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LA THÈSE A ÉTÉ
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COMPARISON OF OUTCOME IN HYPERACTIVE
CHILDREN TREATED WITH STIMULANT
MEDICATION AND WITH PARENT-TRAINING;
A 2-YEAR GROUP OUTCOME STUDY

by

David J. Crowe

Thesis submitted to the School of Graduate Studies
of the University of Ottawa in partial fulfillment
of the requirements for the Degree of Doctor of Philosophy

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CURRICULUM STUDORIUM

David J. Crowe was born September 16, 1950, in Winnipeg, Manitoba. He received the Bachelor of Commerce degree, Honours Economics, from the University of Montreal, Loyola College, in Montreal in 1970.

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ABSTRACT

COMPARISON OF OUTCOME IN HYPERACTIVE CHILDREN
TREATED WITH STIMULANT MEDICATION AND WITH
PARENT-TRAINING: A 2-YEAR GROUP OUTCOME STUDY

David J. Crowe

University of Ottawa

Seventy-three hyperactive children were randomly assigned to one of three treatment conditions, designated Ritalin-only, parent-training-with-placebo, and parent-training-with-Ritalin. The subjects were assessed according to a host of predictor variables including subject variables, familial variables and treatment variables. They were then reassessed according to five criterion variables including hyperactivity, conduct problems, reaction time, impulsive responding, and grade achievement. The assessment periods included pre-test (baseline), post-test (4 months), first follow-up (1 year) and second follow-up (2 years).

Statistical analysis included ANOVA with repeated measures, Stepwise Multiple Regression and Discriminant Function Analysis. Descriptive statistics are also discussed.

The ANOVAs provide significant evidence of short-term superior benefit for children treated with Ritalin when compared with the parent-training with placebo group, thereby replicating earlier short-term treatment comparison research,

particularly Gittleman-Klein (1980). Comparison of means at 2 years, however, shows no significant differences. A discussion of the descriptive statistics, nonetheless, suggests that there may have been some difficulties separating true hyperactive children from children suffering primarily a characterological disturbance. Considerable evidence is presented supporting Loney's notion of the orthogonality of aggression and hyperactivity.

Regression studies demonstrate the importance of parent variables in the prediction of outcome on all criteria with the exception of reaction time.

In general, the results are interpreted to have some support for the long-term superior benefit of Ritalin for hyperactive children, but underline the difficulty in defining the essential characteristics of hyperactivity. It is of interest, also, that the results demonstrate the variability and thus, poor predictability, of response to behavioural intervention - except on a measure of conduct disorder where it appears to be the more reliable and consistently effective treatment.



CHAPTER I

REVIEW OF THE LITERATURE

Introduction

The pre-eminent focus in child psychopathology research is undoubtedly the study of hyperactivity. Despite a plethora of research, however, psychologists are still divided with respect to issues of etiology and treatment. Investigations of etiology have gone the way of similar investigations regarding dyslexia and minimal brain dysfunction; i.e., more questions have been raised than answered. A current interest of those researching hyperactivity is alternative treatment comparison. The two main treatment approaches are psychopharmacological and behavioural (with many researchers recommending combinations thereof), and their proposed contradiction is the subject of a growing number of follow-up and outcome studies. To date, stimulant medication is considered by the majority in the field to be the treatment of choice. A relatively consistent finding of the reported follow-up studies, however, is the lack of stable long-term effects in those children treated with stimulant drugs. This lack of long-term benefit has bred caution in many clinicians and behavioural approaches are therefore, advocated as a viable, if not superior, alternative. The comparison of these two treatment alternatives has thus been a focal concern

of several researchers. Three basic paradigms have been used for this comparison: systematic case study, single subject experiment and group outcome study. Single subject studies generally support behavioural approaches as a preferred treatment while, on the other hand, two recent group outcome studies support stimulant medication as the treatment of choice, at least in regard to improved classroom and interpersonal behaviour and attention.

In any event, the lack of demonstrated long-term benefit with stimulant drugs begs a logical question; i.e., whatever works in the short-term should work in the long-term and if not, why not? There are a number of ways this question might be addressed. This thesis is particularly concerned with the following. First, the group outcome research designs used to date may have been methodologically inadequate and, thereby, subject to Type II errors. This explanation might be arbitrarily designated the 'design-flaw' alternative. Secondly, hyperactivity may not be sufficiently well defined thereby rendering even well designed research inadequate with respect to its potential for clarification. Thirdly, it may, perhaps be true that stimulant medications simply fail to alter the essential aspects of the disorder and offer only temporary symptom-relief. The latter two explanations might be arbitrarily designated the 'definition-flaw' alternative.

In order that the 'design-flaw' alternative might be addressed, the important research studies to date will be reviewed in the following pages. The 'definition-flaw' alternative will be explored in the light of Jan Loney's model of hyperactivity. She and her colleagues have developed a model of hyperactivity which views childhood aggression as the primary predictor of maladaptive behaviour in the hyperactive child's adolescent years. Thus, eventual deviant behaviour (conduct problems and/or delinquency) is viewed as the most predictable and serious long-term consequence for hyperactive children who are unsuccessfully treated. The Loney group, moreover, asserts that hyperactivity, per se, and inattention are of little importance in the eventual outcome of the hyperactive child which, they conclude, is the probable explanation for drug treatment (i.e., CNS stimulants) failing to predict long-term outcome, despite short-term amelioration of hyperactive symptoms.

The focal issue for the current research is the discrepancy between the short-term and the long-term course for hyperactive children treated with stimulant medications. In an attempt to maintain continuity with recent research, however, this study was designed in such a way as to allow for the comparison of behavioural treatment and psychopharmacological treatment in the short-term as well as the

long-term. In addition, a host of predictor variables were included in order to allow for a correlational study of the relationship between outcome and predisposition (subjective, family and treatment). This study is novel insofar as it represents a prospective group outcome study over the long-term. Outcome studies, per se, represent a surprisingly small percentage of the current hyperactivity research, and since 1970, number only some thirty studies. Furthermore, the overwhelming majority of these studies have been retrospective in nature. That is, the researchers have had to rely on clinical notes, test data, and diagnoses which had been recorded years before any research question had been postulated. On the other hand, those prospective studies which have been reported have either focused on a narrow range of variables, or have spanned too brief a time period for any precise definition of long-term expectations.

The report of literature described below includes examples of both prospective and retrospective research. In addition, a brief history of hyperactivity research is described. Essential characteristics of the disorder are described with a particular emphasis on the research of Virginia Douglas and the 'McGill Group'. This is in deference to the DSM III (APA, 1980) which has redefined the disorder as a symptom cluster: "Attentional Deficit Disorder with Hyperactivity." Douglas has been prominent in her research of

attentional deficits in hyperactive children. Finally, the rationale of the study and the research hypotheses will be described.

Definition of Hyperactivity

With each subsequent survey, the extent of hyperactivity is estimated to be increasingly more pervasive to the point now where 5 to 20% of American school children are said to be affected and 50% of referrals to outpatient clinics and similar settings are accounted for by hyperactive children (Loney, 1980).

Clinical descriptions of the hyperactive child have incorporated numerous symptoms varying from restlessness to recklessness, and its precise definition has been a source of continued frustration for the clinician and researcher. Attempts to categorize it as a syndrome (Schulman, Kasper and Throne, 1965; Conners, 1970; Paine, Werry and Quay, 1968) have generally been equivocal, but it is apparent that most agree that the prominent characteristics of the hyperactive child are difficulties of attention and concentration, school problems, and behavioural disturbance (misconduct, poor frustration tolerance, etc.). Less prominent, but commonly associated difficulties include impulsivity, difficulties in peer relations and low self-esteem (Safer and Allen, 1976).

In the current proposal, hyperactivity is operationally defined according to the DSM III (American Psychiatric Association, 1980). The precise definition according to these criteria is Attention Deficit Disorder, with Hyperactivity. The diagnostic criteria are as follows:

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 (APA, 1980).

Historical Perspective

Hyperactivity was described as early as 1902 by a pediatrician named Still who was investigating various treatments for children having sustained brain injury. During the course of his work, he encountered several children who exhibited the same symptoms of irascibility, erratic temper, poor self-control and aggressivity, but who

had not suffered any demonstrable injury or disease process. He labelled these children as those having 'defects of moral control.' Several years later, Tredgold (1908) concluded that these children must imply subtle injury (birth injury or anoxia), but Childers (1935) noted that only a small proportion of these children could be described as having any etiological similarities to children with actual central nervous system disorder. Thus, the 'poor moral control' children remained an anomaly for which there was little explanation, although many years later they would be seen to fit the diagnostic classification of the hyperactive child (Ross and Ross, 1976).

In an effort to ameliorate the headaches of emotionally disturbed children in a residential treatment centre, Bradley (1937) prescribed benzidrine and found, serendipitously, an improvement ranging across school and social behaviour (e.g., better work habits and marked reduction in disruptive behaviour). These children were similar to those described earlier by Still and Tredgold. Accordingly, Bradley became the first to prescribe stimulant medication for the 'hyperactive' child. And despite further evidence produced by Molitch and Eccles (1937) that stimulant medication improved performance on IQ tests, little interest developed in this phenomenon until the middle to late 1950s.

In the 1960s, the use of psychoactive drugs increased dramatically and the use of drugs with hyperactive children gained widespread acceptance (Ross and Ross, 1976); and by the middle 1960s, stimulant medication was well established as the treatment of choice for hyperactive children (Eisenberg, 1966; Werry and Sprague, 1970).

"The composite picture of hyperactivity that emerged in the early 1960s was that of a brain damage syndrome to be treated with stimulant drugs, minimal stimulation classrooms, and possibly psychotherapy, and having a favourable prognosis for the adolescent years." (Ross and Ross, 1976, p. 19).

Outcome studies during this period, however, were the rare exception and those that had been done (Menkes, Rowe and Menkes, 1967) suggested only a guarded prognosis for the hyperactive child.

Nevertheless, with the increased focus on stimulant drug treatment there developed a heightened concern, on the part of both the public and the clinician regarding the long-term effects of these medications on children. These concerns ranged from obstruction of normal growth patterns to contributing to the drug culture by encouraging in the child a passive reliance on pills to cure what 'ails' him. Consequently, the majority of research during this period concentrated on the effects of stimulant medication and a large body of that research provides evidence of positive

short-term improvement on laboratory and rating scale measures of impulse control, attention span and behaviour problems (Backman and Firestone, 1979). The process by which this improvement occurs, or for whom the stimulant medication is most likely to provide relief, is still very highly debated (Whalen and Henker, 1980). Barkley (1976) provides a comprehensive review of this research. In addition, there is little evidence that stimulant drugs have any positive effect on academic performance (Barkley and Cunningham, 1978). Nevertheless, the research of the mid-1960s to mid-1970s has largely vindicated the use of stimulant medication, at least for the short term. It leaves unanswered, however, the question of long-term effect. As well, there are still some hyperactive children who fail to respond to stimulant drugs in a positive direction (Knights and Hinton, 1969; Whalen and Henker, 1976).

Indeed, the plethora of information on hyperactivity compiled over the last twenty-five years appears to have become so unwieldy that it has led to such titles as The Myth of the Hyperactive Child (Schrag and Divorky, 1975) and Have We Been Counting Jars of Raspberry Jam? (Weiss, 1980), in which the authors raise doubts as to standard diagnosis and treatment procedures for hyperactive children. In addition, the recently appearing follow-up studies have put to rest the mid-1960s notion that hyperactivity diminished

with age to an almost negligible degree in mid to late adolescence (Maletzky, 1974; Weiss, Minde and Werry, 1971). Nevertheless, the emergence of follow-up research did give promise of greater clarification especially in regard to the more problematic issues of the viability of intervention in general, and the efficacy of medication in particular. In addition, however, behavioural interventions became a subject of focal interest (Doubros and Daniels, 1966; Keogh, 1971; Patterson, 1966; White, et al., 1979; Mash and Dalby, 1979). Both stimulant drugs and behavioural programs are considered viable options by many clinicians. Thus, examining the relative merits of each has become a particular goal of follow-up research. Backman and Firestone (1979) provide an excellent review of the comparative outcome studies.

Follow-Up Research and Outcome Studies

Insofar as many authors use the terms 'follow-up' and 'outcome' interchangeably, it is, perhaps, more efficacious to consider the terms 'retrospective' and 'prospective'. The essential distinction between the two, of course, is the chronological perspective of the investigator. Both modes of research are designed to examine the changes over time experienced by the studied subject(s), but in the case of retrospective studies, the investigator is confined to a retrospective analysis and, therefore, must rely on data

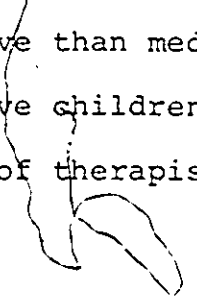
gathered from archives. While the heuristic value of these studies is self-evident, there are inherent difficulties. For example, the extent of clinical notes relied upon to describe the subjects in question may vary in number not to mention the probable variation of one to several clinicians involved with a single patient. Furthermore, the ex post facto construction of scale positions, for example, on a hyperactivity index, is derived from judgements on these same clinical notes. Finally, the response or improvement measure is based on a clinician's relative judgement, not according to an objective scale (e.g., "He's better than he used to be"). The bulk of hyperactivity follow-up research has been retrospective in nature. In any case, valuable information has been obtained from these studies and they will be described below.

On the other hand, prospective studies enjoy the advantage of experimental control, which normally renders their findings more generalizable and variable specific. These studies, like any experimental investigation, are designed to examine particular changes according to specific, well-controlled criteria. The three basic paradigms utilized are systematic case study, single-subject experiment and group outcome. Insofar as hyperactivity is a multifaceted disorder, it would be difficult to account for even most of the significant variables in anything but a group outcome.

study. The major limitation to such a study, however, is the availability of resources and the dependence on relatively smaller numbers of subjects. In addition, appropriate subjects, their commitment to the study, and the consistency of experimental condition are problematic to prospective designs.

In their review of the outcome literature, Backman and Firestone (1979), describe four studies which account for the totality of group outcome research comparing behaviourally and psychopharmacologically treated hyperactive children reported to 1980, (Christenson and Sprague, 1973; Gittelman-Klein, et al., 1980; Loney et al., 1977 and Wolraich, et al., 1978). In general, the data from these studies vindicate both therapeutic approaches, but definitive conclusions regarding their relative efficacy were obstructed by design weaknesses, particularly in the selection of dependent measures. For example, only Wolraich (1978) included a measure of academic performance in the assessment of treatment effectiveness, but he failed to individualize dosages of methylphenidate according to the particular characteristics of the child. Of the studies mentioned, however, Gittelman-Klein (1980) and her associates have provided the most comprehensive research. Their study included as subjects, children reported to be hyperactive in school and with behaviour difficulties at home. The children were then

randomly assigned to treatment groups defined as methylphenidate only, behaviour therapy plus placebo, or behaviour therapy plus methylphenidate. All subjects, at referral, were between the ages of 6-12 years, attending elementary school and were free of neurological disease and psychosis. Each subject had an IQ of 85 or greater. The treatment period was 8 weeks in duration. The behavioural intervention was extensive, including programs instituted at home and in school; the methylphenidate subjects were initially treated with 10 mg/day titrated to a maximum of 80 mg/day for optimal effectiveness relative to the individual child. Significant improvement on ratings of behaviour deviance was demonstrated in all three groups, but global ratings of improvement performed by teachers, mothers and psychiatrists on measures of conduct disorder, inattention and hyperactivity indicated a definite advantage for the children receiving methylphenidate. While there was no significant difference between the methylphenidate plus behaviour therapy group, and the methylphenidate only group, both these groups yielded significantly better results on global ratings than did the behaviour therapy plus placebo group. The authors concluded, therefore, that behaviour modification alone was significantly less effective than medication in ameliorating the symptoms of hyperactive children, despite the unrealistically high involvement of therapists in the behaviour therapy groups.



Nevertheless, behaviour therapy was effective and for children who do not respond to medication, the authors recommend behavioural intervention as a viable alternative, despite the significantly greater cost of such intervention.

There are, however, some limitations to the Gittelman-Klein study. In the first place, the authors do not account for the effect of time, the nemesis of all clinical outcome research. Ethical considerations prevent the use of an experimental control group although waiting list controls may have been possible. In any case, the authors report that in previous research (Gittelman-Klein, et al., 1976; O'Leary, et al., 1976), there was no indication of marked improvement in non-treated hyperactive children. Secondly, some might argue that the treatment period was too brief with respect to obtaining full effectiveness of a behavioural intervention. In an earlier study, however, Gittelman-Klein (1975) showed that children receiving behavioural treatment alone reached a plateau in behavioural improvement after 4 weeks of treatment. Thirdly, the authors did not include as dependent measures any academic achievement scales, or specific measures of attention, apart from that which is extrapolated from the Conner's Teacher's Rating Scale, and classroom observations. Lastly, the follow-up period of 8 weeks is clearly limited in terms of valid prediction for long-term outcome. Despite these limitations, however, Gittelman-Klein and her associates have constructed a

paradigmatically sound approach and the current research represents an attempt to replicate their study with two essential modifications; first, an elaboration of dependent measures, and secondly, an extension of data collection from 8 weeks to 2 years.

Firestone, et al. (1981), completed a 3-month intervention program with 43 hyperactive children, which was constructed in a similar fashion to the Gittleman-Klein study. While the Firestone group found improvement with respect to home and school behaviour across all three groups (parent-training with placebo, parent-training with methylphenidate and methylphenidate only), their results suggested that only children treated with medication showed additional gains in the area of attention and impulse control. Their results also revealed greater improvement in the area of academic achievement and classroom behaviour in the medication groups as compared with children on placebo. They found no evidence of significant benefit from the addition of parent-training to the administration of medication.

An interesting feature of the Firestone study was the inclusion of a group of children whose parents received parent-training and who, themselves, received medication. After the fourth month, however, their medication was gradually replaced by placebo. This replacement took place without the knowledge of teachers or parents. It is reported that the parents and teachers of 7 out of the 8 children in this condition contacted the project within five weeks of the substitution to complain about the re-emergence of difficult and disruptive behaviour and reference was made, in particular, to inattentiveness and tantrums as well as oppositional and aggressive behaviour. Children who were originally placed

on placebo, however, were evidently regarded by teachers and parents to have achieved a stable level of functioning insofar as no complaints were made to the project. The authors suggest, therefore, that there was a "contrast effect" in the former group such that the 'placebo performance' was relatively unacceptable when compared with performance on medication.

Another important contribution to hyperactive outcome research has been provided by Loney and her associates over the last several years (Loney, Prinz, Mishalow and Joad, 1978; Loney, Kramer and Milich, 1979; Milich and Loney, 1979; Loney and Halmi; Loney, 1980). Much of their work is based on a retrospective analysis of adolescent boys from Iowa previously diagnosed hyperactive, and they have offered several innovative and compelling conclusions. In the first place, while they contend that the primary symptoms of hyperactivity tend to diminish with age (Milich and Loney, 1979), they are in general agreement with Weiss and her colleagues (Weiss, 1975; Weiss, et al., 1975; Weiss, et al., 1971) that hyperactive children remain at risk for serious problems in adolescence. Loney's group, however, focuses on secondary symptoms (e.g., aggression) as primary predictors of adolescent outcome and, accordingly, recommend that intervention studies consider more prominently the secondary symptoms (Safer and Allen, 1976) particularly in regard to the question of discerning those children who might best respond to medication.

Second, they present (Loney and Halmi, 1980) a cogent argument for confining research conditions to practical clinical conditions (e.g., not paying subjects). This may appear as a self-evident argument to many, but discussion with those who have attempted responsible, comprehensive research with hyperactive children will reveal the headaches and frustrations inexorably associated with maintaining a reasonable number of motivated subjects. In addition, investigators have often resorted to elaborate experimental interventions in the search for an unequivocally effective treatment. The clinical reality is such, however, that the treating professionals rarely have the time or resources to duplicate the elaborate experimental intervention. Third, Loney presents (Loney, Kramer and Milich, 1979; Loney and Halmi, 1980; Loney, 1980) a unique and assiduous argument for the use of regression designs in hyperactive outcome research. It is argued, for example, that the exclusion criteria necessary for homogenizing treatment groups on all but the independent measures in univariate designs often render the conclusions specific only to the study. Loney suggests that experimenters should rather focus on including those variables which are relevant to the disorder and attempting to discern, through clear description of the research conditions and multivariate analyses, the relative contribution of those variables to the prediction of outcome.

The uniqueness of Loney's argument is in the relegation of priority to the clinical reality. That is, the disorder should be studied as 'realistically' as possible and statistical designs should accommodate that reality, not the converse.

Loney's Model of Hyperactivity

The total contribution of Loney and her associates might be best summarized according to the prediction model which they developed through their work at the University of Iowa. The formulation of this model has steadily acquired prominence since the mid-1970s. The model was constructed primarily to improve the prediction of adolescent outcome and it relies on the examination of four separate criteria: aggressive symptoms, hyperactive symptoms, delinquent behaviour and achievement (academic). The model begins with the hypothesis that ecological variables and childhood aggression which are correlated at referral contribute to adolescent symptoms and delinquency. It is further hypothesized that treatment variables, childhood achievement and hyperactivity, which are also intercorrelated, contribute to adolescent achievement. Finally, Loney posits that only family variables are associated with all four categories of outcome.

Loney attempts to explain, through the model, why drug treatment has not been shown to influence adolescent behaviour and delinquency. This basically results from the essential difference between childhood hyperactivity which is improved with stimulant medication and childhood aggression which is not so improved - and, behavioural outcome and subsequent delinquency are understood to be determined by childhood aggression, in contradistinction to childhood hyperactivity. Loney's model suggests, therefore, that in order to influence adolescent outcome, it would be necessary to reduce childhood aggression or improve their environment (since ecological variables are correlated with childhood aggression).

Loney's work is relevant to the present research insofar as it provides a prediction model which is used to categorize predictor and criterion variables. Her theoretical conclusions are not being specifically tested, although it is anticipated that the results of this present research may encourage a more specific focus on her suppositions regarding the nature of childhood hyperactivity.

Tenacity of the Disorder

One of the earliest reported follow-up studies and one of the most frequently quoted is that which was presented by Weiss and her associates (1971). The authors studied 64 severely handicapped hyperactive children five years after the initiation of treatment. These children had been started on a trial chlorpromazine hydrochloride and failing positive response, switched to another medication (i.e., thioridazine, dextroamphetamine, methylphenidate, or a combination thereof). Twenty percent of the group had remained on the drug(s) for varying periods and most of the families received psychiatric counselling (10-20 interviews) over the five year period

although only 10% of families had received intensive family or individual psychotherapy. The authors found that while the hyperactivity had diminished, other handicaps, notably social and intrapsychic difficulties, attentional and learning disorders persisted. Their major conclusion, therefore, was that hyperactive children do not necessarily outgrow their restlessness (as had been earlier believed), rather, they express it in less gross or disturbing ways. The authors also found the most common psychopathology in their follow-up subjects to be emotional immaturity, followed by a lack of ambition and inability to follow through on a goal. This study provided significant impetus to follow-up research in hyperactivity particularly in view of the feared limitation (i.e., short-term relief only) of medication.

In that same year, Minde, et al. (1971), examined the academic performance of 37 school children diagnosed as hyperactive 4-6 years previously. The authors compared the performance of the hyperactive children with that of an equal number of non-hyperactive classmates. The authors provide no information as to treatment intervention, but the results indicate, nevertheless, that hyperactive children had a significantly higher failure rate in all academic subjects and were rated by their teachers as displaying far more behaviour problems than their control counterparts. This study supports, in general, the findings of Weiss, et al.

(1971) that hyperactive children do not 'outgrow' their illness by early adolescence.

There is now a considerable body of evidence which supports this same conclusion. In an attempt to correlate childhood behaviour with adult diagnoses, Robins (1966) retrospectively studied 524 child guidance clinic patients in comparison with 100 non-patient controls. In follow-up, only 8% of control subjects had seriously disabling symptoms compared with 34% of the patient group. In addition, Robins found that anti-social behaviours were the strongest predictors of adult pathology. In the study by Minde, et al. (1971), described above, results showed that 25% of the hyperactive subjects had a history of antisocial behaviour and 15% had had court referrals in contrast to 2% of the normal controls in Robin's (1966) study with similar experience. Borland and Heckman (1976) studied 20 men, diagnosed 20-25 years earlier as hyperactive, in comparison with their brothers. While the majority had completed high school and were self-supporting, one-half of the hyperactive group continued to show symptoms, and despite normal IQ levels, the hyperactives had not achieved a socio-economic status equal to that of their brothers or their fathers. The authors suggest that the emotional problems experienced by the hyperactive in regard to everyday living may result from the persistence of symptoms and that most of the social and psychiatric consequences

of the disorder relate to its presence in childhood as well as to its persistence in adulthood.

