem worthwhile.

The non-ADDH offenders, unlike their ADDH counterparts, did not show suppression of their risk taking with the threat of shock contingency. This finding is consistent with the performance of psychopaths under similar conditions (Schmauk, 1970). However, the cautious decision time displayed by this group suggests purposeful intent in their failure to avoid the aversive consequences of their behaviour, which is uncharacteristic of the psychopathic style (Buss, 1966; Cleckley, 1971; Shapiro, 1965). This pattern of findings may also, however, be interpreted as suggestive of sensation-seeking (Quay, 1965), which has been implicated in sociopathy (Orris, 1969; Skrypek, 1969; Widom, 1976b). Unfortunately, the present data do not enable conclusions which take into account the role of motivational and cognitive variables in subject's risk taking behaviour.

Relationships Between Symptomology and Variation in Corrections History

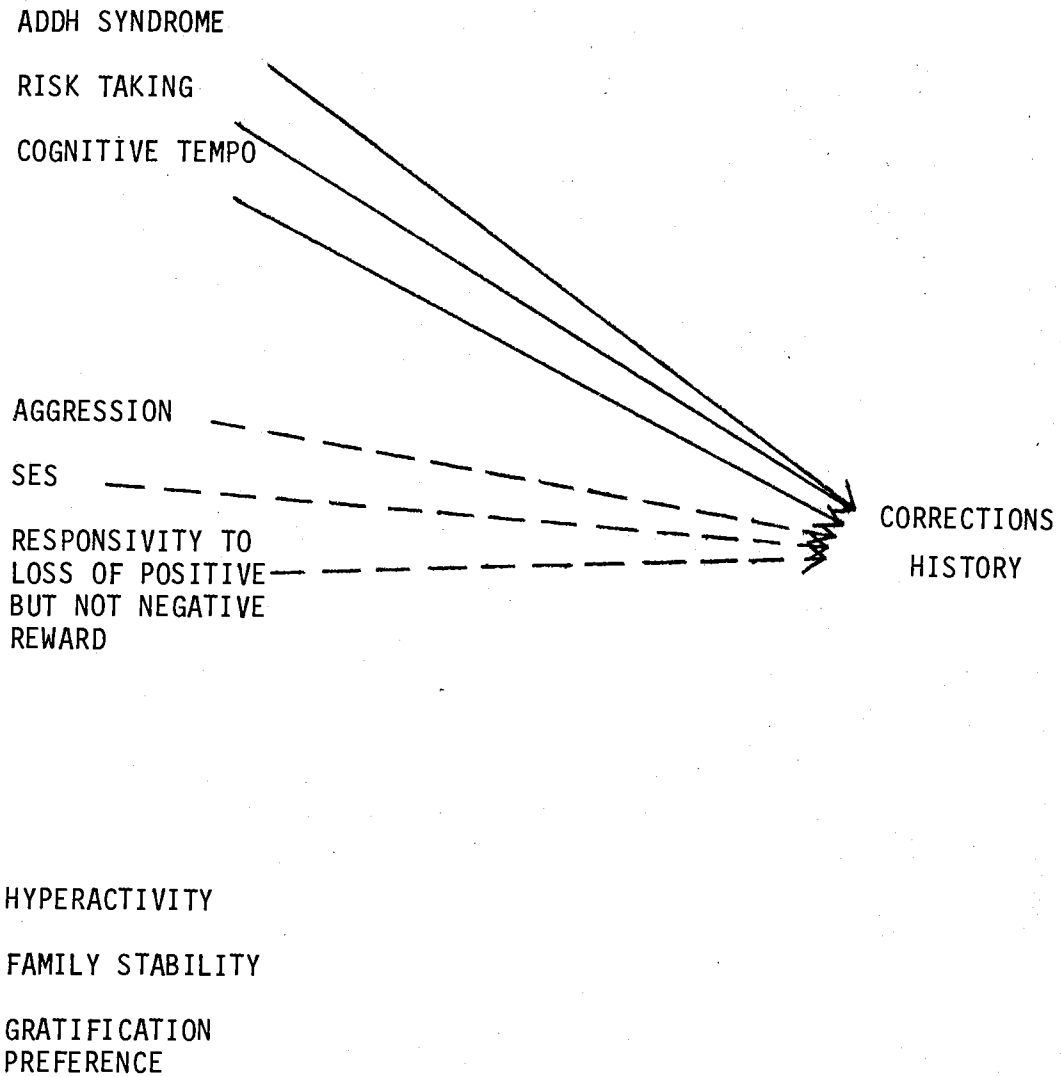
A further purpose of the present work was to identify and differentiate the relative importance of selected symptom and familial variables in accounting for variation in corrections history. A summary of the multivariate relationships between the independent variables and antisocial behaviour is presented graphically in Figure 4. Arrows connect each independent variable found to be a robust predictor with corrections history. Dotted arrows indicate a more moderate relationship between the independent variable and the criterion. Where no arrows connect the independent variable with criminal activity, it is because comparably less strong associations were found between them.