Some authors are less pessimistic concerning the long-term outcome of hyperactives, but this is more a result of the authors' speculations as to etiology than their observation of actual problems in later life. For example, Battle and Lacey (1974) studying 74 predominantly middle class hyperactive children found little correlation between motor hyperactivity in children and later grade achievement. The authors, therefore, argue against the use of "impersonal, external interventions" and recommend improved child-adult interactions through improved orientation toward achievement as a viable intervention for hyperactive children. In a more important study by Hechtman et al. (1976), the authors mollified the earlier concerns of Weiss and her associates (1971), insofar as they found hyperactive children - mean age, 19 years - following five years of no treatment (10 years after first visit to clinic) had become less impulsive and showed less pronounced scholastic difficulty. Nor did the hyperactives show any significant difference from control subjects with respect to adjustment in work situations and living arrangements. Furthermore, the hyperactives did not show significantly more antisocial behaviours, non-medical use of drugs or serious psychiatric disturbances. Nevertheless, the hyperactives continued to demonstrate poor reflectivity and both socialization skills and sense of well-being

continued to be poorer than in normal subjects. While it is difficult to resist the optimism of this study, it is based on a sample of only 35 subjects in a study in which the data is extrapolated from a variety of subjective clinical judgements. In any case, the overwhelming majority of opinion rests with the conclusion that hyperactive children "remain at risk for a variety of academic, social and societal difficulties which apparently develop regardless of whether the child was successfully treated with medication." (Milich and Loney, 1979, p. 93).

The Primary Characteristics

Inattention: The modification of diagnosis from "Hyperkinetic Reaction of Childhood and Adolescence" to "Attention Deficit Disorder with Hyperactivity" described in the DSM-III (American Psychiatric Association, 1980) is testimony to the prevalent belief that difficulties of attention are a universal symptom of hyperactive children, and that individual differences in the expression of excessive motor activity may be incorporated into the diagnosis of the specific disorder. Opinion varies with respect to the nature of the attention deficit but many agree with Douglas (1972) that it represents a disorder of the arousal system characterized by an inability to suppress response to irrelevant stimuli and maintain sufficient attention to the relevant stimuli.

In a review of the research on hyperactivity, Douglas and Peters (1979) concluded that most of the difficulties experienced by the hyperactive child can be traced to three related processes: the investment of attention and effort, the inhibition of impulsive responding, and the modulation of arousal level to meet situational or task demands. Insofar as stimulant drugs are thought to increase arousal, they are seen to produce improved performance on vigilance and reaction time tasks (Barkley and Jackson, 1977; Cohen, Douglas and Morgenstern, 1971; Knights and Hinton, 1969), although there is some suggestion that stimulant drugs may interfere with memory at higher dosages (Sprague and Sleator, 1977). A less well researched intervention for increasing arousal has been the use of contingency management techniques, but there has been reported some evidence that positive reinforcement is related to improved performance on a simple reaction time task (Cohen, 1970; Firestone and Douglas, 1975; Parry, 1973). It has also been shown that positive reinforcement is related to increased psychophysiological indications of arousal (Firestone and Douglas, 1975). It is also apparent, however, that contingency management techniques may produce an excess of tension as reflected in an apparent increase in impulsive responding. In any case, difficulties of arousal appear to be central to the hyperactive child's problem, and this is most clearly expressed

behaviourally through tasks requiring sustained attention. In a cross-group comparison study of hyperactive, behaviour problem, asthmatic and normal control children, Firestone and Martin (1979) found that attentional deficit was the only dependent variable distinguishing the hyperactive children from other disordered children.

School Achievement

With few exceptions (Hechtman, et al., 1976; Battle and Lacey, 1974) investigators report significant differences between the performance of hyperactive children and normals on measures of academic achievement (Loney, 1980; Minde, et al., 1972; Weiss, et al., 1971; Kappelman, 1975; Shrager and Lindy, 1970). The school difficulties of hyperactive children are reported to persist into adolescence and young adulthood (Borland and Heckman, 1976; Mendelson, Johnson and Stewart, 1971). The relationship between the specific school difficulties and the social behavioural problems of the hyperactive child is not yet well understood. In addition, the later school difficulties of hyperactives may result in part from the poor acquisition of basic educational competencies in the early years.

Behaviour Deviance

The behavioural disturbance in hyperactive children is commonly described according to classroom and peer

interaction criteria. Safer and Allen (1976) describe teachers as reporting extensive classroom disruption, that is, speaking out of turn, making disruptive noise, causing fights, while parents report belligerence, fighting, sibling quarrels and disobedience. Misconduct or aggression is referred to as a secondary symptom by some (Milich and Loney, 1979), but estimates of correlation between misconduct and hyperactivity range from 60% (Stewart, et al., 1966) to 90% (Satterfield, et al., 1972). Arguments as to its primary or secondary nature, therefore, are not related as much to the frequency of occurrence, as to its etiology (i.e., whether it is essential to the disorder or a result of the disorder). Its importance to the current research, however, is the reported strength of prediction for adolescent outcome yielded by aggressive symptomatology in childhood (Milich and Loney, 1979; Loney, 1980; Robins, 1966; Huessey, et al., 1973; Huessey, et al., 1974).

For example, Paternite and Loney (1980), in an attempt to examine cross-sectional and longitudinal interrelationships among empirically derived dimensions of hyperkinetic symptomatology and home environment, found statistically and clinically significant associations for aggression, whereas no such relationships were found for hyperkinesis. In addition, they found that aggression at referral predicts the severity of symptomatology in general and aggression at follow-up in

particular, whereas other referral symptom patterns did not predict follow-up outcomes. As is the case with many studies, however, this study relies on symptom reporting criteria to classify a child as aggressive. Very often, the symptom reporting is confined to parents and here one can predict a great variation in the understanding of aggression. It is probably more accurate to describe these symptoms as referring to deviant behaviour problems. Should the investigation of behaviour problems (or, conduct problems) proliferate, a careful analysis of the dimensions of this problem will become extremely important. For example, an aggressive child may not act out aggressively and by the same token, a non-aggressive child may display a variety of aggressive behaviours (this is often seen in work with mentally retarded children, and brain-damaged children). This distinction may be seen as all the more important when one considers the relationship between behavioural symptoms and constitutional symptoms vis-à-vis the arousal theory of inattention, particularly when it has been shown that even in contingency management paradigms, children can be given sufficient 'positive' reinforcement to 'push' them beyond an optimal level of performance and impulsive responding actually increases (Firestone and Douglas, 1975).

Organic Factors

Attempts to relate hyperactivity to organic dysfunction have been equivocal, and particularly, in more recent literature which seeks to find stable predictors for drug responsiveness. Clear distinction is made, however, between children who suffer obvious neurological impairment resulting from disease or trauma and hyperactive children in whom organic indicators are of the "soft" or "minimal" type. The differentiation between organic and non-organic hyperactive children, therefore, is made on the basis of "soft" neurological signs, cognitive assessments, developmental histories and family histories, etc. Epstein, et al., (1968) found on the basis of such differentiation, that hyperactive children believed to suffer organic dysfunction showed greater improvement in Porteus Maze performance, parental evaluations and psychiatric interview ratings while on stimulant drugs as compared with hyperactive children with no evidence of organic dysfunction. Weiss, et al., (1978) found similar differential drug response. Knights and Hinton (1969), however, found no such difference between organics and non-organics, and Rie, et al., (1976) found a negative correlation between organicity and drug response. The literature in this area, therefore, is obviously unclear and discrepant.

Family Variables

Under the rubric of family variables may be included genetic factors and psychological factors. As suggested by Cantwell (1975) the current research in genetic variables is limited, but fruitful evidence is emerging and it is evident that hyperactivity is a familial disorder transmitted from one generation to the next. There is some evidence, as well, that childhood hyperactivity is linked with adult psychiatric illness (Morrison and Stewart, 1971; Cantwell, 1972).

Weiss et al. (1975), found some interaction effects between family variables and chemotherapy which could viably predict treatment outcome. They assigned a family diagnosis rating based on a 5 point scale with 5 indicating the most desired score. The scale items included: stability in the home, marital relationship, psychiatric illness in parents, continuity and presence of mother, deviant child rearing practices and general emotional climate in the family. The family diagnosis was not significantly related to the five year outcome of the non-medication group of hyperactive children, but for those hyperactive children treated with medication, family diagnosis correlated significantly with good outcome for academic achievement ($r = 0.36, p < .05$) absence of delinquency ($r = .38, p < .05$) and emotional adjustment ($r = .48, p < .01$). The authors concluded, therefore,

that when combined with a good family environment, stimulant medication may be predictably effective. These findings are in agreement with the conclusions of Loney, et al., (1975), and Conrad and Insel (1967). Schleifer, et al., (1975), however, found that hyperactive children who responded more positively to medication were more symptomatically severe and had mothers who were more frustrated and punishing than mothers of less severe hyperactive children who responded less positively to medication.

Rationale and Hypothesis

Despite various research efforts, the long term effect of treatment intervention with hyperactive children remains unclear. There is no evidence that medications or behavioural strategies have a significant ameliorative effect in the long term, although there have been design problems in the studies reported to date. In fact, there has been no prospective group outcome study reported to date which examines pre-post data beyond a 12-week period. The present research is intended primarily to examine, prospectively, the longer term consequences of treatment with medications as compared with behavioural interventions. Design flaws discussed in the literature review are corrected not only in regard to the length of the data collection period but also in regard to the outcome measures used; specifically a laboratory measure

of attention (the RT task) and a standard measure of achievement (the Gates-MacGinitie Reading Test).

Secondly, the present research is intended to improve upon previous studies through an examination of predictor variables which might offer better clarity with respect to the nature of interaction between subject and treatment over the long term. Previous prospective studies have sought primarily to draw inferential conclusion from rigid treatment comparison and have ignored concomittant data. In this regard, Loney's work is focused upon especially insofar as her prediction model offers a method of analysis which reduces a host of variables to three predictor categories and four outcome categories. This study examines, in particular, the role of family variables with respect to predicting long term response to treatment intervention.

The first hypothesis reflects the short term findings of the major outcome studies reported in the Review section. It is important that this sample of hyperactive children be regarded as similar to those reported in earlier studies so that whatever long term findings are discovered they may be considered as relevant to the children studied by other investigators. Accordingly the first hypothesis seeks to replicate, with some modification, the findings of earlier work particularly that of Gittelman-Klein, et al. (1979),

Loney, et al. (1980) and Firestone, et al. (1981) and is stated as follows:

1. Hyperactive children treated with stimulant medication will demonstrate significantly better performance in a 4-month pre-post comparison on criterion measures of hyperactivity, conduct problems, attention, impulsive responding, and academic achievement, when compared with hyperactive children treated with placebo and parent-training.

With regard to long term outcome the majority of studies to date would predict no significant differences between treatment groups on outcome measures. In keeping with the logic of 'what works in the short term should work in the long term', however, the long term hypothesis is stated in the positive in the expectation that design improvements in this study may yield the 'logical' findings. Accordingly, the second hypothesis is stated as follows:

2. Hyperactive children treated with stimulant medication will demonstrate significantly better performance in a 2-year follow-up than hyperactive children treated with placebo and parent-training or criterion measures of hyperactivity, conduct problems, attention, impulsive responding, and academic achievement.

It is noteworthy that the first two hypothesis contradict the expectations of the Loney group regarding outcome of conduct problems. Accordingly, there will be some focus on this discrepancy in the Discussion chapter.

The third hypothesis describes the expectation (cf. Weiss, Barkeley, for eg.) that family variables, specifically parental characteristics, will predict outcome. It is stated as follows:

3. Family variables (as listed elsewhere) will predict significantly for outcome on criterion measures of hyperactivity, conduct problems, attention, impulsivity and academic achievement.

CHAPTER II

RESEARCH DESIGN

The magnitude of this project was such that many people were required to maintain up-to-date assessments and regular contacts with parents. Thus, many colleagues from the Department of Psychology of the Children's Hospital of Eastern Ontario were involved with the project. As such, it was difficult to confine essential information to a centralized few, but to the best of the author's knowledge, this research represents a successful maintenance of a double-blind design during the pre-post period.

Subjects

Only children between the ages of five to nine years, referred to the Learning, Psychiatry or Psychology Outpatients services of the Children's Hospital of Eastern Ontario, were considered for participation in the study. Each child with suspected hyperactivity was referred by a physician and judged by a clinical psychologist to fit the DSM-III criteria for attention deficit disorder with hyperactivity (described earlier). All subjects demonstrated these symptoms of hyperactivity, both at home and at school before 3 years of age. Additionally, only those children with a scale rating of 1.5 or higher on the Hyperactivity Index (Conners Teachers' Rating Scale, cf. Conners, 1969) were

included. Each child was required to have a Peabody Picture Vocabulary I.Q. of 85 or higher, and all children who showed definite signs of brain damage, epilepsy or psychosis were excluded from the sample. There were a total of 73 subjects for the pre-post analysis, 52 for first follow-up analysis, and 30 for the second follow-up analysis. Of the 73 subjects considered in the study, eleven were girls.

Procedure

The behavioural intervention was parent-training and included individual consultations with a qualified psychologist, participation in a parent-training group supervised by a qualified psychologist and co-ordination of home-school contacts in order to facilitate the parents cooperation with school personnel. The parent-training therapists provided, as well, two consultation sessions to the teachers involved.

The psychopharmacological intervention was confined to the administration of methylphenidate (or Ritalin) except in the case of 2 subjects who suffered adverse reaction, and who were subsequently switched to dextroamphetamine supervised either by a hospital pediatrician or the child's personal physician, but monitored by a psychologist involved with the project. There was no co-intervention for those children included in the research group. If the child required co-intervention, he was removed from the study.

When a child met the criteria for inclusion in the study, the family was given a full description of the project in addition to information concerning Ritalin. Further appointments for data collection and obtaining a signed informed consent were scheduled once the family agreed to participate.

Following an initial pre-testing, children were randomly assigned to one of three groups: parent-training plus Ritalin (PTRIT), parent-

training plus placebo (PTPL), or Ritalin only (RIT ONLY). The placebo was identical in size, colour and shape to the Ritalin used in the study. One psychologist was responsible for the administration of the Ritalin and placebo, in consultation with the child's physician. None of the pertinent research staff (therapists and those testing the children) nor parents or teachers, however, were aware of the medication conditions during the pre-post period.

For those parents of children in the parent-training groups (PTRIT and PTPL), there were provided initial consultations of approximately 3 sessions. During this time, they were asked to read a book on child management (Patterson, 1971) and demonstrate a reasonable understanding of the behavioural principles contained therein. Having completed this, they were asked to join a parents' group of six sessions where more specific behaviour management programs were discussed. There were four couples in each group. However, nine children had only single parents who participated. Finally, the parents were given advice with respect to efficient cooperation with school personnel. Only those parents of children in the Ritalin-only group were not told of the parent-training. All parents were given the same instructions regarding medication. Virtually all parents attended all group sessions.

Medication regimes were commenced just prior to the initiation of the group meetings. Parents were instructed to give their children dosages in the morning and at noon every day including weekends. Dosages were raised or lowered in 5 mg steps based on parental and teacher reports by

telephone over a 3-4 week period. Once having established an optimal dosage for the particular child (decrease in problematic behaviour and absence of negative side effects), the children were given medication only on school days.

Predictor Variables

The predictor variables are subsumed under three headings: treatment, familial and subject. The treatment variable was discussed earlier, that is all subjects were assigned to one of three treatment groups and the treatments utilized represent the most widely used therapeutic strategies.

Familial variables included both demographic factors and emotional factors. Each family was asked to complete an extensive intake outlining any history of neurological or psychiatric disorder. As well, parents' IQ, income level, level of marital adjustment and index of psychopathology were measured.

Subject variables include age at referral, IQ, academic achievement, attentionality, conduct problems and hyperactivity.

The list of predictor variables is presented below:

<u>Treatment</u>	<u>Familial</u>	<u>Subject</u>
1. PTRIT	1. Total family income	1. Age at referral
2. PTPL	2. Mother's age	2. IQ
3. RIT ONLY	3. Mother's IQ	3. Mean Reaction Time)
	4. Mother's education	4. Impulsive responses) at
	5. Mother's psychopathology index	5. School performance) referral
	6. Father's age	6. Hyperactivity)
	7. Father's IQ	7. Conduct problems)
	8. Father's education	
	9. Father's psychopathology index	

Criterion Variables

The alleviation of primary symptoms is the basic criterion for therapeutic intervention. The symptoms of hyperactivity are pervasive and may profoundly influence the child's adjustment, not only to his immediate environment, but also to the day-to-day demands of his later adult life. Accordingly, the criterion variables used were improvement of symptoms presented at referral. Thus, the list is as follows:

Criteria

1. Mean Reaction Time)
2. Impulsive responses)
3. School performance) at follow-up
4. Hyperactivity)
5. Conduct problems)

Operational Definitions

Mother's IQ

The equivalent score on the Wechsler Adult Intelligence Scale estimated on the basis of the score achieved on the Shipley-Hartford Institute of Living Scale

Mother's Education

Number of years of scholarship

Mother's Psychopathology Index

The total of subscale scores on the Minnesota Multiphasic Personality Inventory with the exception of the lie (L) scale and the correction (K) scale

Father's IQ

Same as for mother

Father's Education	Same as for mother
Father's Psychopathology Index	Same as for mother
Mother's (and Father's) Marital Adjustment	The total score on the Locke-Wallace Marital Adjustment Scale
Child's IQ	The score achieved on the <u>Peabody Picture Vocabulary</u>
Mean Reaction Time	The average time between stimulus and required reaction over repeated trials
Impulsive Responses	Total number of false starts elicited by a warning signal plus all inappropriate inter-stimulus responses
Academic Achievement	The score achieved on the <u>Gates-MacGinitie Reading Test (Vocabulary)</u> . Originally the design included measures of both arithmetic and reading performance levels, but extremely high pre-test correlations obviated the need for all three. Vocabulary had the highest pre-test correlations with the other two.
Hyperactivity	The score recorded on the <u>Teachers' Conners Hyperactivity Index</u>
Conduct Problems	The score recorded on the <u>Teachers' Peterson-Quay Behaviour Problem Checklist: Conduct Problem</u>

Abbreviations

Although each variable is described in full at the time of its first mention in each chapter, they are subsequently referred to in abbreviated form in order to facilitate the readers' task.

The list appears as follows:

Treatment Variables

1. PTRIT - Parent-training plus Ritalin
2. PTPL - Parent-training plus Placebo
3. RIT ONLY - Ritalin only

Familial (Parent) Variables

1. INC - Total Family Income
2. MAGE - Mother's Age
3. MWAIS - Mother's IQ
4. MED. - Mother's Education
5. MMPI - Mother's Psychopathology Index
6. FAGE - Father's Age
7. FWAIS - Father's IQ
8. FED - Father's Education
9. FMPI - Father's Psychopathology Index
10. MLW - Mother's Marital Adjustment
11. FLW - Father's Marital Adjustment

Subject Variables

1. Age - Age at Referral
2. IQ - Child's IQ
3. $\bar{X}$ RT - Mean Reaction Time
4. TIMPR - Total Impulsive Responses
5. GMVG - School Performance (Vocabulary)

- 6. TCHI - Hyperactivity
- 7. TPQCP - Conduct Problems

Testing Schedule

The most extensive testing was performed at intake when all familial and subject variables were measured. At each subsequent testing, however, only the subject variables representing the criteria were reassessed.

Thus, comparisons may be made between the strength of prediction at one follow-up testing as opposed to another.

The schedule, itself, appears below:

- 0 months - Pre-test; all familial and subject variables
- 0- 4 months - Initiative of treatments, parent training completed by 4th month
- 4 months - Post-test
- 10-12 months - First follow-up
- 22-24 months - Second follow-up

Measures

Virtually all measures used in the study are conventional for child treatment research and remain consistent with Loney's categories of prediction and outcome.

Each measure used in the study is described briefly:

Demographic Data Questionnaire

The questionnaire utilized in the study was developed by the research staff but reflects, in general, the typical intake formats used in most clinical settings.

Conners Teachers' Rating Scale

This has become one of the most commonly used scales in hyperactivity research. Each of the 39 behavioural items contained in the scale is numerically weighted, according to a 4 point system (from 0-3) with higher values indicating more severe pathology. A factor analysis of the 39 items yields four factors: 1) conduct-problem, 2) inattentive-passive, 3) tension-anxiety, and 4) hyperactivity. A sum total of the weighted items within each factor represents the symptom score.

In a further extrapolation from the scale items, Goyette, Conners and Ulrich (1978) derived a Hyperactivity Index. This index has been frequently used to estimate the extent of a child's hyperactivity and mean cut-off scores of 15 to 18 are generally used for inclusion in studies of hyperactive children.

Locke-Wallace Marital Adjustment Scale

Developed in the late fifties (Locke and Wallace, 1959), this scale has been recently shown to possess a high level of discriminant validity with other marital satisfaction questionnaires (Haynes, Follingstad and Sullivan, 1979), and is reported to have stable test-retest reliability over a two-year period (Kimmel and Van der Veen, 1974).

Higher scores (approximately 130 plus), on the 15 weighted item test reflect greater satisfaction and lower scores (below 100) reflect poorer marital adjustment. This is a self-report questionnaire and scores range from 2 to 158 points.

Shipley-Hartford Institute of Living Scale

This scale is comprised of a 20 item vocabulary test and a 20 item abstract reasoning test and may be self-administered in 20 minutes.

Due to its relative convenience regarding administration and consumption of time, and in view of its reportedly high correlations with the full scale Wechsler Adult Intelligence Scale (.78 to .90; cf Paulsen and Lin, 1970), it is often used by researchers as an estimate of IQ.

Minnesota Multiphasic Personality Inventory

There is, perhaps, no other psychological test more widely used in clinical research. This is 566 item self-report inventory to which the subject is asked to respond true or false. From his responses, there may be constructed a personality profile comprising ten clinical scales ranging from hypochondriasis to social-introversion. There has been considerable debate regarding its reliability and validity for research, but it has been proposed (Waskow, 1975)

that the MMPI is the best measure of psychological disturbance available to date. The addition of subscales to yield a total pathology index is a procedure reported in Welsh and Dahlstrom (1956).

Peabody Picture Vocabulary Test

This is a convenient (i.e., relatively short) method for estimating a child's IQ, and has been used in lieu of the more comprehensive and time consuming Wechsler Intelligence Scale for Children. The child is asked to indicate one of four drawings as the correct association to the examiner's verbal presentation of the vocabulary stimulus word.

Peterson-Quay Behaviour Problem Checklist

This test has been the subject of some controversy and some find it to be unsatisfactory (Knights and Hinton, 1969). It was used by Minde, et al. (1972), however, and was reported to differentiate poor from good outcome in treated subjects despite the lack of relationship between drug treatment and psychotherapy and outcome.

Gates-MacGinitie Reading Tests

This is a widely used tool in educational psychology, effective in the measurement of grade equivalent achievement

in vocabulary and reading comprehension for grades kindergarten through nine.

Reaction Time Apparatus

This delayed reaction time test has been shown to discriminate between hyperactive and normal children (Cohen and Douglas, 1972; Firestone and Douglas, 1975; Firestone and Martin, 1978). The Reaction Time task has been frequently used, particularly with young children. This task provides for two measures: mean reaction time and total impulsive responses.

The apparatus provides a pre-programmed series of auditory and visual stimuli. An auditory tone of 70 db SPL intensity and 1 second duration was fed directly to the subjects' earphones and served as the warning signal to activate the sequence. Two seconds after the auditory warning signal, a 7.5 watt light bulb was flashed. The subject who was normally maintaining a reaction time button in a depressed position was instructed to release the button as soon as possible following the visual signal. After the subject's response, there was a 5 sec. wait period. Subsequently, a new trial was initiated. Occurring at random within the next 10 sec. interval was the presentation of the auditory warning signal. Testing continued for 60 trials. The signal light was housed in an enclosure placed on a table in front of the child while the reaction time button was fixed to the arm of a chair. An electronic timer was

simultaneously started with the onset of the reaction signal (i.e., the light flash) and continued recording until the subject released the response button. The mean reaction time over 60 trials was then calculated. In addition, a counter automatically recorded all false starts (i.e., responses after the warning signal but before the light flash) elicited by the warning signals as well as inappropriate inter-stimulus responses (i.e., responses before the onset of the warning signal). These false starts and inappropriate responses are referred to as 'impulsive responses'.

Statistical Analysis

There is careful attention paid to descriptive statistics in this study because of the potential for qualitative information which might be lost in a strict inferential analysis. No specific generalizations, however, are drawn from the descriptive statistics.

With regard to the first research hypothesis, data were analyzed according to the standard SPSS program for analysis of variance with repeated measures (Nie, et al., 1975). There are two issues regarding this ANOVA that are worthy of note. The first problem is that which arises from the use of multiple testings and criteria. The use of separate analyses for different variables increases the probability

of Type I error if the same significance level is used as a criterion as when the analysis is used for only one variable. There does not exist a universal rule which governs the choice of significance level. The choice, therefore, becomes largely a question of the researcher's judgement. On the one hand, one may alter the significance level by a factor equal to the number of hypotheses tested (Kirk, 1968, pp. 82-86); on the other hand, one can choose to base the error rate upon each hypothesis tested.

In the present research, there is, in fact, some evidence of a pre-test correlation ($p < .001$) between a number of the criterion variables (Appendix D), particularly GMVG with both $\bar{XRT}$ and TIMPR, $(-.70)$ and $(-.47)$ respectively. It has been assumed, however, that the apparent relationship between both reaction time and impulsive responses and grade achievement is due to a moderator variable. With this assumption in mind, therefore, they will be treated as if they were independent of one another and the data interpreted accordingly. It was further decided to set the alpha level consistent for each analysis.

The second problem involves the assumption of symmetry and equality of the variance-covariance matrix; i.e., with repeated measures, it is assumed that the population covariances between pairs of treatment levels are constant (Kirk, 1968, p. 139). This assumption is also called the

assumption of equal correlations (Edwards, 1967, p. 317) and its validity may be tested using the Box's "M" statistic. In the present research, the only criterion which does not meet the assumption of equal correlations is TIMPR at post-test $F(6, 74442) = 3.32, p < .004$, at first follow-up $F(18, 2740) = 5.70, p < .001$, and second follow-up $F(30, 1022) = 3.50, p < .001$. All other variables meet the criteria described above.

Both the stepwise multiple regression program and the discriminant analysis program are taken from the standard SPSS programs (Hull and Nie, 1981).

The regression analysis is intended primarily to provide evidence pertinent to the second research hypothesis. As well, this is in conformity with Loney's assertions that regression analyses can provide more useful information with respect to the ecological parameters of hyperactivity.

The discriminant analysis is intended primarily to provide some heuristic evidence toward the delineation of stable predictors of relative success within the population of hyperactive children.

In general, the approach to the statistical analysis of the data will follow the general philosophy of Keppel (1973):

The statistical procedures are guides to aid us in guessing at which facts are "real" and which are not. In the absence of any other information, rigid decision rules, where we maintain alpha at an arbitrary level, makes some sense. But if a finding is interesting theoretically, we should not ignore its presence because it fails to exceed the critical F value or its corrected value. Agreement with previous experiments and internal consistency with other response measures in the current experiment are important factors that we should take into consideration when we are drawing inferences from our data. The pure statistical arguments represent one input contributing to our final decision (pp. 466-467).

CHAPTER III

PRESENTATION OF RESULTS

Prior to the actual presentation of the data, this chapter will include a brief introductory discussion of issues which arise from the nature of the data collection. The data will then be presented in four separate stages or formats. In the first stage, the treatment groups will be compared with respect to their performance on criterion measures using analysis of variance with repeated measures. These analyses are intended to provide information pertinent to the hypothesis of continuity with previous research. In the second stage, which serves as a prefatory orientation to the correlation-based statistics presented in the latter stages, the data are presented in the form of descriptive statistics. While this may represent somewhat of a departure from conventional data presentations, it is believed that several important features of the data are better elucidated by descriptive statistics than would be the case with inferential or correlational statistics. In the third stage, data are subjected to a stepwise-multiple regression in order to investigate those hypotheses pertaining to Loney's model of hyperactivity. In the final stage, the data are analysed through discriminant function analysis as part of a heuristic investigation which might give rise to further

research questions. In addition to the section detailing the descriptive statistics, this chapter differs from conventional presentations in at least one other way. This is in reference to the inclusion of some 'discussion' with each of the analyses presented. The decision to include some brief discussion in this chapter is related to the burdensome, at times tedious, routine of data reporting, the meaningfulness of which may be lost or forgotten by the time the reader has reached the end of the chapter. The inclusion of a brief discussion is intended to, at least, orientate the reader to the manner in which the results will be later handled in the discussion chapter per se.

Preface

Prior to the actual presentation of these results, there is some discussion necessitated by the changing cell sizes which occur throughout the study. While considered normal in experimental studies, maintaining a constant number of subjects during an investigation often proves to be very difficult, if not impossible, in clinical studies. There are several reasons for the changing 'Ns' in the present study. First, several children were placed either on or off medication following post-testing, and sometimes back again, according to their progress. That is, the

reality of the child as a patient superceded the child's value as a subject. Secondly, the total number of children involved in the study shrinks from N=73 for post-test (after 4 months) data to N=52 for second follow-up data (after 2 years). This is largely attributed to the staggered entry of subjects into the study. Thus, while some subjects were completing their second follow-up, other subjects were just completing their post-tests. It is important to note, however, that the data, such as they are, represent virtually all children referred for treatment of hyperactivity to the Children's Hospital of Eastern Ontario, who met the conditions for inclusion in the study over a period of approximately 30 months. Thirdly, there is the ever-present problem of drop-outs.

There are two categories of drop-outs in this study. First, there are those who dropped out during the pre-test period (N=61). The reasons for dropping out were variable (cf. Firestone and Witt, 1981) but they were not included in the study. The remaining 73, therefore, represent those children and their families who agreed to participate. There were 2 children whose families moved during the course of their treatment. Nineteen children were lost through staggered entry (i.e., they did not make it to 2nd follow-up by the time of this data report). Thus, of the initial 73 subjects, only 52 had 2nd follow-up data. However, only 30 subjects are considered for 2nd follow-up analysis. The

remaining 22 subjects comprise the second category of drop-outs - i.e., those whose non-adherence to treatment condition made it impossible for them to be included in any one treatment group. Usually the non-adherence occurred by virtue of their poor response to initial treatment and hence the need to be changed to an alternative treatment, and frequently they were changed a second or third time.

While one should attempt to identify particular characteristics of each of the groups resulting from changed condition, drop-out, etc. it can be seen in Table I that the Ns are sufficiently small and variable to render any conclusions drawn from their comparison risky, at best.

The problem remains, however, as to which data represent, most accurately, true clinical conditions. For example, it can be shown that the three treatment conditions differ significantly on performance measures at post-test when all 73 subjects are considered. When only those subjects who have remained in their original condition through to the first follow-up and second follow-up assessments are considered, however, these pre-post differences vanish. In any case, both alternatives will be presented.

Table I

NS FOR RESEARCH GROUPS, AND GROUPS CREATED
BY SUBJECTS CHANGED FROM THEIR ORIGINAL CONDITION

Group	Pre- Post	First Follow-Up	Second Follow-Up
1 Ritalin Only (RIT ONLY)	24	19	12
1A RIT ONLY to Ritalin Withdrawal (RW) After Post	2		
1B RIT ONLY to RW After First Follow-Up	4	4	23
2 Parent Training and Placebo (PTPL)	10	9	8
2A PTPL to PTRIT After Post	7		
2B PTPL to PTRIT After First Follow-Up	4	4	13
3 Parent Training and Ritalin (PTRIT)	16	14	10
3A PTRIT to PTRW After Post	4		
3B PTRIT to PTRW After First Follow-Up	2	2	16
TOTAL	73	52	30
4 PTPL to PTRIT	7	7	5

Pre-Test Homogeneity

Analysis of variance of group means (i.e., Ritalin only (RIT ONLY), Parent Training with Placebo (PTPL), and Parent Training with Ritalin (PTRIT)) (Appendix A) on all pre-test variables, produced non-significant results.

It may be assumed, therefore, that groups are homogeneous with respect to research variables at the beginning of the study. In addition, each of the dependent variables (criterion measures) is, evidently, homogeneously represented by the three treatment groups. Nevertheless, the spread of scores on TIMPRI calls for some caution insofar as there appear to be large individual differences between subjects within each treatment condition. While it is true that this spread is consistent between groups, generalizations will be made very carefully, particularly in view of the results of the test for equal correlation discussed previously in Chapter II.

Relative Improvement vs Required Improvement

The improvement required before a disorder may be considered effectively treated is very often the patient's own report of symptom alleviation and/or laboratory results

which confirm the cessation or elimination of a disease process, or problem. This laboratory confirmation is achieved by comparing the individual patient's results with well established norms for the analysis in question. With the exception of the Teachers' Conners Hyperactivity Index, none of the criterion measures have well established or universally accepted norms which might confirm the 'psychological health' of the child in question. The Gates-MacGinitie Reading Test does provide age norms, but each treatment group has children whose ages range over 4 years. In effect, therefore, there can be little judgement made regarding an absolute elimination of a particular child's hyperactivity.

The present research will, therefore, be confined to an analysis of 'relative' improvement and in Tables II through IV, the group means and standard deviations of the three treatment groups on each of the criteria are provided. A readily apparent feature of these data is that each group 'improves' (i.e., performance scores become relatively better) over time. The significance of this relative improvement might have been better established by comparing it with the performance of an experimental control group of hyperactive children who receive virtually no intervention. Ethical considerations, of course, prevent such a strategy but some attempt to place this relative improvement into perspective will be made in the discussion chapter.

Table 11

GROUP MEANS AND STANDARD DEVIATIONS FOR
PRE-POST RESULTS ON ALL CRITERION MEASURES

Criterion	Group	Pre-Test		Post-Test	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.
TCHI	RIT ONLY	1.96	.37	0.91	.58
	PIPL	1.93	.35	1.37	.57
	PTRIT	1.85	.31	0.89	.79
TPQCP	RIT ONLY	9.50	2.89	5.75	3.53
	PIPL	9.57	2.78	8.33	4.14
	PTRIT	9.48	2.22	5.40	3.67
XRT	RIT ONLY	.81	.27	.67	.24
	PIPL	.84	.28	.82	.23
	PTRIT	.84	.23	.68	.23
TIMPR	RIT ONLY	22.93	29.42	11.01	20.91
	PIPL	13.56	13.69	11.18	15.62
	PTRIT	21.32	23.42	10.81	12.94
GNG	RIT ONLY	2.64	1.81	3.34	2.23
	PIPL	2.81	2.27	3.23	2.47
	PTRIT	2.95	1.33	3.44	1.65

Table III
GROUP MEANS AND STANDARD DEVIATIONS FOR
PRE-POST-FIRST FOLLOW-UP RESULTS ON ALL CRITERION MEASURES

Criterion	Group	Pre-Test		Post-Test		First Follow-Up	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
TCHI	RIT ONLY	1.97	.37	.88	.61	.96	.54
	PIPL	1.86	.33	1.21	.52	1.27	.62
	PTRIT	1.87	.34	.98	.51	.96	.43
TPQCP	RIT ONLY	9.64	3.18	6.14	3.87	6.29	3.88
	PIPL	9.46	4.32	7.46	3.91	7.61	4.22
	PTRIT	9.15	2.09	6.25	3.89	6.28	4.25
XRT	RIT ONLY	.79	.27	.66	.23	.59	.16
	PIPL	.78	.23	.77	.30	.66	.21
	PTRIT	.84	.22	.66	.22	.59	.20
TIMR	RIT ONLY	22.44	31.46	11.4	23.49	2.24	4.58
	PIPL	14.48	13.42	9.0	11.38	7.54	11.70
	PTRIT	19.98	25.19	8.4	12.16	4.18	4.96
GMVG	RIT ONLY	2.64	1.72	3.26	1.82	3.46	1.98
	PIPL	3.16	2.32	3.56	2.50	3.97	2.39
	PTRIT	2.94	.95	3.47	1.14	3.96	1.22

Table IV

GROUP MEANS AND STANDARD DEVIATIONS FOR PRE-POST
FIRST FOLLOW-UP/SECOND FOLLOW-UP RESULTS ON ALL CRITERION MEASURES

Criterion	Group	Pre-Test			Post-Test			First Follow-Up			Second Follow-Up		
		$\bar{X}$	S.D.	(N)	$\bar{X}$	S.D.	(N)	$\bar{X}$	S.D.	(N)	$\bar{X}$	S.D.	(N)
TCHI	RIT ONLY	2.03	.39	(11)	.81	.44	(11)	.96	.59	(11)	1.09	.60	(11)
	PTPL	1.83	.28	(9)	1.12	.56	(9)	1.07	.55	(9)	1.09	.63	(9)
	PTRIT	1.81	.38	(10)	1.03	.46	(10)	.92	.36	(10)	1.06	.59	(10)
TPQCP	RIT ONLY	9.59	3.61	(11)	6.45	4.42	(11)	5.91	3.61	(11)	6.97	4.41	(11)
	PTPL	9.56	4.37	(9)	6.89	4.23	(9)	6.44	4.02	(9)	4.51	3.57	(9)
	PTRIT	8.90	2.23	(10)	5.80	2.81	(10)	6.43	3.36	(10)	5.98	3.63	(10)
XRT	RIT ONLY	.77	.16	(12)	.64	.19	(12)	.59	.13	(12)	.60	.11	(12)
	PTPL	.82	.16	(8)	.75	.22	(8)	.70	.15	(8)	.64	.14	(8)
	PTRIT	.86	.24	(10)	.66	.27	(10)	.63	.25	(10)	.52	.12	(10)
TIMPR	RIT ONLY	17.81	28.93	(12)	6.75	11.01	(12)	1.00	.95	(12)	2.75	3.30	(12)
	PTPL	17.17	14.14	(8)	10.01	13.13	(8)	10.50	14.07	(8)	3.00	2.51	(8)
	PTRIT	17.43	12.62	(10)	7.40	12.72	(10)	3.30	4.32	(10)	5.60	6.91	(10)
QWVG	RIT ONLY	2.51	1.35	(10)	3.42	1.54	(10)	3.56	1.62	(10)	4.56	1.70	(10)
	PTPL	2.42	1.96	(8)	2.51	1.62	(8)	3.23	2.16	(8)	4.29	2.74	(8)
	PTRIT	.95	3.47	(9)	3.46	1.22	(9)	3.97	1.34	(9)	5.14	1.92	(9)

It is also apparent from these tables, that the within-group variances change differently according to treatment condition, criterion variable and with the duration of the subjects' participation in the study. It is further apparent that the means of the treatment group performances change at different rates despite their virtual similarity at the second follow-up assessment. For example, in Table IV, the RIT ONLY group improves from a mean performance of 2.03 on the Teachers' Conners Hyperactivity Index, at pre-test to a mean of 0.81 at post-test - a 60% improvement. The corresponding standard deviation increases 12% from .39 to .44. The PTRIT group changes from a mean performance of 1.81 at pre-test to a mean of 1.03 - a 43% improvement. The corresponding change in standard deviation in this group is an increase of 21% - from .38 to .46. The PTPL group, on the other hand, shows a more modest improvement from 1.83 to 1.12 or 38% and a corresponding standard deviation increase of 100%! At first glance, these ratios would seem to indicate that children treated with Ritalin respond more consistently and quickly while children treated behaviourally, without medication, demonstrate greater individual differences in response, the small cell sizes notwithstanding. When these same groups are compared at second follow-up, however, they show virtually the same mean performances (1.09, 1.06 and 1.09 respectively) and

correspondingly similar standard deviations (.60, .59 and .63 respectively). These ratios, therefore, would seem to indicate that given sufficient time, children will respond equally well to either treatment. When this same analysis is performed on an increasingly greater number of subjects (Tables II and III), however, different conclusions may be drawn. For instance, Table III shows the progression of performance over three test periods based on a total of 50 children. Focusing on the TCHI, it is evident that the Ritalin groups improve at a similar rate; the RIT ONLY group from a mean of 1.97 at pre-test to .88 at post-test and to .96 at first follow-up, the PTRIT group from 1.87 to .98 and .96 respectively. Alternatively, the PTPL group again shows a relatively more modest improvement from a mean of 1.86 to 1.21 and at first follow-up, a mean of 1.27. In contradistinction to the data reported in Table IV, however, the standard deviations of all three groups jump approximately 60% to similar levels at post-test. It is only at first follow-up that the two Ritalin groups show a decrease in standard deviation (approximately 13%) indicating an increasingly greater consistency between subjects with respect to their response to Ritalin. The placebo group (PTPL), however, continues to show an increasing spread at first follow-up (from .52 to .62 or 20%), indicating that the children's response to behavioural treatment is, indeed, more variable - or, less predictable.

In other words, there are some conclusions which may well prove to be unreliable depending on which data they are based, and which data are understood to more accurately reflect real clinical circumstances. Nevertheless, an important implication of the descriptive statistics is the apparent rapidity-of-response and consistency-of-response differences between children treated with Ritalin, on the one hand, and children treated with a behavioural approach and without medications, on the other. Of particular interest is the suggestion that children treated behaviourally show less consistent responses than the drug treated children. No doubt, the changing variance may, to some extent, be an artifact of the shrinking Ns, but insofar as it may reflect important individual differences in response, it deserves further study. Interestingly, the prediction of response to drug treatment has been a far greater preoccupation of researchers than has the prediction of response to behavioural treatment.

There are four additional criterion measures for which a descriptive analysis may be accomplished. The above discussion was intended to highlight the complexity introduced to the study by changing cell sizes and subjects who were changed from their original condition, thereby altering, retroactively, the makeup of the original group. For instance, if 50 subjects begin a study in condition A and

25 of them are changed to other groups through to a fourth post-test, then it may be argued that a truer comparison of pre-test with 1st, 2nd, 3rd and 4th post-test should be made only on the basis of the 25 subjects who remained in their original condition throughout the study. In any event, the results will be presented separately for each criterion.

Section I

Comparative Group Performance Analysis of Variances with Repeated Measures

The ANOVA results will be presented separately for each criterion and this format will remain consistent throughout the presentation. All ANOVA tables appear in Appendix E.

Teachers' Connors Hyperactivity Index (TCHI)

As mentioned earlier, this is the only criterion for which there exists an a priori and universal 'pathology cut-off' score. Children scoring below 1.5, for instance, were not included in the study insofar as lower scores are understood to reflect only sub-clinical levels or relative absence of hyperactivity. It might be argued, therefore, that a comparison between alternative interventions with children who have for the most part improved beyond the 1.5 cut-off is, in fact, a straw-man argument. Clearly, however, it is the objective of this study to examine the changes over

time in children who were empirically diagnosed hyperactive at the time of their referral to the hospital.

In Table V (Appendix E), the ANOVA with repeated measures is presented for each of the testing periods on the TCHI (cf. Tables II through IV and Figures 1 through 3). A significant interaction effect is found at post-test $F(2, 70) = 4.71, p < .05$. Using Tukey's (1949) post hoc procedures (Table VI: Appendix E), it is evident that while there is no significant difference between the performance of the two Ritalin groups, both these groups differ significantly from the placebo group. The results suggest, therefore, that children treated with Ritalin alone or with Ritalin and parent training combined, respond more quickly than do children treated with parent training and a placebo medication. These results, however, are not evident at first or second follow-up. That is, there is no significant interaction between treatment condition and time when measured beyond the initial post-test at 3 months.

Teacher's Peterson-Quay: Conduct Problems (TPQCP)

The pre-post results shown in Table VII (Appendix E) indicate a significant interaction effect $F(2, 69) = 3.21, p < .05$ (cf. Tables II through IV and Figures 4 through 6). These results correspond with the results described for the TCHI; and post hoc comparisons, (Table VIII: Appendix E),

confirm that while the two Ritalin groups changed similarly over time, they both show a significantly better improvement than the placebo group. As was the case for the TCHI results, however, these interaction effects vanish after the post-test, indicating that there is no long-term or sustained benefit regarding control of behaviour problems for children treated with medication. It is also evident, however, that all groups do change over time (i.e., test effect).

Mean Reaction Time ($\bar{XRT}$)

Pre-post comparisons shown in Table IX demonstrate a significant interaction effect, demonstrating that the treatment groups, while similar at pre-test have changed at different rates to post-test $F(2,70) = 3.93, p < .05$ (cf. Tables II-IV and Figures 7 through 9). Post hoc comparison (Table X) indicates the superiority of both Ritalin groups over the placebo group, thereby replicating the results yielded by analyses of both the TCHI and the TPQCP. In short, the results according to this criterion are virtually the same, in every respect, to those achieved in respect to hyperactivity and conduct problems. Short-term advantages with Ritalin therapy are plainly evident, but this advantage evidently disappears by the first follow-up assessment, 12 months later.

Total Impulsive Responses (TIMPR)

As was discussed earlier, this variable was shown to be unreliable in view of the failure to meet the assumption of equal correlations. There was no evidence of a significant interaction (Table XI) nor was there a main effect for treatment condition. What can be said, as with

the previous criteria, is that there is a significant change in all three groups over time, from pre-test to second follow-up; $F(3,25) = 4.72, p < .01$.

Gates-MacGinitie Reading Test: Vocabulary (GMVG).

As can be seen in Table XII, there are no significant between group comparisons on GMVG at any post testing. It is evident, as with all the other criteria, that the within group changes remain significant throughout the follow-up period. This is not a remarkable finding considering that grade achievement can be expected to improve to some degree with the child's attendance at school. There is no evidence however, that hyperactive children will achieve any better on Ritalin than they will on placebo. Nor can it be said that parent-training has any significant impact.

Section II

The Descriptive Statistics

In the preface, it was asserted that the descriptive statistics give light to characteristics of the data which might well be obscured in the more conventional inferential and correlational analyses. Some attempt will be made, therefore, to integrate the ANOVA results described in Section I with the descriptive statistics herein described. Accordingly, the criteria will be discussed separately.