Regression analyses conducted on both groups combined identified diagnostic group and two of the three impulsivity factors as the predictors contributing to greatest variation in corrections history. Thus, in a sample of adolescent offenders who do and do not have ADDH, the ADDH syndrome and impulsive symptomatology, expressed as risk taking behaviour and cognitive tempo, predicted greater severity of delinquency.

These findings support the hypothesized importance of impulsivity to delinquent outcome. They further suggest the potential significance of impulsivity in accounting for antisocial outcome in ADDH children. Impulsive symptomatology,

Figure 4

Relationships Between Predictor Variables and Corrections History



which has typically been subsumed under a primary symptom factor or the general category of ADDH in previous outcome research, was found to cluster together along meaningful dimensions that are importantly related to severity of delinquency. The importance of this symptom may therefore have been obscured in earlier research by a failure to adequately examine differences in severity of symptomology. The present data raise the possibility that deficient impulse control is the primary component of ADDH that is linked to criminal behaviour in later life. Children with ADDH may well differ in the severity of impulsive symptomatology, and hence in outcome.

The results of this study are in accord with follow-up research (Loney et al., 1981) which has identified aggression and SES to be important predictors of delinquent outcome. It is interesting, however, that aggression was not as strongly associated with severity of corrections history as were the Risk Taking and Cognitive Tempo factors, particularly in view of the finding that the ADDH offenders showed considerably more aggressive symptomology than their non-ADDH counterparts. Nonetheless, the ADDH syndrome, impulsivity, aggression and SES were found to be the most robust predictors of antisocial behaviour in a sample of ADDH and non-ADDH adolescent offenders. This suggests several lines of investigation of the role of ADDH symptomology in antisocial behaviour. If aggression serves as a powerful mediator of antisocial outcome in ADDH children, does this association rest on aggression in combination with

impulsivity? Is either aggression or impulsivity an essential factor in the association, or are both necessary for the development of antisocial behaviour? If so, is the relationship between impulsivity, aggression and outcome modified by SES? Research indicates that low SES, as well as poor parental supports, are associated with the appearance and persistence of aggressive conduct (Langhorne & Loney, 1979). High SES and parenting style may well insulate against antisocial outcome.

With respect to the hyperactivity symptom, the present findings support the contention (Loney, 1980a) that hyperactivity is unimportant relative to other ADDH symptoms in predicting poor outcome. This symptom variable correlated with corrections history, but the relationship was not strong. This is perhaps not surprising, in view of evidence that overactivity diminishes with age (Ackerman et al., 1977; August et al., 1983; Rutter, 1968; Minde et al., 1972; Weiss et al., 1971), while other primary symptoms appear to remain stable over time (August et al., 1983; Hechtman et al., 1976; Weiss et al., 1971, 1978, 1979).

The Family Stability factor was also found to be a poor predictor of antisocial conduct. This result is consistent with earlier research by Robins (1978) who found family variables to have a weak association with delinquency compared with child symptom variables. Similarly, Loney et al. (1981) observed a strong relationship between parenting style and outcome, but did not find family intactness or number of living changes to

predict antisocial behaviour at follow-up.

Caveats

The findings of the present investigation contribute to knowledge of the link between childhood ADDH and delinquency in adolescence. However, caveats to this study warrant mention.