Teachers' Conners Hyperactivity Index (TCHI)

The pre-post results on this criterion are illustrated in Figure 1. Here, it is apparent that the two Ritalin groups show a much greater improvement than the parent training-plus-placebo group ($\bar{X}$ s = .91 and .89 vs. 1.37) at post-testing; i.e., 4 months after the initial pre-test. These differences are significant according to the ANOVA discussed in the previous section. Furthermore, there appears to be a negligible difference between the parent-training-plus-Ritalin group and the Ritalin-only group ($\bar{X}$ s = .89 vs. .91). It is evident in Figure 2, however, that while the quantitative differences between the two Ritalin groups and the placebo group remain at first follow-up ($\bar{X}$ s = .96 and .97 vs. 1.27), the respective within-group changes are virtually constant, so that the graph shows a 'plateau' from the post-test at 3 months to the first follow-up at 12 months. There is a fourth group plotted in Figure 2. It is referred to as the placebo-changed-to-Ritalin group (PTPL-to-PTRIT) and it represents all those subjects who were changed from their original PTPL condition after the post-tests were administered. Thus, what appear in Figure 2 are the separate plots for the 'pure' group (N=13; Table I) and the 'change' group (N=7). The change occurred as a result of a very poor progress in the individual child's

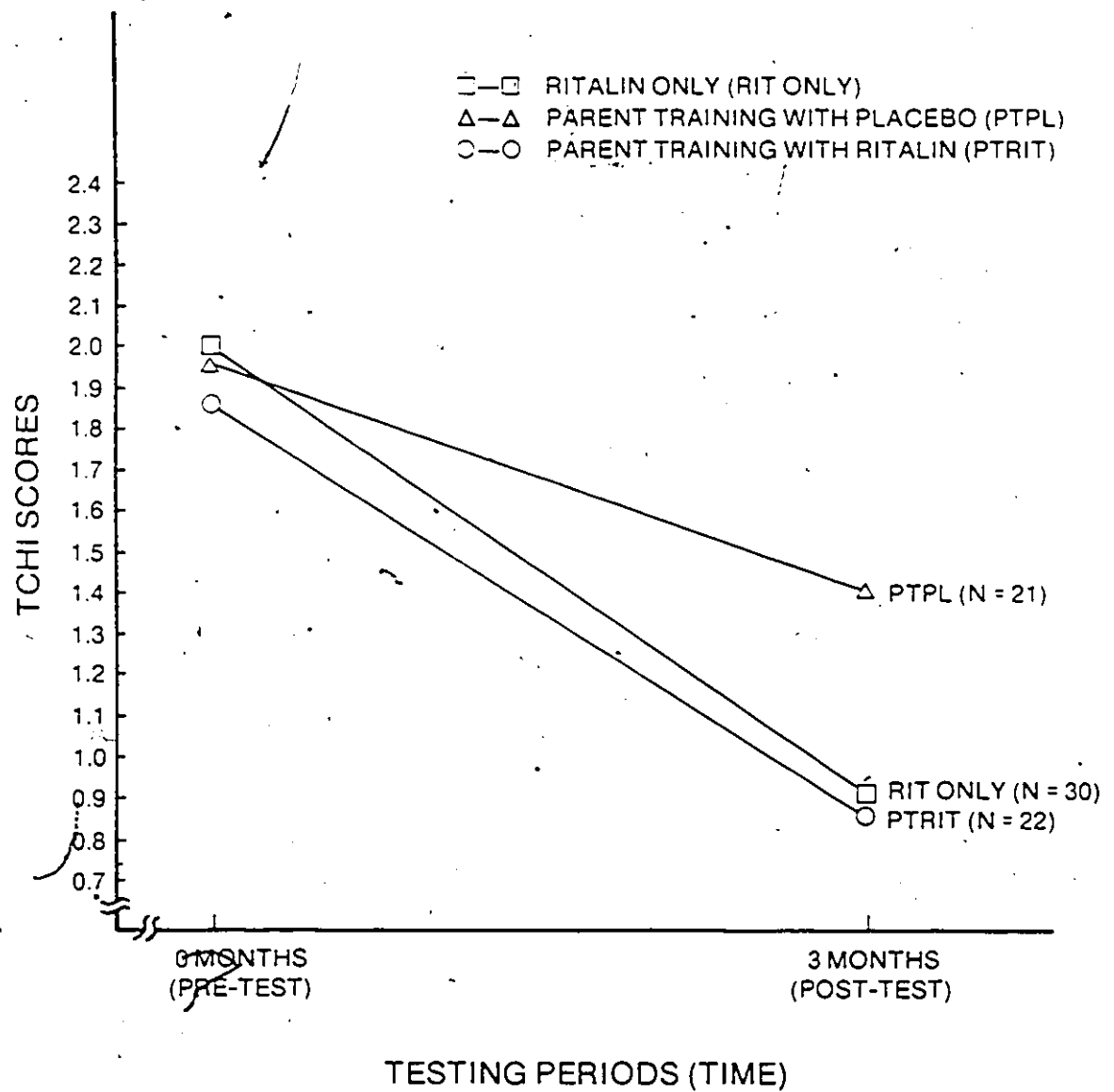


Figure 1. Teachers' Conners Hyperactivity Index (TCHI) Pre-Post Results

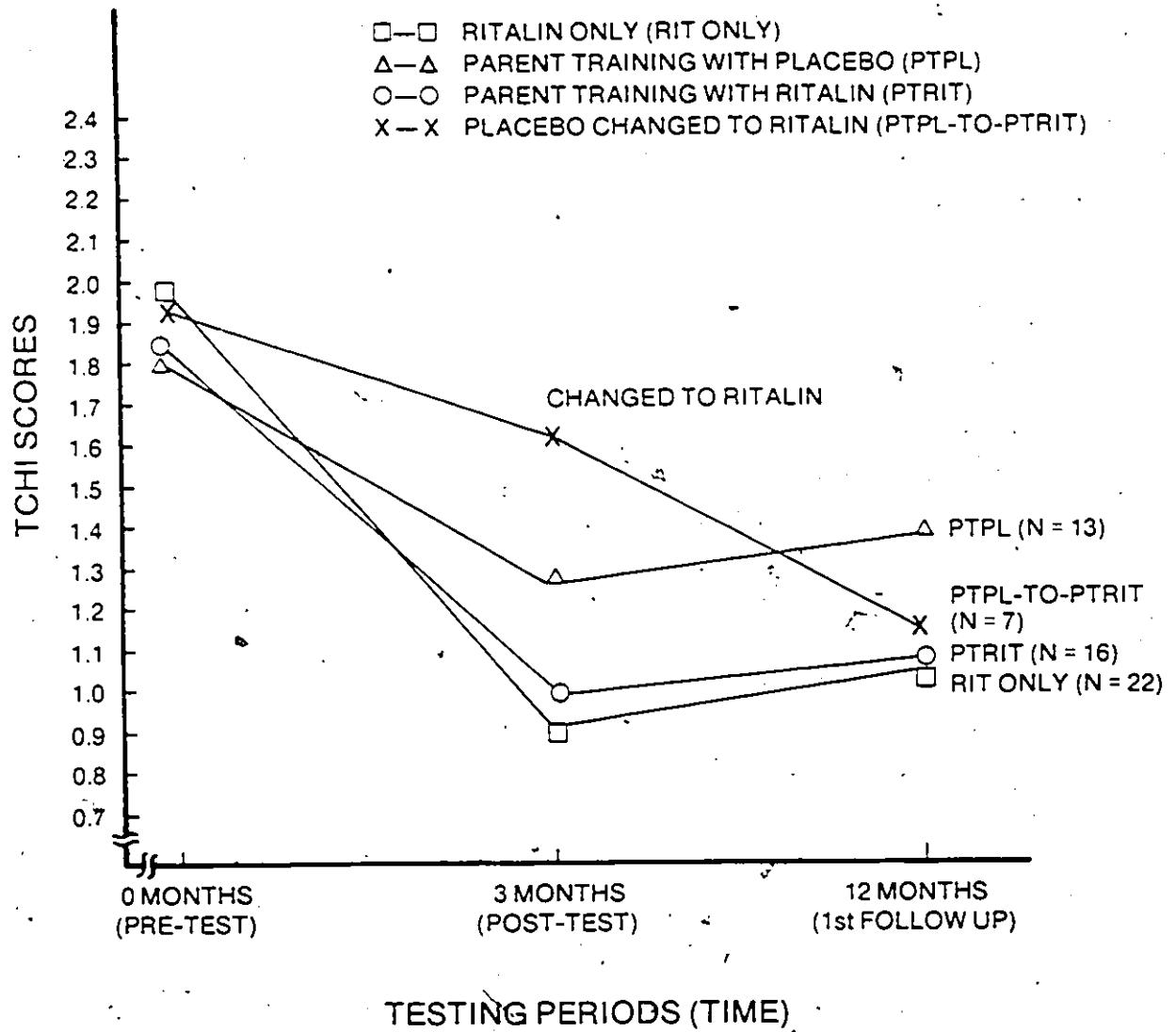


Figure 2. Teachers' Conners Hyperactivity Index (TCHI)
Pre-Post/First Follow-up Results

treatment which necessitated an alternate strategy. This poor progress resulted in a mean performance score of 1.6 in the 'change' group compared with mean performance scores for the three original groups of 1.20, 0.98 and 0.88 respectively at post-test. It was at this point that the change from placebo to Ritalin was made and from this point, the 'change' group shows dramatic improvement with a mean performance score of 1.05 at first follow-up compared to a mean of 1.27 for the PTPL group. It would appear that the differences between the original three groups at post-test may, in fact, have continued through first follow-up had all the original PTPL subjects been held in that condition with no changes. On the other hand, it is evident that the switch to Ritalin at post-test was of some benefit to those 'change' group children judging by the slope of their progress, illustrated in Figure 2. This benefit, furthermore, appears to be quite stable insofar as the mean performance of this group at second follow-up (Figure 3) surpasses the three 'pure' groups. It is difficult, however, to render clear inferences from these comparisons in view of the small Ns. It is important, nonetheless, to acknowledge the consistency of slope in the PTPL-to-PTRIT group as this may suggest novel approaches to long-term outcome data.

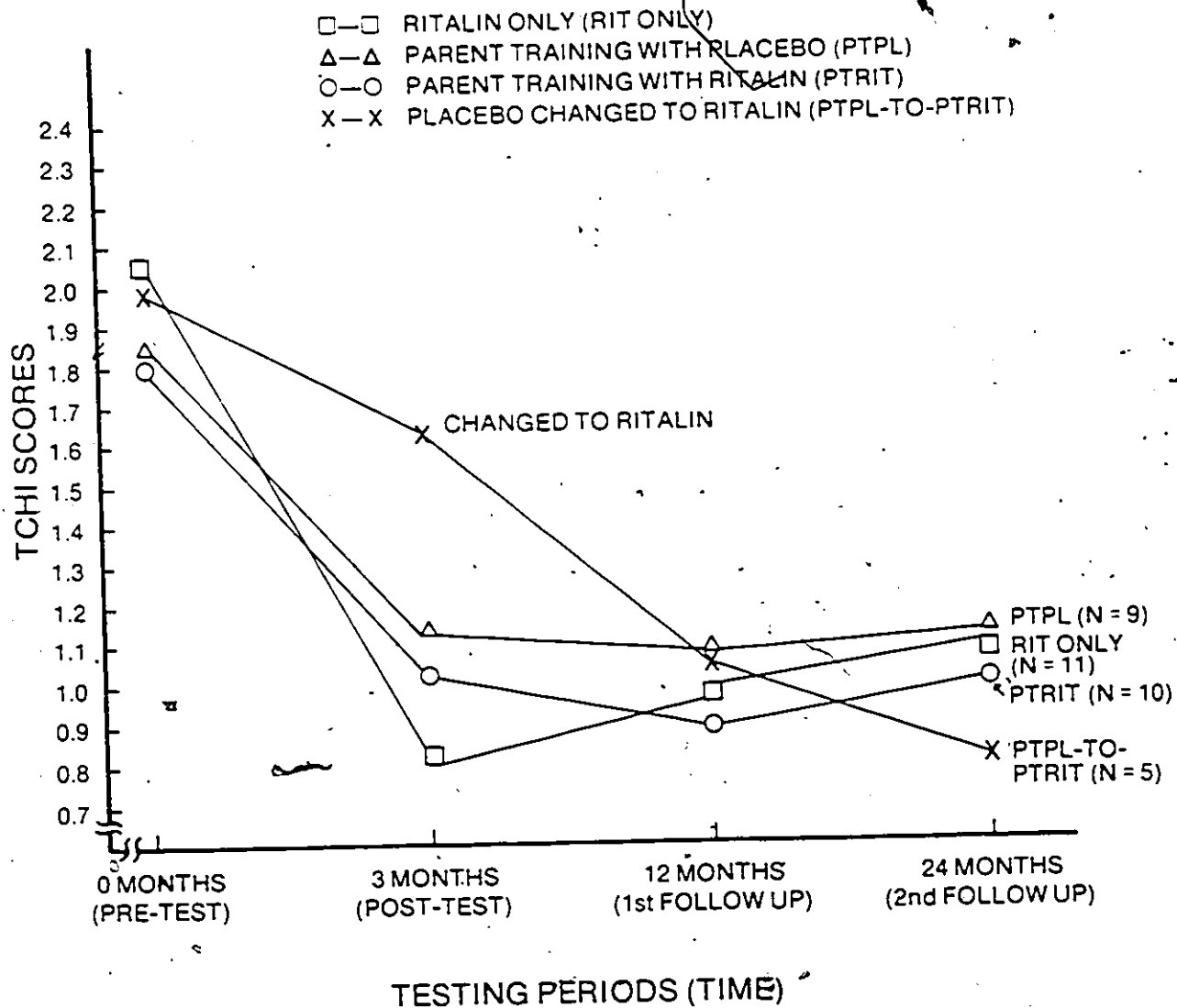


Figure 3. Teachers' Conners Hyperactivity Index (TCHI) Pre-Post/First Follow-up/Second Follow-up Results

The introduction of the 'change' group to the discussion, however, raises several issues which require attention. First, the homogeneity of the 'change' and 'pure' groups must be established with respect to predictor variables. A comparison of the PTPL and PTPL-to-PTRIT groups (Appendix B) shows a remarkable similarity between the two groups, small Ns and differing variance notwithstanding. Considering that 11 of the 21 subjects who were originally placed in the PTPL condition, were later changed to Ritalin, this would suggest that a hyperactive child treated behaviourally has approximately a 50% chance of succeeding with that treatment. Alternately, of the 30 children who were originally placed in the RIT ONLY condition, only 6 were removed from Ritalin therapy (20%). In other words, 80% of the children placed on Ritalin only were maintained in that treatment regimen and continued to show improvement over time.

A second issue raised by the inclusion of the 'change' group is the question as to which subjects should be regarded as belonging to the original three conditions - all subjects who remained from pre-post, or only those subjects who remained in these original three conditions throughout the study. For example, it has already been shown that the Ritalin groups differ significantly (more improved) than the placebo group when all 73 subjects are compared pre-post.

When only the 'pure' subjects are compared, however, these pre-post differences fail to reach significance beyond .05 probability (Appendix C).

There are several points which emerge from the exploration of the TCHI data. First, the hypothesis of superior benefit for children treated with Ritalin, at least in the short term, is upheld. Second, it is evident that superior benefit from Ritalin over behavioural strategies may well have been demonstrated over the long-term had it not been for the change of nearly 50% of the PTPL group on to medication regimes immediately following the post-tests. Third, children treated with Ritalin appear to respond more rapidly than do children treated behaviourally, despite similar outcomes over the long-term. Fourth, children treated behaviourally demonstrate much greater individual difference in response to treatment, than do children who are treated with medication. In other words, it appears evident that the response to behavioural intervention is much less predictable.

Teachers' Peterson-Quay: Conduct Problems (TPQCP)

Looking at Figure 4 it is again evident that the two Ritalin groups show a more dramatic improvement than does the PTPL group and the slopes for the two Ritalin groups are virtually similar. Furthermore, it is apparent that the

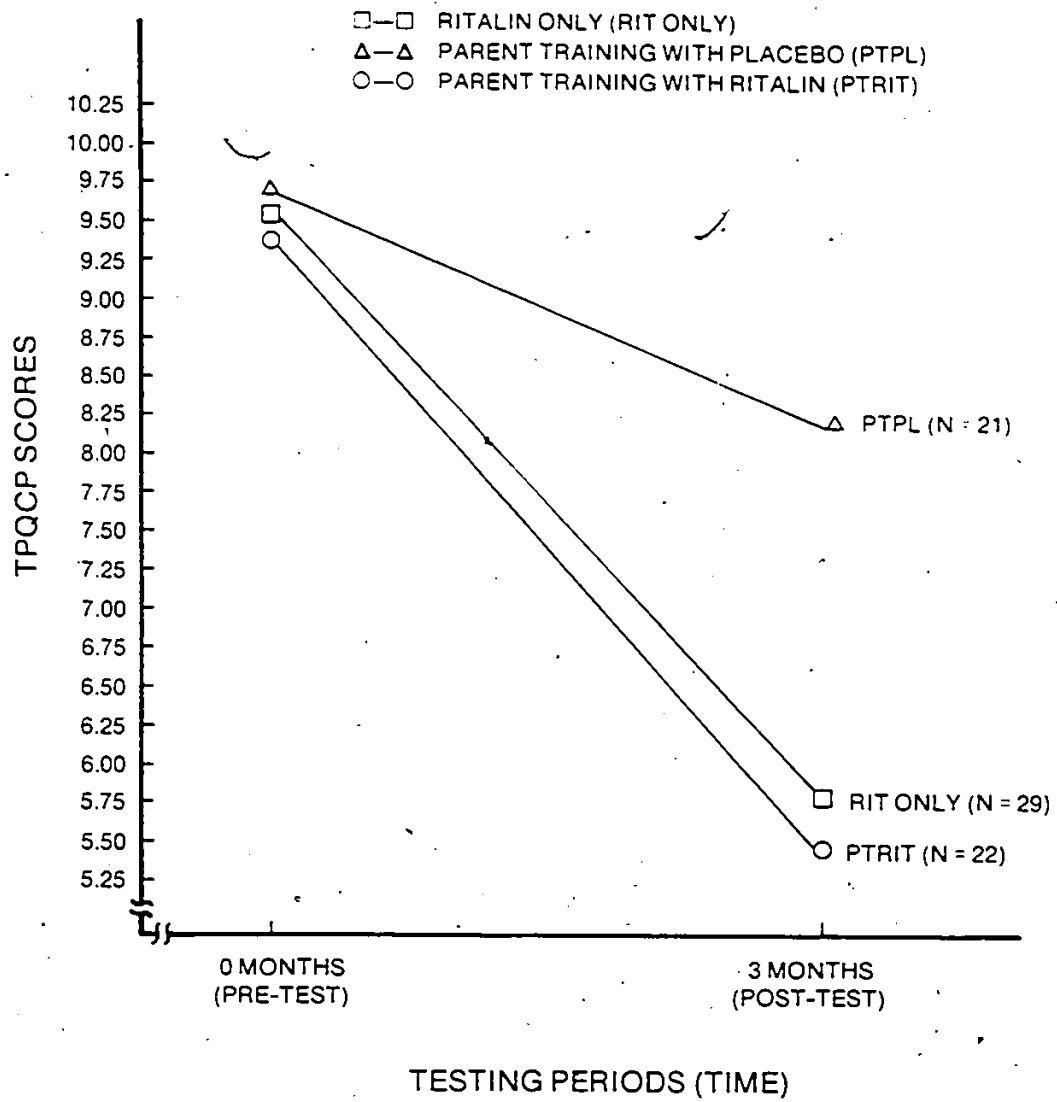


Figure 4. Teachers' Peterson-Quay: Conduct Problems (TPQCP) Pre-Post Results

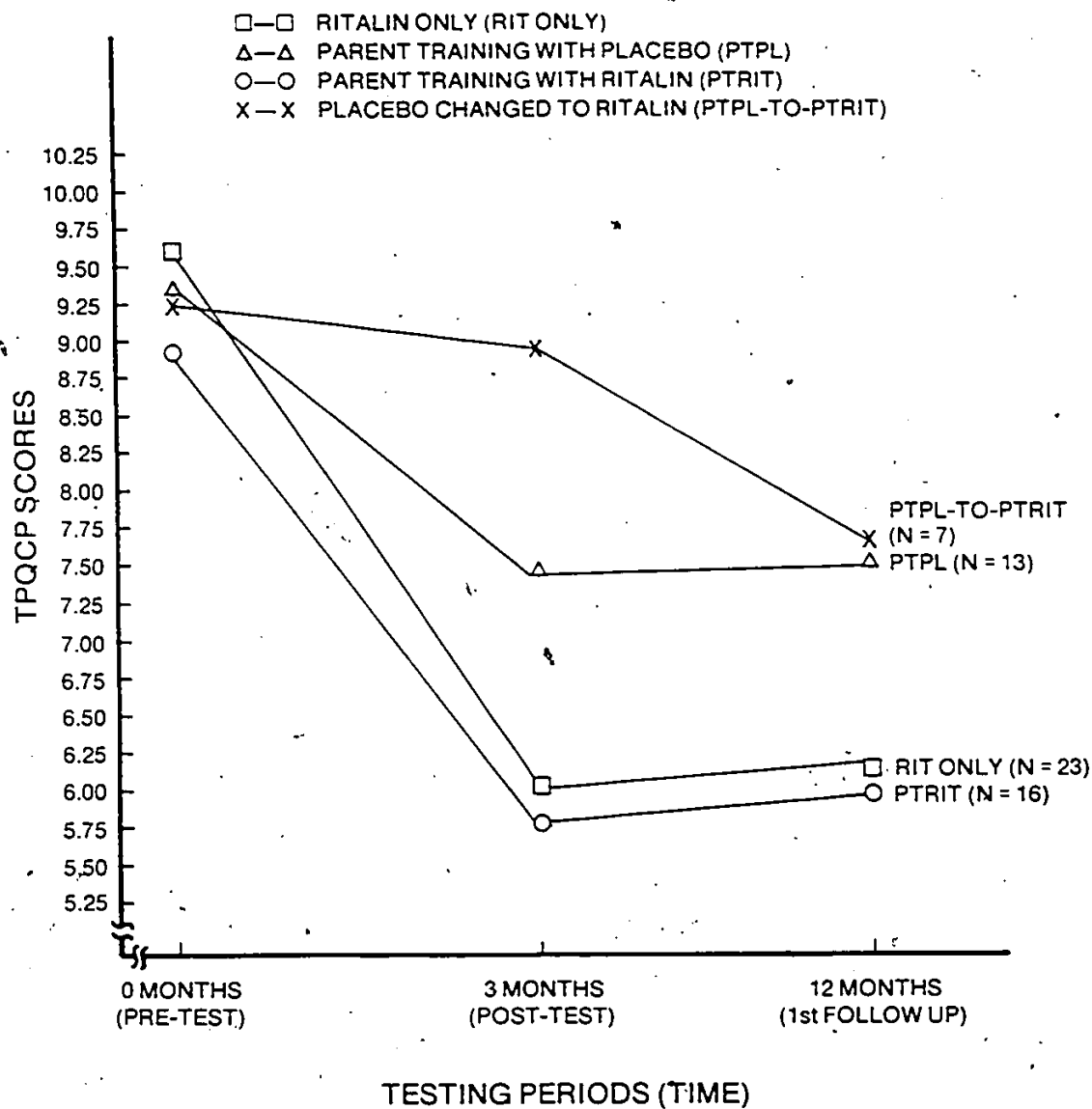


Figure 5. Teachers' Peterson-Quay: Conduct Problems (TPQCP) Pre-Post/First Follow-up Results

PTPL group shows greater individual differences than the RIT ONLY group in a manner similar to the TCHI measure. For example, the RIT ONLY group shows an increase in standard deviation from pre to post of 22% (2.89 to 3.53). The PTPL group, on the other hand, shows a corresponding standard deviation increase of 49% (from 2.89 to 4.14). It is also true, however, that the PTRIT group also shows a large increase (65%). Moreover, the variation in standard deviations becomes more negligible with the shrinking N at further follow-up testing. In Figure 5, the PTPL-to-PTRIT group shows a converging slope with respect to the three original conditions. Again, this was similar to the TCHI results and indicates an ameliorative effect from Ritalin in those children who demonstrated very poor improvement with behavioural intervention alone. The second follow-up results which are illustrated in Figure 6 also replicate the TCHI follow-up results. Indeed, the PTPL-to-PTRIT group surpasses the other three groups, continuing to show dramatic improvement with the addition of Ritalin therapy.

One curious feature of the results illustrated in Figure 6, however, is the reversing slope of the RIT ONLY group in contradistinction to the other treatment groups which continue to show a gradual decline in their TPQCP scores. ANOVAS, (Tables VII and VIII) rule out any significant differences between groups, but insofar as the

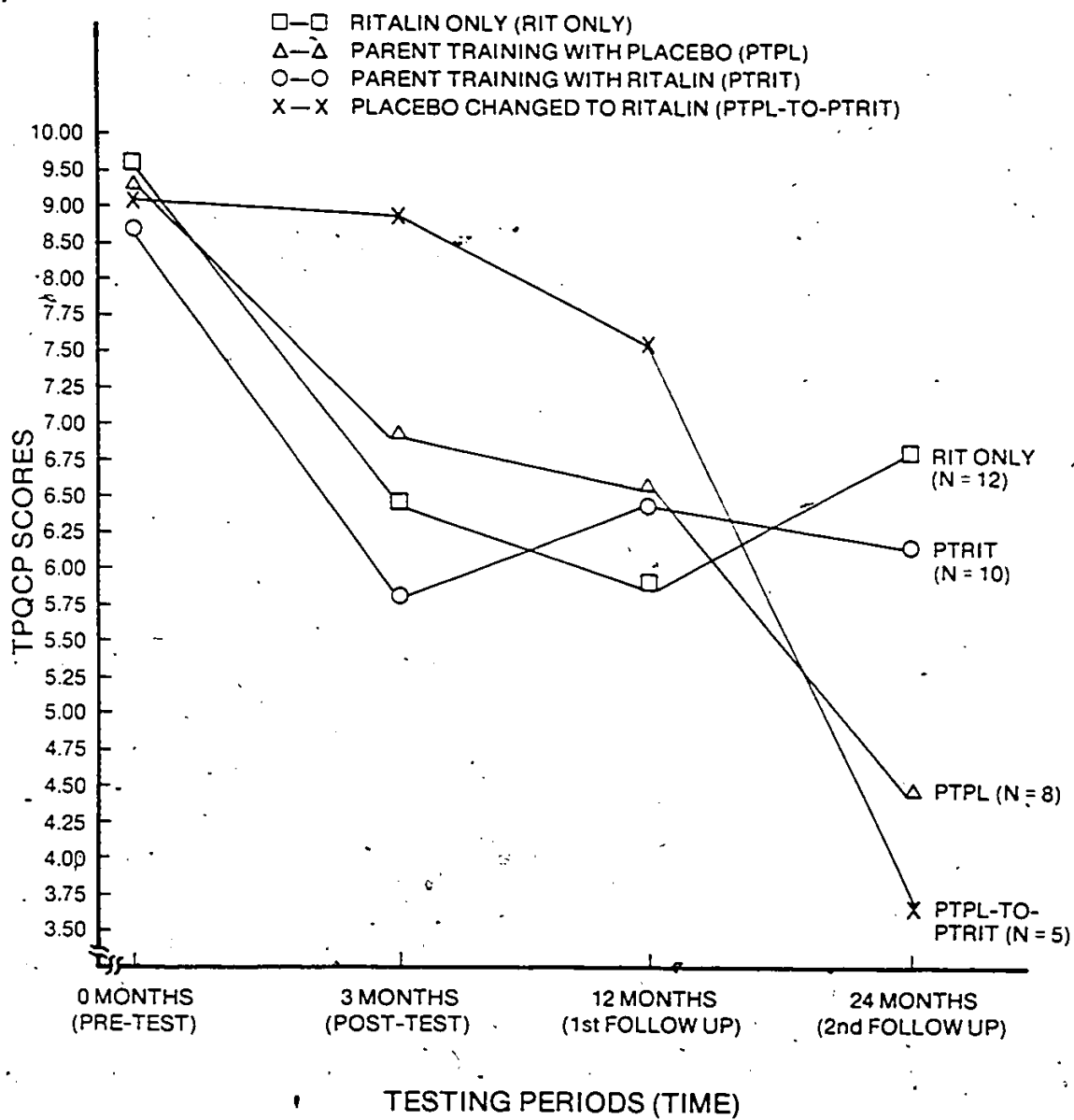


Figure 6. Teachers' Peterson-Quay: Conduct Problems (TPQCP) Pre-Post/First Follow-up/Second Follow-up Results

reversing slope may indicate a trend, this reversing slope will be pursued in the discussion chapter.

In general, the TPQCP results support the TCHI results especially insofar as Ritalin is shown to produce speedier short term results and furthermore, that response to behavioural treatment is less predictable. In contrast to the TCHI results, however, it is apparent from the long-term results that the children who demonstrate an initial response to behavioural intervention may show long-term superior performance on a measure of conduct problems. Again, the first follow-up and second follow-up ANOVAS fail to demonstrate any significant differences but the graphic evidence is of interest and may suggest a trend.

Mean Reaction Time ($\bar{XRT}$)

The pre-post data illustrated in Figure 7 are similar to the TCHI and TPQCP insofar as the two Ritalin groups appear similar in progress and both these groups show significantly more rapid gains than does the PTPL group. Nevertheless, when the poor responders to behavioural intervention are separated from the original PTPL group and given Ritalin, they appear to make a dramatic improvement. In Figure 8, the PTPL-to-PTRIT group intersects, in a positive direction, the PTPL group at first follow-up - a similar occurrence across the three criteria discussed thus far.

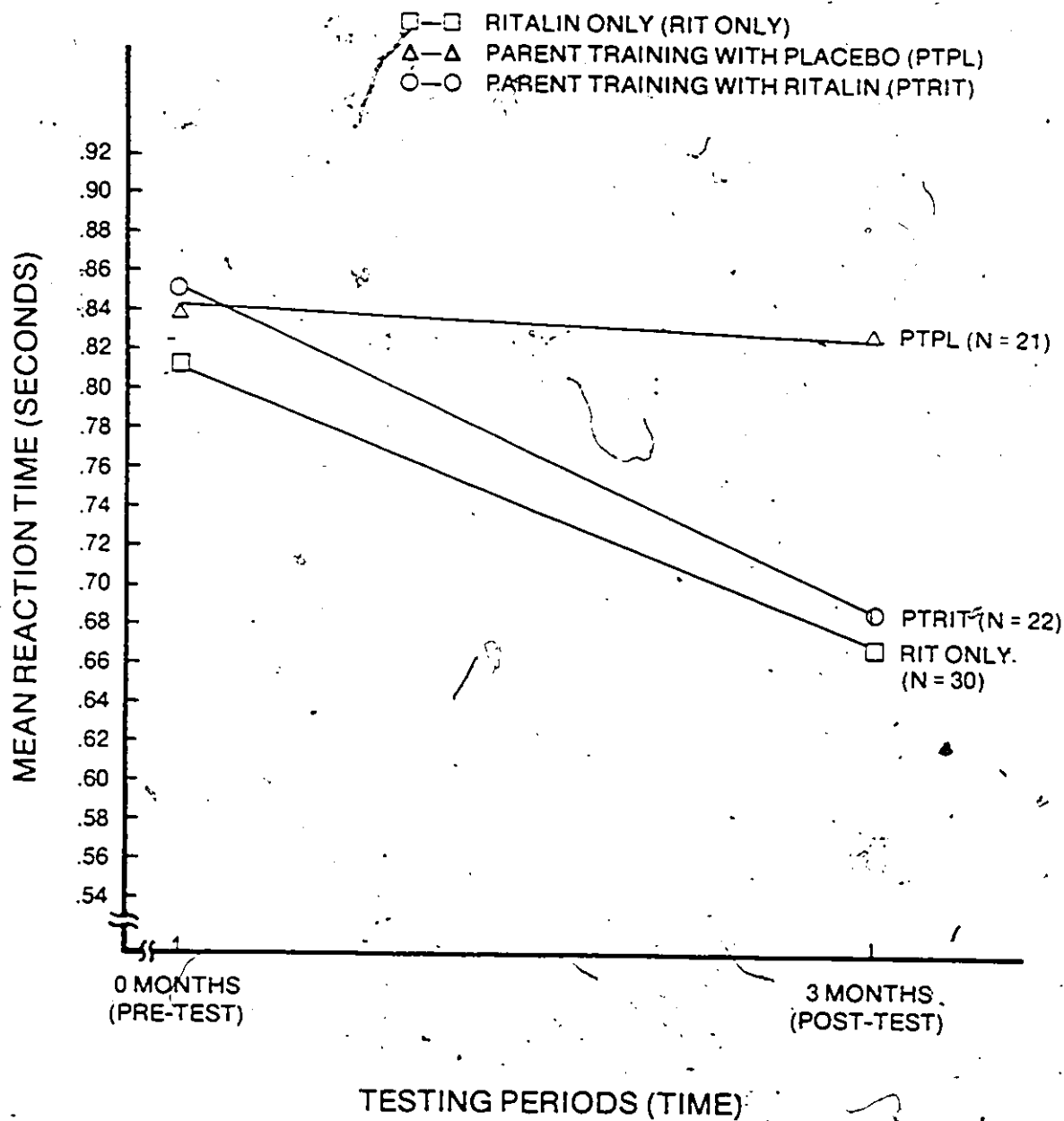


Figure 7. Mean Reaction Time ($\bar{X}$ RT) Pre-Post Results

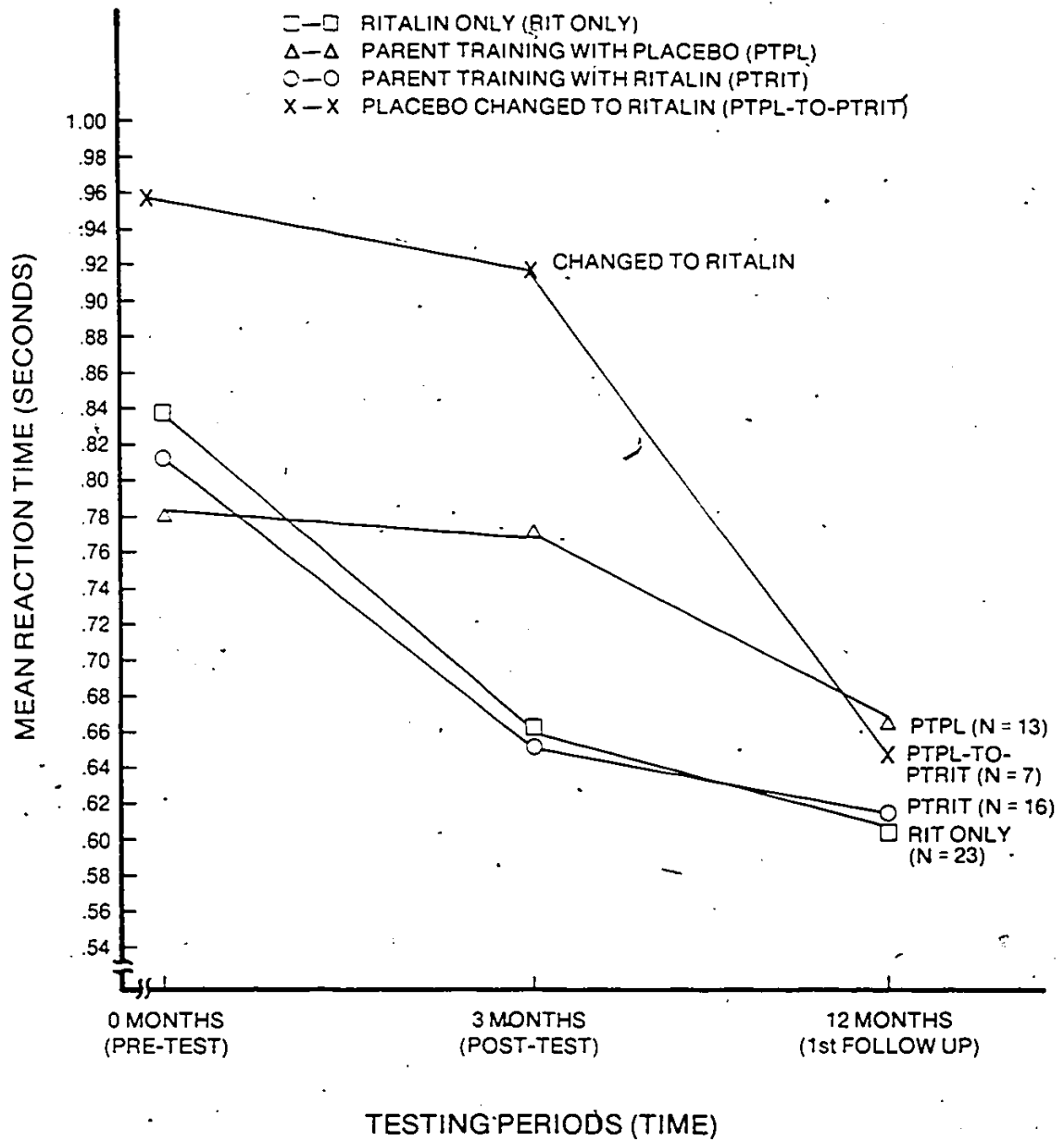


Figure 8. Mean Reaction Time ($\bar{X}$ RT) Pre-Post/First Follow-up Results.

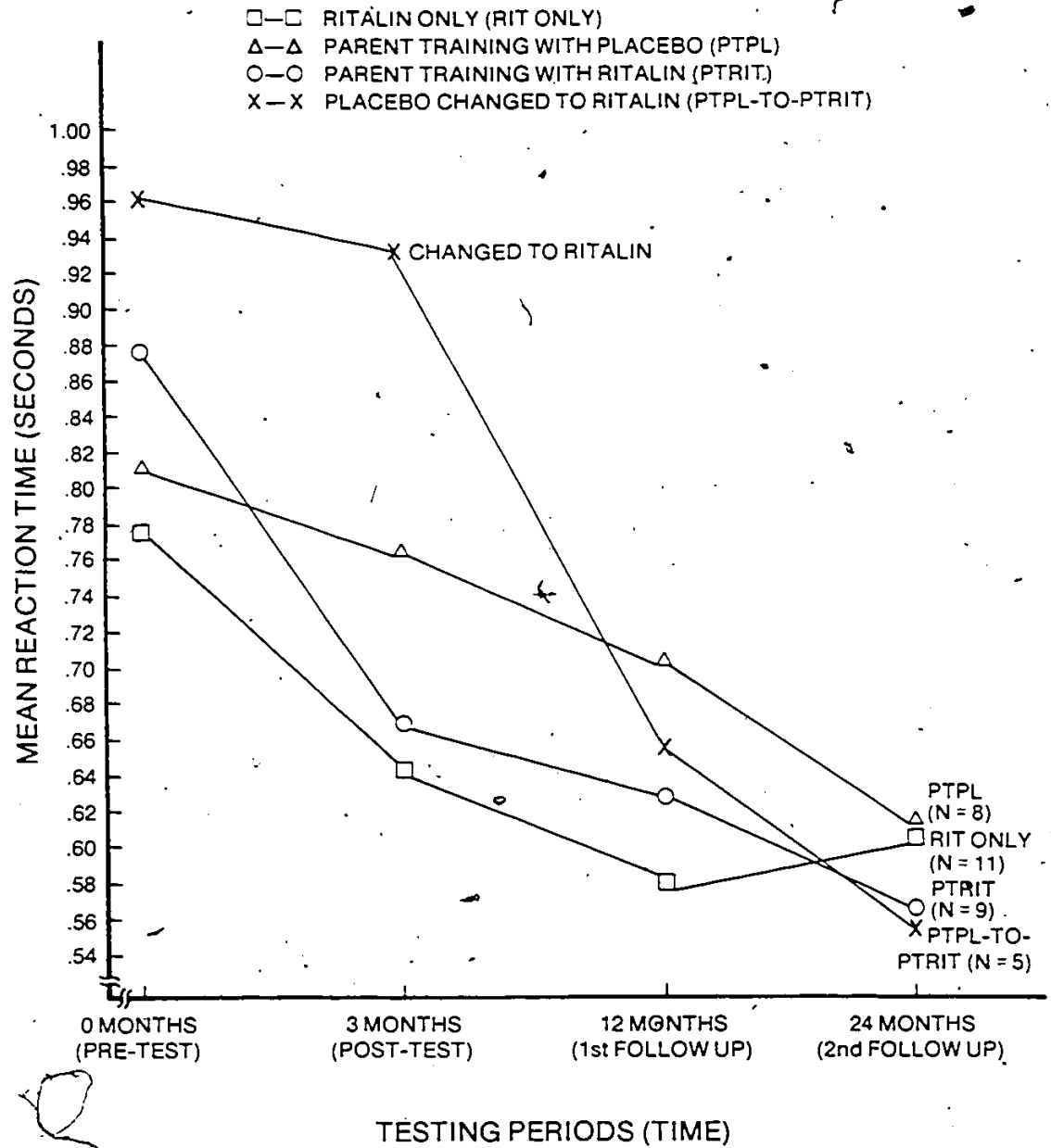


Figure 9. Mean Reaction Time ($\bar{X}$ RT) Pre-Post/First Follow-up/Second Follow-up

This is the only criterion, however, for which a significant interaction effect is found at first follow-up.

The improvement of the PTPL-to-PTRIT group remains consistent through the second follow-up (Figure 9). In fact, most of the subjects in the study appear to hover around the same level of performance by first follow-up. Thus, the one feature of the XRT results which confirms the findings in the previous two criteria is the speedier response to Ritalin, demonstrated to be a significant source of variance in the pre-post comparison. Otherwise, all subjects appear to achieve similar levels of performance by second follow-up (Figure 9).

Total Impulsive Responses (TIMPR)

The pre-test mean on TIMPR of the PTPL group is approximately 13, while the pre-test means of the two Ritalin groups is 22. The Ritalin groups show a virtual doubling of the PTPL errors at pre-test, and yet, all three groups demonstrate similar scores at post-test (Figure 10). Unlike the previous criteria, however, the PTPL-to-PTRIT group shows a curious resistance to improvement from post-test to first follow-up (Figure 11), although the now characteristic 'dramatic' improvement occurs by second follow-up whereupon the 'change' group converges on the scores of the three original groups. No significant differences are found between the three

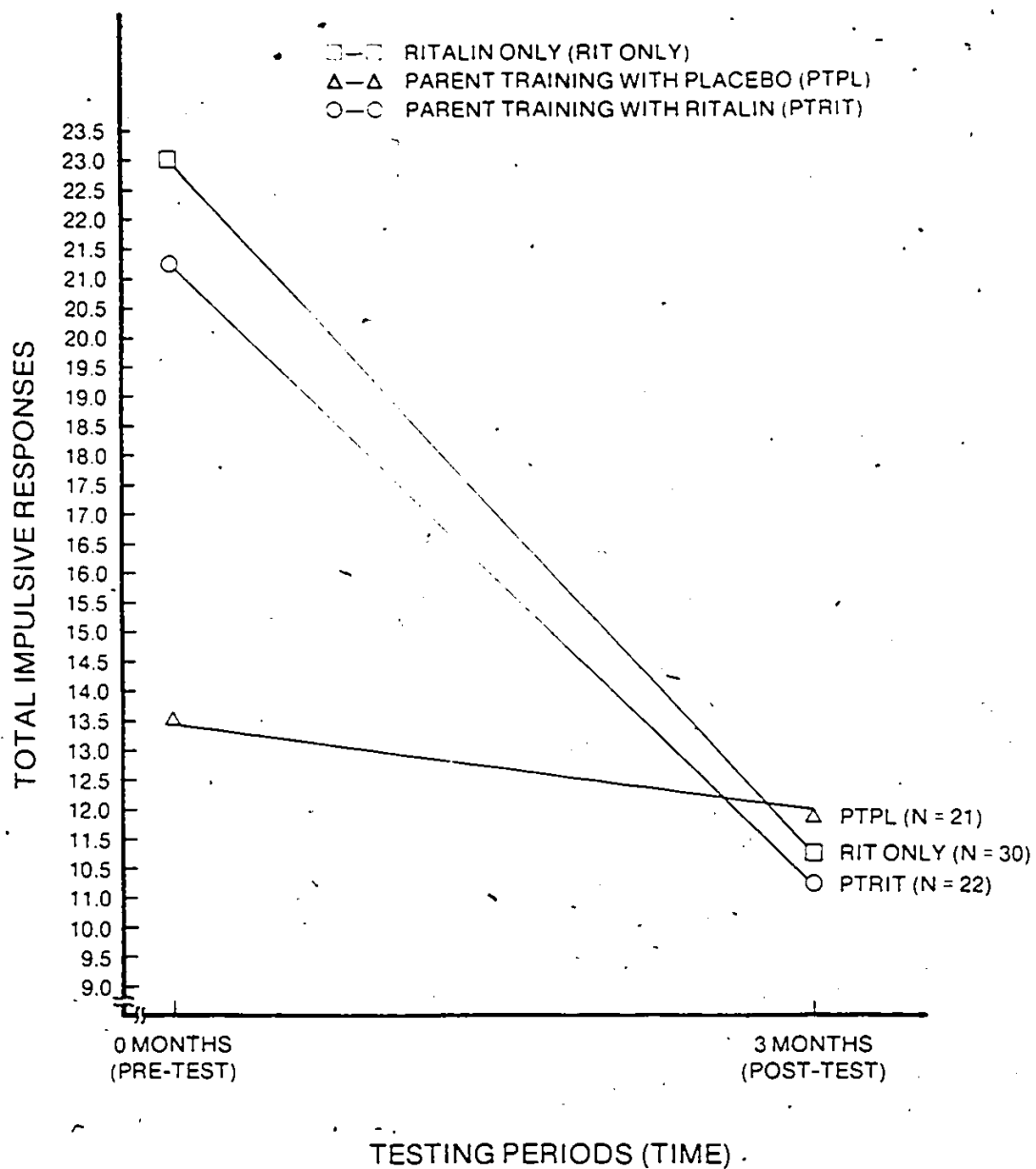


Figure 10. Total Impulsive Responses (TIMPR)
Pre-Post Results

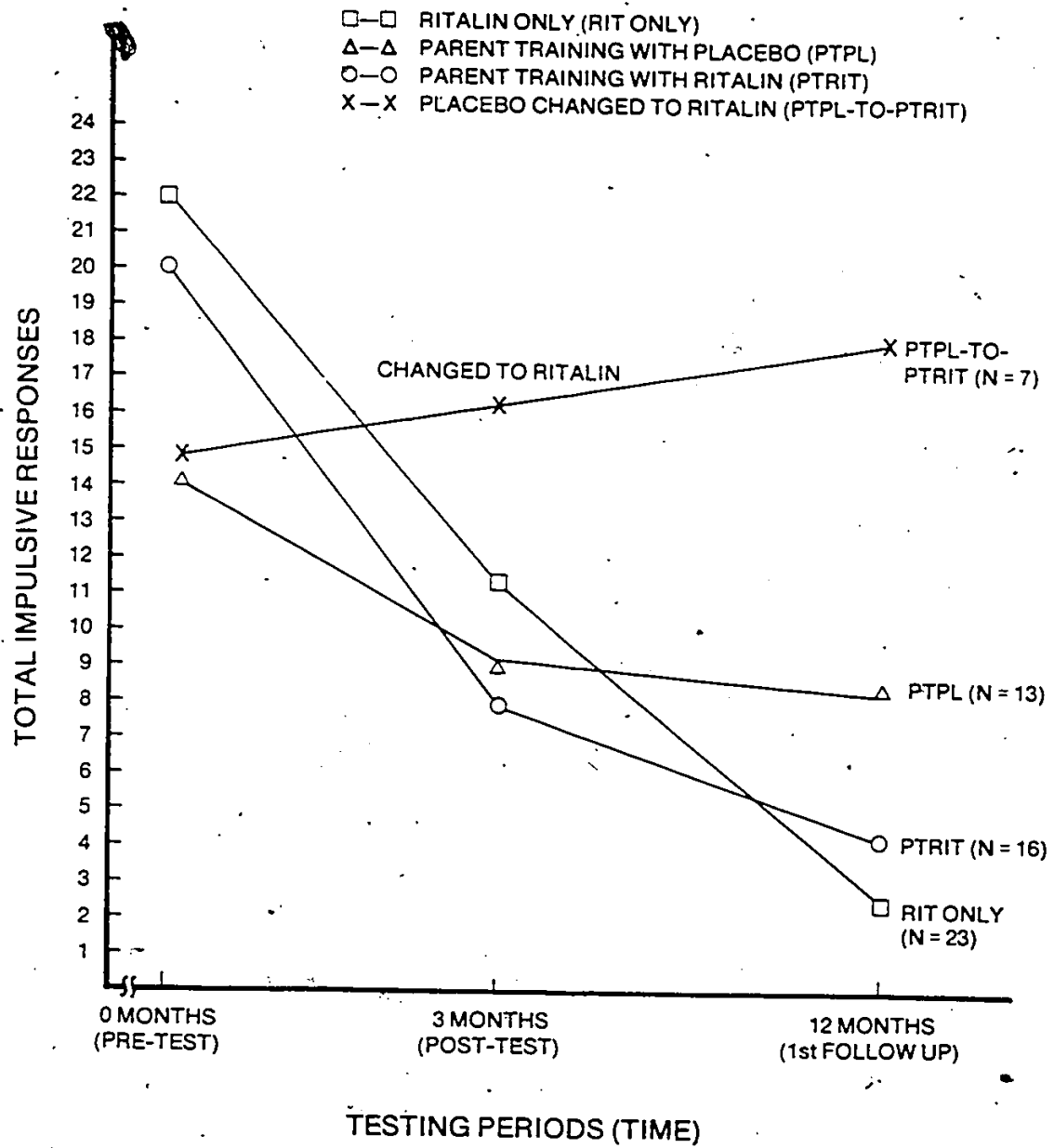


Figure 11. Total Impulsive Responses (TIMPR)
Pre-Post/First Follow-up Results

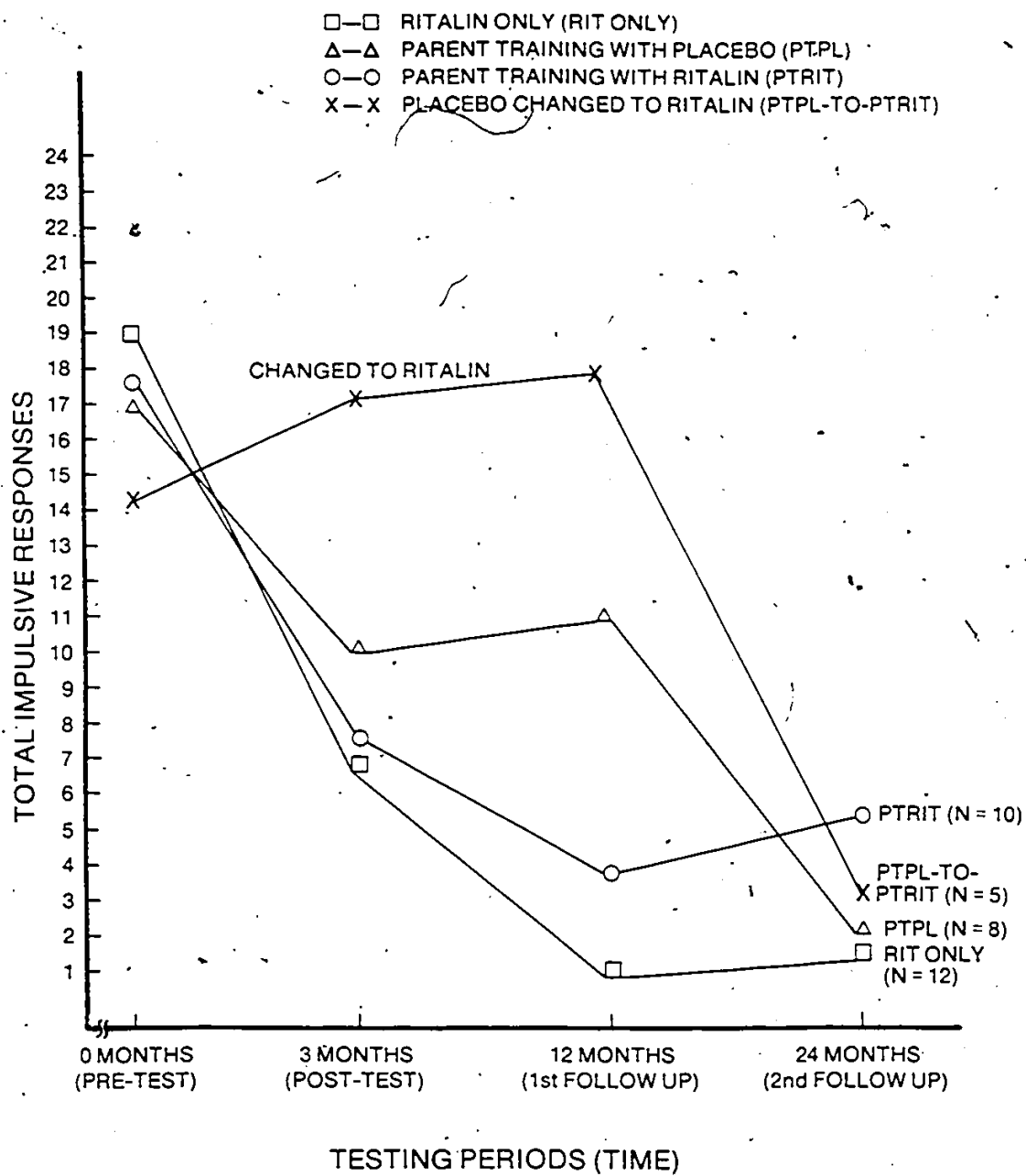


Figure 12. Total Impulsive Responses (TIMPR)
Pre-Post/First Follow-up/Second
Follow-up Results

original groups on this variable at any point in the study. In Figure 12, however, it is evident that the PTPL group reaches a plateau at first follow-up. The standard deviations (Table IV) indicate a comparatively larger spread of scores within the PTPL group. Again, it appears that even this criterion is sensitive to greater individual differences in response to behavioural strategies. Otherwise, this criterion is not producing support for the evidence achieved in the analyses of the TCHI, TPQCP and XRT.