First, problems with the retrospective study method which center on the validity of information used for subject diagnosis, limit conclusions of the data. Though 17 of the 24 ADDH adolescents had received medication or psychiatric treatment for hyperactivity, the remaining seven who were retrospectively and currently diagnosed as having ADDH, may not necessarily be typical of the general population of ADDH children. This is based on the assumption that there is an element of selectivity regarding the children who come to the attention of psychiatric professionals. Moreover, the cross-situational and temporal variability of the ADDH child's behaviour is well documented (Campbell & Redfering, 1979; Langhorne et al., 1976; Schleifer et al., 1975). Therefore, the use of a multi-source method of assessment in the present study would have enhanced the generalizability of the findings.

The present study would have further benefited from larger sample size, particularly in the ADDH group. This would have enabled the multiple regression analyses to be performed on the ADDH and non-ADDH groups separately, thereby delineating the

variables which contribute to recidivism in each group. It is possible that the predictors identified as important in accounting for variation in outcome would differ for the group of offender. In general, larger sample size would have permitted stronger assumptions regarding the reliability of the current findings.

The relatively small number of ADDH adolescent offenders obtained for inclusion in this study on which complete data was obtained (N=16) reflects the difficulty in first locating this group and second in gaining subject's voluntary consent to participate. Robins (1966) and others (Satterfield et al., 1982) have commented on the fact that the subjects hardest to locate at follow-up are those with a disproportionately high rate of deviant behaviour. This was the case in the present study where 23 percent of subjects identified as ADDH as compared to seven percent of subjects identified as non-ADDH were located. A considerable proportion of the ADDH offenders were AWOL or institutionalized at the time of data collection. Moreover, the corrections history of the ADDH offenders who were not located was observed to be considerably more severe than both the ADDH and non-ADDH subjects who were located.

The present design would have also benefited from the addition of a normal control group. This would have provided useful information and possibly expanded the conclusions that can be reached from the findings. Normative data would have been particularly useful on the impulsivity tasks where interpretive

problems arose.

Directions for Future Research

The search for predictors of antisocial outcome in the ADDH population is relatively recent and has met with a modicum of success. Previous outcome research has typically examined the relationship between primary or secondary symptom factors and outcome. When no or little association has been found between the primary symptom factor and the outcome measures, the assumption has been that hyperactivity is not a contributing factor (Loney, 1980; Loney et al., 1981). This is misleading, however, since the primary symptom factor is actually describing general ADDH symptomology, not only hyperactivity. Moreover, the current findings indicate that when the significance of primary symptoms is considered separately, different results are obtained. The conclusions from the present data suggest that impulsivity is a robust predictor of antisocial behaviour, whereas hyperactivity appears to be only weakly associated. Thus, a symptom dimension approach to studying the relationship between ADDH and antisocial behaviour in later life which focuses on the predictive utility of primary symptoms combined, may obscure the independent contribution of individual symptoms to outcome. Research which examines the specificity of ADDH symptoms as related to outcome may provide a clearer and more meaningful picture of the relative importance of primary

symptomatology that earlier follow-up work.

A methodological difficulty with prediction research is the reliability and sensitivity of the measurement instruments that are used. Previous studies (August et al., 1983; Loney et al., 1980, 1981) have relied on symptom checklists and ratings of severity as measures of child symptoms. However, assessment of children's performance on cognitive and behavioural tasks, particularly tasks which tap attentional and impulse control deficits, may be a more sensitive, if not reliable, method of measurement. Outcome studies share a need for standardized assessment of children's initial characteristics. The present findings suggest that future research incorporate a task-oriented approach to measurement of symptom severity.

Though outcome studies have identified a preponderance of antisocial behaviour among ADDH children at follow-up, it is by no means clear whether a developmental association exists between childhood ADDH and adult psychopathy. The present investigation found considerably higher rates of recidivism in the ADDH group, but this in itself does not indicate sociopathy. Research which compares ADDH offenders with psychopathic and normal controls on a variety of clinical and psychophysiological measures found to differentiate psychopaths from normals, would help clarify this issue.

Follow-up studies thus far have typically applied a structural approach to outcome, while research on the development of antisocial manifestations in ADDH children is

lacking. The present study, which shares with all retrospective research a focus on the adolescent or adult, can say little about causation in the development of antisocial psychopathology. Intervention is unlikely to be successful without a clearer theoretical and empirical understanding of the mechanisms responsible for antisocial outcome in ADDH children. Developmental-longitudinal studies which subdivide ADDH children on the basis of hypothesized differences in vulnerability to antisocial outcome, would prove invaluable in providing empirical bases for prediction and intervention.

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