Gates-MacGinitie Reading Test: Vocabulary (GMVG)

The ratio of individual differences with respect to this criterion appears to remain consistent within groups, and individual response does not, therefore, appear to be a factor in grade achievement. There is one similarity with the previous criteria, however. This is in respect to the PTPL-to-PTRIT group which shows that characteristic improvement at first follow-up, demonstrating an intersecting positive slope with the three original groups (Figure 14). As with the other criteria, this remains stable to second follow-up (Figure 15) when this group even surpasses the others in vocabulary achievement.

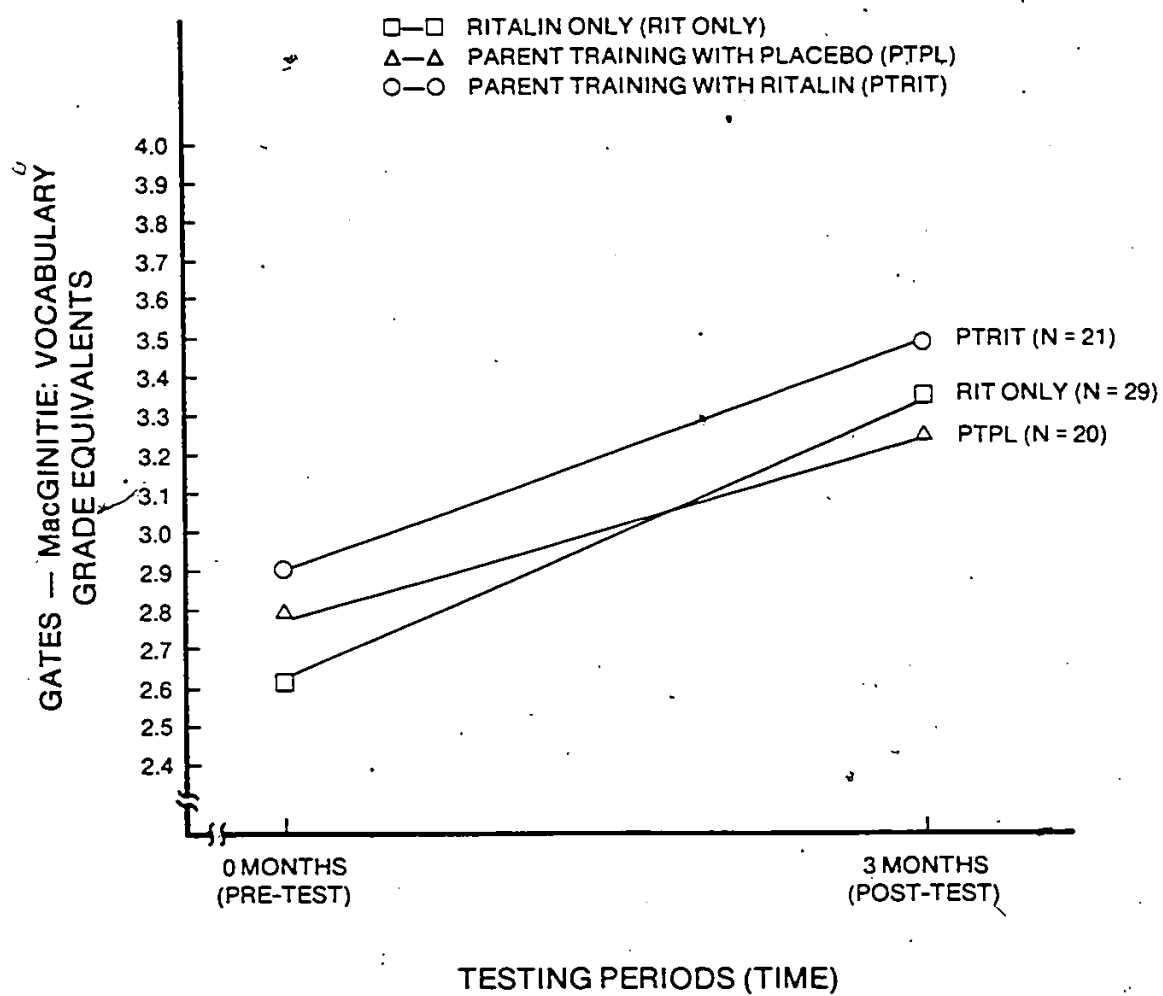


Figure 13. Gates-MacGinitie Grade Achievement: Vocabulary (GMVG) Pre-Post Results

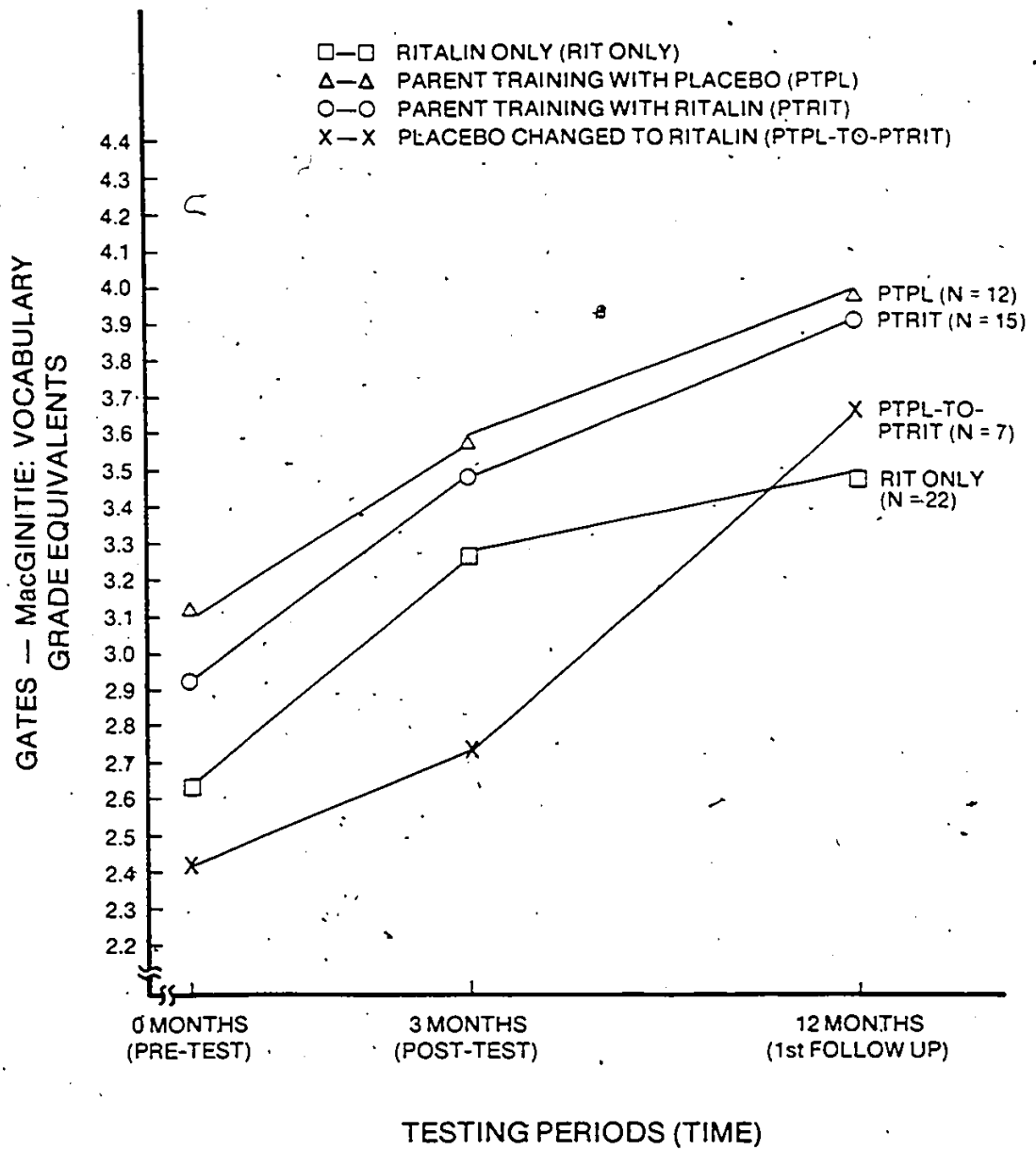


Figure 14. Gates-MacGinitie Grade Achievement: Vocabulary (GMVG) Pre-Post/First Follow-up Results

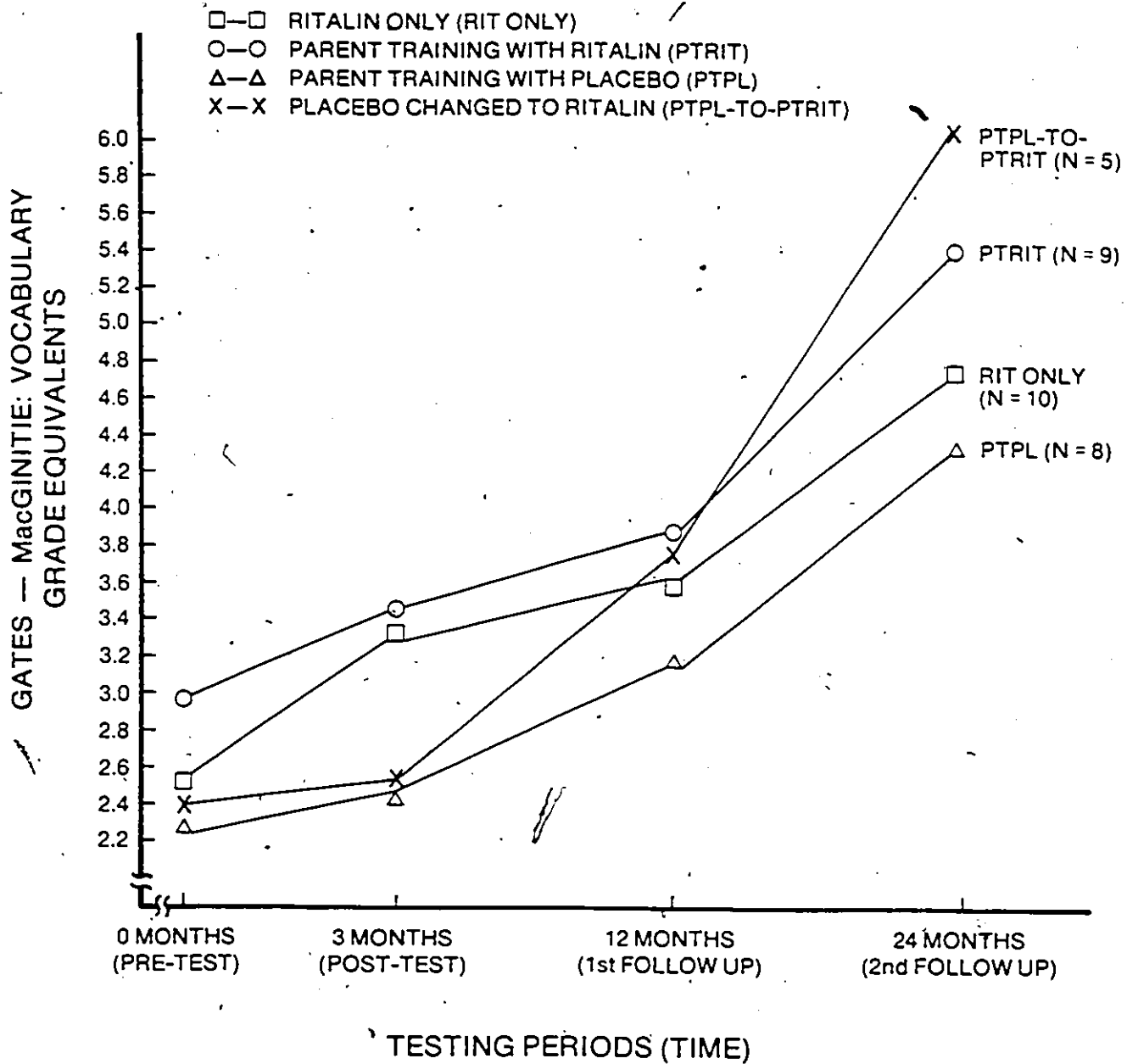


Figure 15. Gates-MacGinitie Grade Achievement: Vocabulary (GMVG) Pre-Post/First Follow-up/Second Follow-up Results

Despite insignificant comparisons between the three main groups, Ritalin appears to be effective for children who fail to show positive response to behavioural treatment.

Section III

Stepwise Multiple Regression

The data presented in this section are addressed primarily to hypotheses arising out of the Loney research. Specifically, the role of family variables (particularly parental), and the role of conduct problems, per se, in the prediction of outcome on criterion measures.

All pre-test criterion measures (with the exception of the variable being predicted) and all independent measures were entered as predictors. The cut-off prediction probability for the equation was set at .01.

In view of the nominal nature of the condition variable, each level of the condition was entered in the form of a dummy variable. Accordingly, all subjects who still belonged to one of the three original conditions were included. Once a subject was changed from his original condition, he was eliminated from the subject pool for the dummy variables. As was the case with children changed from placebo to Ritalin, children removed from Ritalin are considered to be in the Ritalin-to-Ritalin Withdrawal (R-to-RW) condition.

All subjects from the R-to-RW condition were also entered into the subject pool in order to act as a reference group allowing for the possible identification of each of the three original conditions in the potential regression equations. Hence, whenever a particular treatment group is mentioned in this particular section, PTPL for example, the precise meaning should be read as "membership in the PTPL condition". All tables showing regression analyses are found in Appendix F.

Teachers' Connors Hyperactivity Index (TCHI)

The regression information for this variable across the three post-test periods is contained in Table XIII (Appendix F). The most significant predictor of hyperactivity at post-test and first follow-up is PTPL ($R^2 = .13$ and $.15$ respectively). Since the simple correlations (.36 and .39) are positive, this may be understood to imply that membership in the PTPL group is likely to be related to higher TCHI2 and TCHI3 scores. There is no indication, however, of a positive prediction (prediction of improvement) by membership in alternative treatment conditions.

At post-test, the other variables entered are mother's IQ (MWAIS), child's IQ (IQ), mother's educational level (MED), and mother's total pathology index (MMPI). The total variance explained by the combined addition of these variables is 14%. Alone, MMPI and MED account for barely 2% of the

variance. In short, therefore, the four variables taken together might legitimately represent a 'predictor', but taken alone, they are negligible. With the exception of the child's IQ, it appears that all subjects share a common denominator with respect to prediction of outcome on the TCHI - that is, the characteristics of their mother, particularly her IQ (MWAIS) and educational level (MED). The MMPI is difficult to interpret since all parents fall within normal limits and higher vs lower scores - within an overall normal group - are difficult to compare meaningfully, especially when the variance share is so low. Nevertheless, these predictions are reasonably consistent between post-test and first follow-up. MED and MMPI survive even to second follow-up, but treatment condition disappears as a meaningful predictor of outcome. It is noteworthy, however, that the TCHI is predicted only within 25% of the total variance and consistently so, throughout the study. At second follow-up, the 13 to 15% of the variance explained by treatment condition earlier is replaced by subject variables ($\bar{X}RT1$ and age at referral).

Despite the survival of MED, it is difficult to have confidence in this predictor insofar as the simple r alternates between a positive and a negative relationship! This is one of the variables described earlier, however, as a potential problem because of the relatively low chance probability of initial difference between groups ($F = 2.7$,

$p < .07$). Having removed it as a predictor would not likely have altered the equation insofar as pre-test correlations with other variables apart from MWAIS, IQ, INC, FWAIS and FED are all well below significance (Appendix D). Having removed MED at second follow-up, however, one would be left with four variables accounting for approximately 10% of the variance ($.51 - .19 = .32$; $.32^2 = 10\%$). Thus, it might be said that long-term prediction is not possible, or very tenuous, at best. At first follow-up, however, it is evident that paternal variables do influence outcome on the TCHI. Why the fathers' and mothers' IQ should have converse relationships with the criterion is not immediately evident, but will be addressed in the discussion chapter.

Teachers' Peterson-Quay: Conduct Problems (TPQCP)

Somewhat better predictions were obtained for the TPQCP (Table XIV), and PTPL is again evident in both the post-test results and first follow-up results - and again in a negative direction (i.e., the more likely one is in the PTPL group, the more likely he is to be rated as more problematic on TPQCP2 and TPQCP3).

Initial hyperactivity appears to be prominent both at post-test and second follow-up, accounting for an individual variance share of 18% and 16% respectively. It is not evident

at first follow-up whereas parental variables predominate in the equation predicting first follow-up performance. Alternatively, parental variables are relatively more insignificant at post-test and second follow-up. An exception is FED at second follow-up with a simple correlation of $(-.27)$, suggesting that children of better educated fathers tend to be better behaved.

The fact that TCHI would 'return' as a predictor of second follow-up perhaps suggests that whatever benefit children might enjoy with respect to hyperactive symptoms early in their treatment, these benefits are shortlived and essential conduct problems or characterological disturbances are not really affected in the long run. This was also reflected in the earlier results (Figure 6) in which it appeared that children treated with Ritalin show an upward (or negative) drift by second follow-up with respect to their performance on this scale.

Mean Reaction Time ($\bar{XRT}$)

The regression information for $\bar{XRT}$ is described in Table XV. Very strong equations were achieved in this analysis from post-test through to second follow-up accounting for 60%, 55% and 48% of the overall variance respectively.

Age at referral is clearly an important predictor of attention (i.e., reaction time), and accounts in large measure

for the powerful equations. In follow-up 1, GMVG1 replaces AGE, but high pre-test correlation between these two variables would render them interchangeable, at least in this case. Thus, the older the child at referral, the more likely he is to perform more successfully (negative simple r) at outcome.

With the exception of the father's total pathology index (FMPI) at first follow-up, no family or parental variables figured in these equations.

The variables which are related are subject and treatment. Once again PTPL appears in the equations, this time including the second follow-up. Consistent with the results described for the TCHI and the TPQCP, PTPL has a positive correlation with $\bar{XRT}$, therefore suggesting that membership in the PTPL group predicts poorer performance on $\bar{XRT}$ at each post-testing. Membership in the Ritalin plus parent-training group (PTRIT) appears in the post-test equation and the second follow-up equation. At post-test, however, it has only a .08 simple correlation and should be ignored, especially with an independent variance share of .01.

Likewise, with RIT ONLY in the second follow-up equation, there is little reason for considering it seriously in view of its low (.08) simple correlation with XRT_4 . On the other hand, PTPL and PTRIT offer an interesting contrast at second follow-up. Each has a correlation of .28, both in opposite

directions. According to these relationships, membership in PTPL predicts for poor performance at second follow-up on $\bar{XRT}$, whereas membership in PTRIT would appear to have a precisely opposite relationship with the criterion.

This may well represent the first tangible evidence that Ritalin continues to have longer term benefit, at least with regard to the criterion of attention. This, of course, would have important implications not only for promoting the child's amenability for therapy, but also for improving his 'opportunity' for acquiring benefit from school.

Total Impulsive Responses: TIMPR

Despite the high degree of relationship between TIMPR and $\bar{XRT}$, the results in Table XVI are in contrast to those described in relation to $\bar{XRT}$, with respect to the role of family variables. It would appear, at post-test in any case, that the lower the parents' IQ and educational level, the more likely the child would be impulsive. This is quite congruent with the results achieved for the TPQCP.

The reverse relationship with respect to the mother's and father's pathology indices at first follow-up underlines the difficulty in using this test as a predictor. The extent of the correlation, however, is sufficiently strong to warrant further study with this test, perhaps in modified form with

specific item selection, in order that specific traits might be examined.

PTPL maintains its visibility with this criterion. Here again, there is a strong prediction of poorer performance at first follow-up for those children who are being treated through parent-training without medication. In contrast, however, the emergence of PTRIT as a poor performance predictor at second follow-up is quite surprising. Although, the standard deviation at second follow-up (Table IV) is relatively high (almost triple the S.D. in the PTPL group) and, therefore, large individual differences may render the variable an unreliable predictor. The spread of scores on the PTPL group, is considerably more narrow, suggesting greater homogeneity than exists in the PTRIT group.

A negative correlation with pre-test hyperactivity scores (TCHI) is also surprising, but may suggest that while the two are related (characterological symptoms and hyperactive symptoms, per se), a child can still have conduct problems without being hyperactive, insofar as impulsive responding in this task may reflect a general impulsivity. In any event, Loney's suggestion, that characterological problems are often masked by the hyperactivity diagnosis and treatment, may have some support here.

Gates-MacGinitie Reading Test: Vocabulary (GMVG)

Very high multiple correlations are achieved for the GMVG at each post-testing (Table XVII). There is no support here, however, for asserting the effectiveness of Ritalin therapy or parent-training with regard to improving academic performance.

Clearly at post-test, the prediction of success is based on age at referral and $\bar{X}$ RT. The older the child at referral, and the more attentive he is, the more likely he will perform well at post-test, first follow-up and second follow-up. The mother's pathology index appears to figure prominently, particularly at second follow-up. At a more speculative level, it could be suggested (in view of the magnitude of the correlation) that the child has a better chance of academic success when he has a less pathological mother. The parental Locke-Wallaces also figure prominently at second follow-up, suggesting that when either or both parents are happily married, and, presumably, therefore, provide a happier home life, their child has a better chance for academic success.

Section IVDiscriminant Analysis

The discriminant function analyses were intended primarily as a heuristic exploration as to which variables

would discriminate between responders and non-responders on each of the criteria. In addition, a specific focus on the TPQCP was attempted insofar as Loney has argued that treatment with medication would not alter the essential problem of hyperactivity: aggression.

Subjects were pooled in a similar fashion to the method described for the regression analysis. That is, when a subject was changed from an original condition he was eliminated from further analysis.

The actual groups for which membership is predicted in each analysis are designated "0" and "1". Group 0 comprises those subjects whose individual score on a particular criterion measure falls above the mean for all subjects considered in the analysis on that same criterion measure. Group 1 includes all subjects whose individual scores fall below the mean. Thus, with regard to the TCHI, TPQCP, $\bar{XRT}$ and TIMPR variables, membership in Group 1 would indicate better than average performance. Conversely, membership in Group 0, with respect to GMVG, would signify above average performance.

It could be argued perhaps, that it would have been more effective to select the extreme 25% subjects on either side of the mean in order to establish more discrete groups. In addition to being discrete, however, they would likely be of very small size. Unfortunately, multivariate techniques such as discriminant function analysis require large sample

sizes. Even including all of the original subjects, the sample size is still only minimally acceptable. All tables describing discriminant analyses are found in Appendix G.

Teachers' Conners Hyperactivity Index (TCHI)

These results are described in Tables XVIII, XIX and XX (Appendix G). The function derived for the post-test result is shown to have a canonical correlation of .57 and thus, accounts for approximately 33% of the variance between the two actual groups. The only treatment variable which emerges is PTPL (the creation of dummy variables has the same rationale as in the regression analysis and was performed in the same fashion). Of the 21 subjects in the placebo group, 66% (N=14) of them were above the mean on TCHI2 leaving only 33% to show a better than average improvement. In fact, however, this accounts for only 17% of the total Group 1 or "improved" group.

Interestingly, total family income appears to predict negatively for good performance in this analysis insofar as the more improved group shows a smaller income (\$23,000) than the less improved group where average family income is markedly higher at \$29,000.

It is also evident that more and less improved subjects on TCHI can be distinguished according to initial grade level with the more improved subjects showing an average of 3.02 compared with 2.49 for the less improved.

The difference in the means of Group "1" and Group "0" on the parental characteristics variables (MWAIS, MED and FMPI) appear negligible and, therefore, breed caution. While it may appear noteworthy that MWAIS and MED follow the same direction as did INC, it must be remembered that these three variables have significant pre-test correlations. In any event, it appears that children who have more fortunate mothers tend to perform less favorably on TCHI2.

The overall success of the discriminant function is described in the classification results (Table XVIII). On the basis of that function, 71% or 52 children of a total 73 children were accurately distinguished with regard to their comparative performance.

The only variable which met the criteria for inclusion in the discriminant function at first follow-up (Table XIX) was PTPL. Alone this accounts for less than 10% of the total variance but it evidently contributes were to a high degree of accuracy in predicting membership in the "more improved" group, albeit in an indirect fashion. Once again, the more improved and less improved PTPL subjects are split, Ns equal 5 and 8 respectively. The classification results suggest that non-membership in PTPL may be an important characteristic of the more improved subjects.

At second follow-up, again only one variable qualifies, this time IQ with a 16% share of variance. Judging by the

mean IQ's of the more improved and less improved groups, however, IQ may be considered a legitimate discriminator. The more improved at second follow-up show a mean IQ of 125 - a full 13 IQ points above the mean (IQ = 112) of the less improved group. In addition, IQ alone, demonstrates a 70% correct classification percentage, equally successful in discerning both more improved and less improved subjects.

Teachers' Peterson-Quay: Conduct Problems (TPQCP)

The TPQCP discriminant analysis information is contained in Tables XXI, XXII and XXIII. At post-test, four variables were included in the discriminant function (Table XXI), TCHI, PTPL, MLWI and MWAIS. Together they account for 25% of the total variance and show a 69% correct classification percentage; 63% of Group 0 and 75% of Group 1 being correctly classified.

The results suggest that children who are initially evaluated by teachers as less hyperactive, will later be evaluated by teachers (TPQCP2) as demonstrating fewer conduct problems, or at least, better than average improved with respect to conduct problems.

PTPL, once again, appears as a negative discriminator. That is, subjects in the PTPL condition, at least 62% of them (13/21), show a lesser degree of improvement than do subjects not in the PTPL condition. The role of the PTPL group with respect to the discriminant functions for both

TCHI2 and TPQCP2 is consistent with the findings in the regression analysis.

It is further evident that children whose mothers are satisfied with their marriages (more so than the average, at any rate) tend to perform more successfully at post-test with regard to conduct problems. The mean differences with respect to MWAIIS appear negligible.

The function successfully distinguishes (69%) both the more improved and less improved subjects at post-test.

No variables qualified for the analysis at first follow-up suggesting that the "actual" groups showed no distinguishing characteristics with respect to the variables used in this study. In other words, the outcome on this conduct problems scale remains relatively unpredictable. This shows some support for Loney, albeit weak, insofar as she postulates that the best predictor of outcome regarding aggression is early childhood aggression.

The second follow-up results, shown in Table XXIII, indicate that only TCHI1 was selected as a significant discriminator. Although it is evident that the mean differences of the two actual groups on TCHI1 are substantial (1.99 for Group "0" and 1.75 for Group "1"), the inclusion of TCHI1 is more likely a function of its high degree of pre-test correlation with the criterion variable. In any case, there is not a sufficient difference between groups

divided according to TCHI ($p < .067$) to warrant detailed discussion and the classification results demonstrate a slightly better than chance prediction of correct group membership.

Mean Reaction Time ($\bar{XRT}$)

The results for this analysis are presented in Tables XXIV, XXV and XXVI.

The post-test results (Table XXIV) show a powerful discriminant function accounting for 50% of the total variance and correctly predicting more improved and less improved group membership with an 83% accuracy.

Age at referral is, understandably, an important discriminator with the self-evident suggestion that older children perform more quickly. It is also evident, however, that the more impulsive the child, the more likely he will be among the less improved with regard to reaction time (at post-test).

PTPL emerges here, as well. The division of PTPL subjects, however, is not as dramatic as in the case of TCHI2 and TPQCP2. A total of 19 PTPL subjects were included in the analysis, 11 of them in Group "0" or less improved and 8 of them in Group "1", the more improved. Consequently, it would be difficult to argue that non-membership in PTPL is an important distinguishing characteristic of the more improved subjects at post-test.

Age of referral is again the important discriminator of first follow-up (Table XXV). As was discussed earlier in this chapter, the parental MMPI defy clear interpretation and no more will be attempted here.

The second follow-up results (Table XXVI) demonstrates the continued strength of age at referral as a discriminator. Evidently, no other predictor variables or treatment variables serve as distinguishers of less improved and more improved attention. It is as if the children simply needed time to adjust to the task itself before mastering it. At second follow-up, however, TCHI1 is included in the function. However, the mean differences indicate that children evaluated as more hyperactive initially were more likely to perform better than average at second follow-up. This is a surprising result but may suggest that the more clearly hyperactive the child is to start with, the better chance he has to improve with regard to attention. This will be explored further in the discussion chapter.

Total Impulsive Responses (TIMPR)

Discriminant analysis information regarding the TIMPR is presented in Tables XXVII, XXVIII and XXIX. At post-test one of the difficulties with the TIMPR becomes plainly visible. The actual Groups, "0" and "1" are extremely inequitable with respect to Ns, indicating a highly skewed

distribution. This remains the case at first follow-up, while at second follow-up the sizes of the two groups even out.

In any case, $\bar{XRT1}$ and $GMVG1$, (which have a high degree of intercorrelation (.58, $p < .01$), figure most prominently as discriminators. At post-test FWAIS is included with the suggestion that children with high IQ fathers are likely to show better improvement at post-test than children whose fathers' IQ's are more average.

At first follow-up, PTPL emerges. Unlike all previous appearances, however, membership in the PTPL group appears to be positively related to improved performance on TIMPR3. Of the total 13 subjects in the PTPL condition, nine of them are indicating better than average performance on this criterion. The distribution, however, is so skewed that confident interpretation is not indicated. Despite the skewed distribution, though, the discriminant function is surprisingly accurate in predicting group membership (77%), both for the more improved and less improved subjects.

At second follow-up, the one discriminating variable fails to differentiate the groups significantly ($p < .056$) and it shows only a slightly better than chance probability of correct prediction.

Gates-MacGinitie Reading Test: Vocabulary (GMVG)

The results for this analysis are described in Tables XXX, XXXI and XXXII. As was the case in the regression analyses, a high degree of prediction is achieved for all three post-testings with age of referral (Age), attention ($\bar{XRT}$) and IQ figuring prominently in the prediction. At each testing, the older the child the more attentive he was and the higher his IQ, the more likely he was to succeed academically, than those children whose positions on these three predictors were lower on the scale.

Moreover, at post-test, TPQCP1 is included as a discriminator as well as at second follow-up. In both cases, children with higher pre-test scores on conduct problems score more positively with respect to grade achievement. Apart from the MMPI, subject variables, alone, combine to explain 60% of the total variance and to predict actual group membership with 86% accuracy.

It appears that the child's innate resources have more to do with his eventual grade achievement than either environmental conditions or treatment interventions.

At first follow-up, only the three subject variables already mentioned are included in the function ($\bar{XRT}$ 1, Age, IQ). They function in the expected direction and combine to explain 55% of the total variance while demonstrating 88% accuracy in predicting group membership, both for less

improved and more improved subjects. The power of the subject variables is so great that one hardly needs to look elsewhere in order to comprehend the contingencies of academic performance.

Nevertheless, there is still some room for greater precision and at second follow-up, PTRIT is introduced as a discriminator along with TPQCP1. Again, it appears that children with higher scores on the conduct problem scale show eventual superiority in their performance on the grade achievement scale.

Membership in the PTRIT group is a surprising addition, but in view of the group Ns (5 for Group "0" and 4 for Group "1"), it should be interpreted with caution. In any event, it appears that membership in the PTRIT group may auger well for eventual academic performance. When the variables in this function (AGE, IQ, TPQCP1, PTRIT) are combined, they show a remarkable 100% accuracy in predicting Group "0" membership, or an overall accuracy of 89%. In addition, they account for a total variance share of 71%.

CHAPTER IV

DISCUSSION

The stated objective of this study was to provide clarification with respect to the apparent failure of available treatment strategies to affect the long-term course of hyperactivity. The specific focus was the discrepancy between the demonstrated short-term effectiveness of stimulant medication and the lack of demonstrated long-term effectiveness. Two areas of resolution were discussed as potential explanations of this discrepancy. These were arbitrarily designated the 'design-flaw' and the 'definition-flaw' alternatives. In the design-flaw alternative, questions pertaining to design deficiencies in previous studies were examined. Theoretical issues pertaining to the nature of hyperactivity were examined in the definition-flaw alternative. While each of these alternatives might be independently researched, it was argued in the present study that design-flaws ought first to be ruled out as the reason for failing to demonstrate in the long-term what had been so convincingly demonstrated in the short-term. Accordingly, the research hypotheses were classified according to the two alternatives. With respect to design-flaw, hypotheses of continuity with previous treatment

comparison research were constructed; and, with respect to definition-flaw, hypotheses regarding the predictive accuracy of Loney's model of hyperactivity were constructed. Four separate statistical analyses were performed on data collected pertaining to five separate criterion variables. It is, therefore, evident that the results might be discussed in several different ways, but the format selected for this chapter is as follows: each criterion variable will be discussed separately and results will be discussed across statistical analyses. The results will then be discussed in such a fashion that the evidence for the hypotheses might then be addressed.

Teachers' Conners Hyperactivity Index (TCHI)

The pre-post results on this variable virtually replicate the findings of Gittleman-Klein, et al. (1980), and Firestone, et al. (1981), and, therefore, remain consistent with the main body of previous research which supports the conclusion that Ritalin results in superior short-term benefit for hyperactive children when compared with behavioural interventions. ANOVA results, pre-post, confirm the significance of this benefit but fail to show significant differences at further follow-up. Furthermore, there appears to be a plateau effect between post-test at 3 months and first follow-up at one year where quantitative differences between the treatment

groups remain and within group changes do not occur. There is other evidence, however, of a possible longer term benefit to those children using Ritalin. This evidence is partly contingent upon consideration of a new treatment group, designated the PTPL-to-PTRIT group. This group comprises children who had been placed initially in the PTPL group but were changed to Ritalin therapy following their post-test results. This change was necessitated by very poor treatment progress without medication. In any case, the effect of Ritalin added to their treatment regimen appears to have been quite dramatic insofar as these children surpassed those children remaining in the PTPL group, both at first follow-up and second follow-up.

There is an additional consideration of the results which arises from the descriptive statistics. There are at least two phenomena which can be gleaned from these statistics. They have previously been designated 'rapidity of response' and 'consistency of response'. It was apparent that children treated with Ritalin not only responded more quickly than children treated behaviourally (with no medications), they also demonstrated an increasingly narrow range of response in contrast to the increasingly greater range of response characteristic of the children in the placebo group. It, therefore, became evident that the

response to behavioural intervention was more difficult to predict over the long-term than was the response to Ritalin.

The results from the multiple regression analysis suggest that children in the placebo condition have some likelihood of 'deteriorating' with respect to their scores on the TCHI. This likelihood disappears by second follow-up which might imply that the families of children treated behaviourally require more time for the integration of ameliorative coping strategies. Nevertheless, this could be taken as evidence that Ritalin may offer some advantage to children up to one year following initiation of treatment.

The results of the discriminant function analysis are consistent with the previous analyses particularly insofar as membership in the placebo group is an important variable. At post-test 14 subjects from the placebo group score above the mean on the TCHI as compared with only 7 subjects who score below the mean. That is, the number of placebo group subjects who score poorly on the TCHI outnumbers those who show an overall improvement by a margin of 2 to 1. This trend continues to first follow-up where membership in the placebo appears as the only discriminator derived from the analysis.

Teachers' Peterson-Quay: Conduct Problems (TPQCP)

As was the case with the TCHI, significant evidence was found for the short-term superior benefit of Ritalin when compared with placebo, on this particular measure of conduct problems. The increasing variance, over time, in the placebo group is also evident with this measure but is not sustained after first follow-up. This might be interpreted as an indication that behavioural interventions are more effective in the long-term (or, at least, more predictable) than they are in the short-term. It was suggested above that families of children treated behaviourally may require more time for the integration of ameliorative strategies. In any event, it must be remembered that those subjects who showed no improvement in this group (or negative progress) by post-test were then removed from the placebo group and placed on Ritalin. It is further evident that these 'change' subjects (PTPL-to-PTRIT) showed dramatic improvement when changed to medication. It is, therefore, becoming more consistently evident that Ritalin is an effective treatment for those children who fail to respond to behavioural interventions and, moreover, this effectiveness continues through the long-term. Conversely, the Ritalin-only group, while significantly more improved than the placebo group in the short-term, shows a deteriorating effectiveness by second follow-up to the point where subjects in the Ritalin-only group begin to show a regression with

respect to their TPQCP scores. It is evident, therefore, that whatever benefit is gained through Ritalin alone, it is short-lived. These results might have been clarified in a more symmetrical design which include a group of children who were placed originally in the RIT ONLY condition and then changed, because of poor improvement, to parent-training condition. The subjects who showed the greatest and most consistent improvement are those who demonstrated an initial positive response to behavioural intervention alone and those who, not having made adequate progress in the placebo group, were changed to Ritalin at post-test. It is suggested by these results that those characteristics which define children who fail to respond to behavioural intervention may be the same characteristics which predict long-term positive response to medication. This would appear to be a specific predictor insofar as children randomly placed on Ritalin show an eventual regression in the long-term, despite short-term improvement. It should be stated, however, that this phenomenon of a negative drift in the Ritalin-only group could be due to other factors. For example, clinical experience has demonstrated that patients tend to discontinue treatment when they have achieved some symptom alleviation. Thus, those children who remain in treatment may experience continued difficulties for which they seek relief from a longer treatment period. In fact, there was a higher non-adherence rate with respect to the Ritalin-only condition, than from the other two

conditions and the continued participation of these 'drop-outs' could, perhaps, have contributed to a continued positive improvement in the group as a whole. In any event, children who demonstrate positive response in the short-term to behavioural strategies can be expected to maintain their improvement even into the long-term, without the addition of stimulant medication. It would appear quite clear, therefore, that the initial treatment of choice for hyperactive children would be behavioural (in this case, parent-training) so long as the target symptoms were understood to be, specifically, conduct problems. This would be in contrast to the suggestion by Gittelman-Klein who recommends behavioural treatment only where medication is proven to be ineffective.

It was noted that the above discussion is based upon the results of the descriptive statistics, and is highly speculative especially in view of the failure to demonstrate significant group differences at second follow-up. Following from the discussion, however, these results could be seen to offer legitimate cause for the re-examination of the defining characteristics of hyperactivity. This is discussed in further detail below.

The regression analyses yielded relatively strong equations, particularly at second follow-up when the combined predictors account for 43% of the overall variance in the TPQCP scores. The results from the descriptive statistics

notwithstanding, it would appear from the regression analyses that pre-test hyperactivity index scores predict follow-up conduct problem scores most effectively, except at follow-up when membership in the placebo group and parental characteristics are prominent. The regression equation at first follow-up, however, is relatively more ineffective ($R^2 = .26$). Evidently, the addition of father's IQ to the prediction equation at first follow-up adds significantly to the R^2 , but in view of the relatively low simple correlation ($r = -.10$), it would be difficult to attach particular definition to the relationship between father's IQ and the criterion. The remaining variables, then, would be membership in the placebo group (PTPL), MWAIS and MLWI. As was the case with the TCHI, membership in the placebo group appears to predict for higher TPQCP scores (or increasingly poor performance) at least up to first follow-up. At post-test, PTPL is even a stronger predictor ($r = .32$). Again this might be interpreted as indirect evidence for the continued benefit from Ritalin, at least, up to one year following the initiation of treatment. That is, children left in the placebo condition appear to remain at risk for relatively greater difficulties. This is not the case at second follow-up, though, and the turn of events at this level has already been discussed above.

It has previously been shown that the TCHI and TPQCP are significantly correlated at pre-test and the predictive strength of the TCHI is not, therefore, surprising. What is surprising is that the converse does not appear to be the case. That is, TPQCP1 was not selected as a predictor for follow-up TCHI scores. It may be the case, therefore, that the items in the TCHI which are extracted from the subset of conduct problem questions in the Teachers' Connors Hyperactivity Scale are, alone, responsible for the correlation with the TPQCP. The TPQCP items as a whole, however, are more specifically related to acting out difficulties and have little to do with the basic focus of the TCHI items. This, and the evidence from the descriptive statistics support the assertion of Loney, et al. (1979) that aggression and hyperactivity are orthogonal factors. The results, then, would further suggest that hyperactivity and conduct disorders be regarded as separate phenomena, requiring different therapeutic strategies. Despite the plethora of research in this area, it would not be surprising to discover that many psychologists, physicians, parents and teachers confuse the two - i.e., mistake conduct disorders for hyperactivity.

This discussion has not yet addressed some important questions, particularly in the light of the dramatic success shown by those subjects from the placebo condition placed on Ritalin following post-test. The first question has to do with the construct validity of the criteria, themselves.

It is possible, for example, that those subjects in the parent training plus placebo condition who showed no improvement were more homogeneous with respect to hyperactivity. The other subjects in this condition, however, may have represented a more heterogeneous or 'blended' group - some hyperactive symptoms but mainly characterological problems for which some parent training was effective. The blended nature of the group would, naturally, be the case for the Ritalin groups as well, but here the failure of the mainly conduct disordered children to respond to Ritalin would dampen the overall response of the group to the medication. In other words, the tests used to discern hyperactivity may not yet be sufficiently discrete. A possible reason for this, however, has to do with the second question, that is, hyperactivity as a diagnosis may be used more and more frequently to describe children who appear inattentive to authority and structure, when in fact, this inattention may well be due to psychogenic factors. Thus, there may be an inadvertent tendency among professionals to confuse constitutional and ecological etiologies in children who are difficult to handle. In other words, Loney may indeed be right when she asserts that medication is ineffective in reducing long-term maladaptive symptomatology insofar as hyperactivity is not the first link in the chain of eventual maladaptive behaviour - rather, it

is childhood aggression. Thus, it may be true that the retrospective studies to-date have actually been examining the long-term course of conduct disorder, not hyperactivity. Loney's statement, therefore, does not preclude the possibility that stimulant medication may indeed be a long-term effective treatment in 'bona fide' hyperactivity, or for children whose attentional deficit is constitutionally based.

Mean Reaction Time ($\bar{X}$ RT)

Up to and including first follow-up, the descriptive statistics for mean reaction time essentially confirm the findings relative to the two previous criteria, TCHI and TPQCP. There appears to be a consistent demonstration of the superiority of Ritalin in ameliorating symptoms and, in this case, that superiority is proven to be significant even at first follow-up. It can also be seen, however, that the PTPL-to-PTRIT group shows a striking pre-test difference from the PTPL group on this variable. From Appendix B it is further evident that the mean reaction time is the only criterion variable for which a significant difference exists between the two groups. In the above discussion, it is suggested that the PTPL-to-PTRIT group may represent a bona fide or true hyperactivity in which

case, reaction time or attention would appear to be a significant variable in the disorder. This is consistent with the earlier work of Douglas and the McGill group (1972) and further suggests that hyperactivity is a constitutional disorder characterized chiefly by the inability to sustain attention-- hence, the dramatic effectiveness of the Ritalin in the PTPL-to-PTRIT group in this study.

The fact that all groups achieve a similar level of performance by second follow-up is probably due to a 'floor effect'. That is, all children in the study have reached a limit, or a performance which they cannot exceed, even under normal circumstances.

The prediction of reaction time performance is quite effective (minimum $R^2 = .70$), and unlike the other four criteria, only subject variables and treatment variables appear as predictors (no parental variables). Admittedly, age at referral is entered at each follow-up as the pre-eminent source of variation and is consistently negatively correlated with the criterion. Thus, older children have faster reaction time. This, of course, is self-evident, but insofar as it is a major predictor, it may be the case that the task was too complex and, therefore, unable to render age irrelevant to this measure of 'attention'. In any event, PTPL is again listed consistently throughout the three test periods as a predictor and at second follow-up,

it has a precisely opposite relationship to the criterion in comparison with membership in the PTRIT group (+.28 and -.28, respectively). In the case of reaction time, then, there is evidence of a long-term superior benefit for those treated with Ritalin.

Total Impulsive Responses (TIMPR)

A brief discussion of the results with respect to this variable was presented along with the statistical analyses in the previous chapter. Any general conclusions can be made only with extreme caution in view of the failure of the parameters to meet prerequisite assumptions for the repeated measures ANOVA. Despite the fact, therefore, that even on this criterion the results remain consistent with the previous results, the preference of the author is to disregard the evidence from this variable in view of the more serious statistical problems it presents.

Gates-MacGinitie Reading Test: Vocabulary (GMVG)

As was discussed in the previous chapter, this is the only criterion for which the descriptive and inferential statistics combine in consistent fashion to disclaim any significant differences between treatments, both in rate of response and extent of response. There is one exception - the PTPL-to-PTRIT group. Children in this group demonstrate

the characteristic dramatic improvement by first follow-up. Despite the inferential statistics, therefore, consideration of this 'change' group might well demonstrate that Ritalin is effective for children, described above, as bona fide hyperactives.

One of the more interesting results of the regression analyses with respect to vocabulary achievement is the apparent support contained therein for the earlier suppositions of Weiss and her colleagues (1975) that family environment has much to do with outcome. In her case, Weiss was examining the relative amenability of the hyperactive child to Ritalin therapy. In the present results, it appears that when either or both parents believe themselves to be more happily married (and, presumably, therefore, providing a happier homelife), their child has a better chance for academic success. This may appear self-evident, but in view of the fact that academic achievement has heretofore defied prediction (Barkley and Cunningham, 1978), these results lend some credence to Weiss's strategy of constructing a scale which might describe family dynamics and amenability to treatment.

The results of the discriminant function analyses show a high degree of prediction was achieved for all three post-testings. Mean reaction time is a significant discriminator and, as such, sheds some light on the reasons for the

impressive improvement demonstrated by the 'change' group. Mean reaction time is the only criterion variable which significantly differentiates the PTPL group and the PTPL-to-PTRIT group, showing much slower reaction times in the 'change' group. If one assumes that stimulant medication serves to improve attention and that learning is greater when attention is greater, then it would be only logical that the change group could be expected to demonstrate a positive response to Ritalin even on a criterion of academic achievement.

Summary and Conclusions

The first two research hypotheses stated that children treated with stimulant medication would show significantly better performance on criterion measures of hyperactivity, conduct problems, reaction time, and grade achievement, both in the short-term (3 months) and the long-term (2 years) when compared with children treated behaviourally with no medications. The results only partially support the second hypothesis (long-term) but there is very strong support for the first hypothesis (short-term), albeit incomplete. This shows valuable support through replication for the earlier work of Gittelman-Klein, et al. (1980) and Firestone, et al. (1981). There are some indications that, indeed, Ritalin might well be proven more effective when given to bona fide hyperactive children. In other words, Ritalin can be shown effective in the long-term, perhaps, given further improvements in research design. For example, the lack of differences between groups in the long-term might be attributable to practice effects and/or regression to the mean which may have masked treatment effects. Most particularly, one is mindful of Loney's (1980) admonition regarding the use of

placebo groups. She advises a 'placebo behavioural' condition in addition to a 'placebo medication' condition and it appears she is well justified in advising such. It appears from the present results that it was the response to behavioural intervention which was, in fact, more varied (less predictable) and in approximately 50% of the cases, totally ineffective. Moreover, it appeared that children who failed entirely to respond to behavioural intervention showed dramatic improvement when placed on Ritalin. Thus, studies investigating potential prediction of response to behavioural treatment seems strongly indicated. Finally, there was indirect evidence of a risk of deterioration, with respect to attention and with respect to the measure of hyperactivity in children treated behaviourally with no medications. This gives rise to discussion concerning the actual definition of hyperactivity with resulting support for Loney's assertion regarding the orthogonality of hyperactivity and aggression. Thus, while there is certainly room for improvements in design, the question of theoretical suppositions underlying the hyperactivity construct appear to require further study. In any event, there was good evidence for the superiority of Ritalin in the short-term and this study, therefore, remains consistent with the findings of Gittleman-Klein, et al., and Firestone, et al. The variable which both studies (Gittleman-Klein and the present one) lacked was a measure of the child's

own perception of his/her experiences and this is probably a significant lacuna. For example, it might have been possible to gain some understanding of the role of the child's emotions in his (hyperactive) behaviour. This would be important in refining the diagnosis for it might be expected from the present results that true hyperactives may show little conscious awareness of anger, aggression, etc. and alternatively an aggressive child given the appropriate psychological intervention might demonstrate a significant diminution of 'hyperactive' behaviour. Perhaps with younger children a free play paradigm could be utilized and in later childhood and adolescence, interview and questionnaire formats might be appropriate. In any case, design-flaws are still significant and need further improvement. As is the case with most clinical outcome studies, the number of subjects was a problem. It might be possible to combine the data of several clinics whose perspectives are compatible. On the basis of the present research, there is sufficient encouragement for the potential to demonstrate long-term effectiveness with Ritalin, at least for children for whom the medication is properly intended.

The third research hypothesis stated that family variables would predict significantly for outcome on each of the criterion measures. The results support this hypothesis only tenuously and in the case of reaction time,

fail to show any evidence that family variables influence outcome. This hypothesis was made in respect to Loney's argument that long-term outcome for hyperactives had more to do with childhood aggression than with hyperactivity, per se. Accordingly, the role of the family in providing models for the coping with aggressive feelings is self-evident. Even in respect to academic achievement, family models are important and in the present research, the prediction focused primarily on marital satisfaction. Most clinicians have witnessed the confusion visited upon children of broken homes and it appears that hyperactive children are no less vulnerable. In any case, the results do support Loney's argument for the role of family variables, and in addition, give further impetus to Weiss' suggestions regarding the assessment of 'family amenability' to treatment. Barkley (1981), in speaking of the importance of family variables, has pointed out that "in spite of the obvious, ..., most literature dealing with hyperactive children has virtually ignored this social context and the implications it has for assessment and therapy".

Perhaps, the most compelling results of this study were in regard to the question of the relationship between stimulant medication and conduct problems. In the description of the first hypothesis, which suggested generalized improvement for children treated with Ritalin, it was noted that

Loney specifically stated the opposite. Adolescent (and adult) maladaptive patterns, she believes, are the result of early childhood aggression, not hyperactivity, and hence the failure of Ritalin to affect the long-term course. Loney's objection was focused upon through an analysis of the conduct problem measurement.

The evidence for Loney's presupposition (and, therefore, the first hypothesis) is mixed. That is, Ritalin appears to have been a quick remedy for children exhibiting behaviour problems, with the exception of one small group of children and much has been said about them already. These are the children in the PTPL-to-PTRIT group. It was suggested that these children represented bona fide hyperactives - children, whose behaviour problems were indeed the result of purely constitutional factors and not the result of ecologically based aggressive feelings and/or psychogenic inattention; hence, the long-term benefit from Ritalin for these children. It was also evident that children treated only with Ritalin (i.e., Ritalin-only group) showed a tendency to deteriorate or regress over the long-term so that any short-term benefit was gradually eradicated (the effect of drop-outs notwithstanding). It was, therefore, evident that conduct problems remained, despite stimulant medication. In any event, it is quite clear from the results that Loney's separation of aggression from hyperactivity may be entirely

justified. It is further evident that hyperactivity is, in fact, a specific disorder which may show a specific response to Ritalin. In Loney's retrospective studies, bona fide hyperactive children may have been obscured by their inclusion in a much larger group of children, all of whom showed adjustment problems in later adolescence. While it may have been true that the common denominator for these children was aggression in earlier childhood, it also appears true that the etiology of the aggressive behaviour may have been quite different for the hyperactives. Clearly, further study is required, specifically toward the isolation of discrete characteristics separating conduct/character disorder from hyperactivity. If anything, the present research findings encourage a return to the earlier work of Douglas, et al. and, at the same time, promote the efforts of Loney with respect to her investigation of the social and developmental parameters of childhood aggression.

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APPENDIX A

ANALYSIS OF VARIANCE: ALL VARIABLES BY CONDITION (RIT ONLY, PTPL, PTRIT)
PRE-TEST SCORES

	N	X	S.D.	SOURCE	D.F.	F	SIGNIFICANCE
AGE (MOS)							
RIT ONLY	30	89	16	Between Groups	2	.218	.804
PTPL	21	88	24	Within Groups	70		
PTRIT	22	91	17				
IQ							
RIT ONLY	30	109	13	Between Groups	2	2.49	.09
PTPL	21	111	19	Within Groups	70		
PTRIT	22	118	15				
INC							
RIT ONLY	30	24	13	Between Groups	2	1.38	.26
PTPL	21	24	12	Within Groups	70		
PTRIT	22	28	12				
MWAIS							
RIT ONLY	30	109	8.3	Between Groups	2	.38	.69
PTPL	21	108	9.7	Within Groups	70		
PTRIT	22	110	9.2				
MED							
RIT ONLY	30	11.9	2.1	Between Groups	2	2.7	.07
PTPL	21	12.7	2.0	Within Groups	70		
PTRIT	22	13.3	2.7				
-FWAIS							
RIT ONLY	30	107	11	Between Groups	2	2.24	.115
PTPL	21	107	10	Within Groups	70		
PTRIT	22	113	11				
FED							
RIT ONLY	30	11.9	2.9	Between Groups	2	2.4	.105
PTPL	21	13.0	2.8	Within Groups	70		
PTRIT	22	13.8	2.6				
MLWI							
RIT ONLY	30	98	29.2	Between Groups	2	1.5	.222
PTPL	21	102	21.2	Within Groups	70		
PTRIT	22	110	22.4				
FLWI							
RIT ONLY	30	100	23.6	Between Groups	2	2.4	.095
PTPL	21	102	26.5	Within Groups	70		
PTRIT	22	115	22.3				

		N	X	S.D.	SOURCE	D.F.	M.S.	F	SIGNIF.
MMP1									
	RIT ONLY	30	542	68					
	PTPL	21	541	69	Between Groups	2	.07		.924
	PTRIT	22	535	54	Within Groups	70			
FMP1									
	RIT ONLY	30	553	38					
	PTPL	21	539	37	Between Groups	2	.90		.411
	PTRIT	22	539	52	Within Groups	70			
GMVG1									
	RIT ONLY	30	2.6	1.8					
	PTPL	21	2.8	2.1	Between Groups	2	.86	.28	.755
	PTRIT	22	2.9	1.3	Within Groups	70	3.05		
XRT1									
	RIT ONLY	30	.81	.27					
	PTPL	21	.84	.28	Between Groups	2	.01	.146	.865
	PTRIT	22	.85	.23	Within Groups	70	.07		
TIMPR1									
	RIT ONLY	30	23	29					
	PTPL	21	14	14	Between Groups	2	579	1.01	.371
	PTRIT	22	21	23	Within Groups	70	575		
TCH11									
	RIT ONLY	30	1.96	.37					
	PTPL	21	1.94	.36	Between Groups	2	.08	.664	.518
	PTRIT	22	1.85	.31	Within Groups	70	.12		
TPQCP1									
	RIT ONLY	30	9.5	2.8					
	PTPL	21	9.6	3.8	Between Groups	2	.05	.006	.994
	PTRIT	22	9.5	2.2	Within Groups	70	8.8		

APPENDIX B

COMPARISON OF PTPL AND PTPL-TO-PTTRIT GROUPS ON ALL PREDICTORS

<u>Variable</u>	<u>Group</u>	<u>N</u>	<u>Mean</u>	<u>Stand. Dev.</u>	<u>ANOVA ($p < .05$) Significance</u>
AGE	PTPL (A)	10	82.2	20.1	N.S.
	PTPL-to0PTTRIT (B)	7	82.5	25.1	
IQ	A	10	112.1	24.8	N.S.
	B	7	108.1	14.4	
INC	A	10	25.0	11.0	N.S.
	B	7	23.5	5.2	
MWAIS	A	10	106.9	11.1	N.S.
	B	7	109.4	9.9	
MED	A	10	12.8	2.3	N.S.
	B	7	12.9	1.8	
PWAIS	A	10	109.7	9.1	N.S.
	B	7	106.6	13.5	
FED	A	10	12.9	2.6	N.S.
	B	7	13.1	3.3	
GMVGL	A	10	2.4	1.6	N.S.
	B	7	2.4	2.3	
XRT1	A	10	.8	.1	p < .05
	B	7	.9	.3	

<u>Variable</u>	<u>Group</u>	<u>N</u>	<u>Mean</u>	<u>Stand. Dev.</u>	<u>ANOVA ($p < .05$) Significance</u>
TIMPR1	A	10	15.6	13.5	N.S.
	B	7	14.2	16.4	
TCH11	A	10	1.9	.4	N.S.
	B	7	1.9	.2	
TPQCPI	A	10	9.9	4.1	N.S.
	B	7	9.3	2.9	
MLW1	PTPL (A)	10	92	22.8	$p < .05$
	PTPL → PTRIT (B)	7	106	16.1	
FLW1 46 108	A	10	46	32	$p < .05$
	B	7	108	24	
MMPI	A	10	574	80	$p < .05$
	B	7	488	36	
FMPI	A	10	525	26	$p < .05$
	B	7	533	35	

APPENDIX C

ANALYSIS OF VARIANCE OF PRE-POST RESULTS
ACROSS ALL CRITERIA IN PURE GROUPS ONLY
(UP TO AND INCLUDING FIRST FOLLOW-UP)

<u>Criterion</u>	<u>N</u>	<u>Source</u>	<u>D.F.</u>	<u>Mean Square</u>	<u>F</u>	<u>Significance</u>
GMVG2	57	Betw. With.	2 54	1.46 3.64	.45	.672
XRT2	60	Betw. With.	2 57	.05 .06	.94	.397
TIMPR2	60	Betw. With.	2 57	74.18 284.16	.26	.772
TCHI2	60	Betw. With.	2 57	.59 .30	1.96	.150
TPQCP2	59	Betw. With.	2 56	27.24 14.48	1.88	.196

APPENDIX C

ANALYSIS OF VARIANCE OF PRE-POST RESULTS
 ACROSS ALL CRITERIA IN PURE GROUPS ONLY
 (UP TO AND INCLUDING SECOND FOLLOW-UP)

<u>Criterion</u>	<u>N</u>	<u>Source</u>	<u>D.F.</u>	<u>Mean Square</u>	<u>F</u>	<u>Significance</u>
GMVG2	47	Betw. With.	2 44	2.93 2.77	1.05	.356
XRT2	50	Betw. With.	2 47	.08 .05	1.60	.212
TIMPR2	50	Betw. With.	2 47	37.7 118.9	.317	.730
TCHI2	50	Betw. With.	2 47	.222 .275	.809	.451
TPQCP2	49	Betw. With.	2 46	14.8 15.0	.987	.380

APPENDIX D

Pearson Product Moment Correlation* of All Prediction Measures

	AGE	IQ	INC	MMAIS	MED	FMAIS	FED	GMGI	XRTI	TIMPRI	TCHI1	TPQCP1	MLW1	FLW1	MPI	FMP1
AGE																
IQ	-.05															
INC	.18	.13														
MMAIS	.20	.34*	.31*													
MED	.0	.40*	.53*	.49*												
FMAIS	.33*	.34*	.38*	.50*	.61*											
FED	.21	.39*	.23	.32*	.61*	.32*										
GMGI	.73*	.10	.22	.21	.08	.31*	.29*									
XRTI	-.65*	-.06	-.27*	-.23*	-.16	-.31*	-.32*	-.70*								
TIMPRI	-.45	-.05	-.22	-.31*	-.25	-.31*	-.47*	.58*								
TCHI1	.08	-.22	.14*	.10	.12	.03	.08	.03								
TPQCP1	.11	-.05	.06	-.04	.01	-.16	-.08	-.07								
MLW1	.10	.02	.01	-.12	-.07	-.13	-.01	.12								
FLW1	.13	.08	.08	-.07	.03	-.05	-.01	.01								
MPI	.01	.01	-.06	-.10	-.05	.03	-.08	-.05								
FMP1	.11	.04	-.01	.12	-.13	-.04	.10	-.06								

	GMGI	XRTI	TIMPRI	TCHI1	TPQCP1
GMGI					
XRTI	(-.70)*				
TIMPRI	(-.47)*	.58*			
TCHI1	.08	.03	(-.13)		
TPQCP1	(-.03)	.11	(-.07)	.44*	

*p<.001

✓ APPENDIX E

TABLES OF ANALYSES OF VARIANCE WITH
REPEATED MEASURES FOR EACH CRITERION

Table V
ANOVA WITH REPEATED MEASURES OF TEACHERS' RATINGS ON THE TEACHERS'
CONNERS HYPERACTIVITY INDEX (TCHI) FOR POST-TEST THROUGH SECOND FOLLOW-UP

<u>Test Period</u>	<u>Comparison</u>	<u>D.F.</u>	<u>M.S.</u>	<u>F.</u>	<u>Prob.</u>
Post-Test	Cond	2.70	.94	3.68	<.04
	Cond x Test	2.70	.74	4.78	<.02
	Test	1.70	28.23	178.06	<.001
First Follow-Up	Cond	2.48	.46	1.24	<.30
	Cond x Test	4.94	.50	1.39	<.30
	Test	2.47	26.34	73.17	<.001
Second Follow-Up	Cond	2.27	.06	.12	<.90
	Cond x Test	4.50	.40	.87	<.50
	Test	3.25	17.69	38.46	<.001

Table VI

TUKEY'S HONESTLY SIGNIFICANT DIFFERENCE POST-HOC ANALYSIS OF INTERACTION
EFFECT ON THE TEACHERS' CONNERS HYPERACTIVITY INDEX (TCHI) POST-TEST

GROUP	MEAN	MEAN DIFFERENCES	
		<u>PTPL</u>	<u>RIT ONLY PTRIT</u>
PTPL	1.37		.47*
RIT ONLY	.92	.45*	.02
PTRIT	.90		

*p < .05
HSD = .04
df = 70
 α = .05
n = 22

Table VII

ANOVA WITH REPEATED MEASURES OF TEACHERS' RATINGS ON THE TEACHERS' PETERSON-QUAY: CONDUCT PROBLEMS (TPQCP) FOR POST-TEST THROUGH SECOND FOLLOW-UP

<u>Test Period</u>	<u>Comparison</u>	<u>D.F.</u>	<u>M.S.</u>	<u>F</u>	<u>Prob.</u>
Post-Test	Cond	2.69	29.78	1.99	<.15
	Cond x Test	2.69	26.38	3.21	<.05
	Test	1.69	348.47	42.58	<.001
First Follow-Up	Cond	2.47	17.74	.77	<.50
	Cond x Test	4.92	6.84	.30	<.70
	Test	2.46	39.42	13.59	<.001
Second Follow-Up	Cond	2.27	2.54	.08	<.90
	Cond x Test	6.50	5.81	.62	<.70
	Test	3.25	201.20	6.89	<.002

Table VIII

TUKEY'S HONESTLY SIGNIFICANT DIFFERENCE POST-HOC ANALYSIS OF INTERACTION
EFFECT ON THE TEACHERS' PETERSON-QUAY: CONDUCT PROBLEMS (TPQCP) POST-TEST

GROUP	MEAN	MEAN DIFFERENCES		
		PTPL	RIT ONLY	PTRIT
PTPL	8.33		2.58*	2.93*
RIT ONLY	5.75			.35
PTRIT	5.40			

*p < .05
HSD = 2.31
df = 70
 α = .05
n = 22

Table IX.

ANOVA WITH REPEATED MEASURES OF CHILDREN'S PERFORMANCES ON THE MEAN REACTION TIME ($\bar{X}_{RT}$) TASK FOR POST-TEST THROUGH SECOND FOLLOW-UP

<u>Test Period</u>	<u>Comparison</u>	<u>D.F.</u>	<u>M.S.</u>	<u>F</u>	<u>Prob.</u>
Post-Test	Cond	2.70	.10	.85	<.50
	Cond x Test	2.70	.06	3.93	<.03
	Test	1.70	.48	31.10	<.001
First Follow-up	Cond	2.49	.04	.30	<.40
	Cond x Test	4.96	.18	1.49	<.05
	Test	2.48	3.48	29.04	<.001
Second Follow-up	Cond	2.27	.06	.58	<.80
	Cond x Test	6.50	.08	.92	<.50
	Test	3.25	1.63	17.16	<.001

Table X

TUKEY'S HONESTLY SIGNIFICANT DIFFERENCE POST-HOC ANALYSIS OF
INTERACTION EFFECT ON THE MEAN REACTION TIME (XRT) TASK POST-TEST

GROUP	MEAN	MEAN DIFFERENCES		
		PTPL	PTRIT	RIT ONLY
PTPL	.82		.14*	.15*
PTRIT	.68			.01
RIT ONLY	.67			

*p < .05
HSD = .02
df = 70
 α = .05
n = 22

Table XI

ANOVA WITH REPEATED MEASURES OF CHILDREN'S TOTAL IMPULSIVE
RESPONSES (TIMPR) FOR POST-TEST THROUGH SECOND FOLLOW-UP

<u>Test Period</u>	<u>Comparison</u>	<u>D.F.</u>	<u>M.S.</u>	<u>F</u>	<u>Prob.</u>
Post-Test	Cond	2.70	270.38	.38	<.70
	Cond x Test	2.70	315.58	1.91	<.16
	Test	1.70	2890.27	17.50	<.001
First Follow-Up	Cond	2.49	44.26	.07	<.90
	Cond x Test	4.96	531.36	.83	<.50
	Test	2.48	6684.70	10.39	<.001
Second Follow-Up	Cond	2.27	92.07	.41	<.70
	Cond x Test	6.50	335.07	1.53	<.20
	Test	3.25	1033.68	4.72	<.01

Table XII
ANOVA WITH REPEATED MEASURES OF CHILDREN'S PERFORMANCE ON THE GATES-
MACGINITIE READING TEST: VOCABULARY (GMVG) FOR POST-TEST THROUGH
SECOND FOLLOW-UP

<u>Test Period</u>	<u>Comparison</u>	<u>D.F.</u>	<u>M.S.</u>	<u>F</u>	<u>Prob.</u>
Post-Test	Cond	2.67	.79	.11	<.90
	Cond x Test	2.67	.30	.94	<.40
	Test	1.67	8.60	26.62	<.001
First Follow-Up	Cond	2.46	2.61	.28	<.80
	Cond x Test	4.90	4.16	.45	<.80
	Test	2.45	212.93	23.02	<.001
Second Follow-Up	Cond	2.24	4.89	.50	<.60
	Cond x Test	6.44	14.88	1.55	<.20
	Test	3.22	168.86	17.59	<.001

APPENDIX F

TABLES OF MULTIPLE REGRESSION
ANALYSES FOR EACH CRITERION

Table XIII

STEPWISE MULTIPLE REGRESSION* ON TEACHERS' RATINGS
ON THE TEACHERS' CONNERS HYPERACTIVITY INDEX (TCHI)
FOR POST-TEST THROUGH SECOND FOLLOW-UP

Post-Test	Predictor (p<.01)	Mult R	R ²	R ² Change	Simple R
(N=73)	PTPL	.36	.13	.13	.36
	MWAIS	.43	.19	.06	.20
	IQ	.48	.23	.05	(-.14)
	MMPI	.50	.25	.06	.10
	MED	.52	.27	.02	(-.02)
First Follow-Up					
(N=47)	PTPL	.39	.15	.15	.39
	MWAIS	.43	.19	.04	.12
	FWAIS	.49	.24	.05	(-.14)
	MED	.51	.26	.02	.07
Second Follow-Up					
(N=27)	MED	.19	.04	.04	(-.19)
	INC	.27	.08	.04	.06
	XRT1	.37	.14	.06	.17
	AGE	.43	.18	.04	.17
	MMPI	.51	.26	.08	.16

* Variables Entered Accordingly: p<.01
tolerance = .01

Table XIV

STEPWISE MULTIPLE REGRESSION* ON TEACHERS' RATINGS
ON THE TEACHERS' PETERSON-QUAY: CONDUCT PROBLEMS (TPQCP)
FOR POST-TEST THROUGH SECOND FOLLOW-UP

Post-Test	Predictor ($p < .01$)	Mult R	R ²	R ² Change	Simple R
(N=73)	TCHIL	.42	.18	.18	.42
	PTPL	.52	.27	.09	.32
	MWAIS	.56	.31	.04	.21
	AGE	.57	.33	.02	.19
	GMVGI	.60	.36	.03	.06
First Follow-Up (N=47)	PTPL	.25	.06	.06	.25
	MWAIS	.35	.12	.06	.20
	FWAIS	.43	.18	.06	(-.10)
	MLWI	.52	.26	.08	.16
Second Follow-Up (N=27)	TCHIL	.40	.16	.16	.39
	FED	.53	.28	.08	(-.27)
	AGE	.57	.32	.04	.19
	MMPI	.62	.38	.06	.08
	TIMPRI	.65	.43	.05	.12

* $p < .01$
tolerance = .01

Table XV

STEPWISE MULTIPLE REGRESSION* ON CHILDRENS' PERFORMANCES
ON THE MEAN REACTION TIME ($\bar{X}_{RT}$) TASK
FOR POST-TEST THROUGH SECOND FOLLOW-UP

Post-Test	Predictor (p<.01)	Mult R	R ²	R ² Change	Simple R
(N=73)	AGE	.70	.50	.50	(-.70)
	PTPL	.73	.53	.04	.24
	IQ	.76	.57	.03	(-.15)
	TIMPRL	.77	.58	.02	.40
	PTRIT	.78	.60	.01	(-.08)
First Follow-Up (N=47)	GMVGL	.64	.41	.41	(-.64)
	PTPL	.68	.46	.05	.13
	FMPI	.70	.49	.04	(-.22)
	AGE	.72	.52	.03	(-.63)
	TCHIL	.74	.55	.03	.12
Second Follow-Up N=27)	AGE	.54	.29	.29	(-.54)
	TCHIL	.60	.36	.07	(-.20)
	RIT-ONLY	.64	.41	.05	.08
	PTPL	.67	.45	.04	.28
	PTRIT	.70	.49	.04	(-.28)

* p<.01
tolerance = .01

Table XVI

STEPWISE MULTIPLE REGRESSION* ON CHILDRENS'
TOTAL IMPULSIVE RESPONSE (TIMPR)
FOR POST-TEST THROUGH SECOND FOLLOW-UP

Post-Test	Predictor (p<.01)	Mult R	R ²	R ² Change	Simple R
(N=73)	XRT1	.51	.25	.25	.50
	FWAIS	.56	.32	.06	(-.39)
	MWAIS	.58	.34	.02	(-.34)
	TPQCP1	.60	.36	.02	(-.05)
	MED	.61	.37	.01	(-.18)
First Follow-Up (N=47) ^b	XRT1	.38	.15	.15	.38
	PTPL	.53	.28	.13	.33
	FMPI	.60	.36	.08	(-.30)
	MMPI	.64	.40	.04	.25
	MED	.67	.44	.04	.11
Second Follow-Up (N=27)	XRT1	.56	.31	.31	.55
	TCHIL	.62	.39	.08	(-.22)
	PTRIT	.66	.43	.04	.36
	MMPI	.72	.51	.08	.19
	AGE	.73	.54	.03	(-.12)

* p<.01

tolerance = .01

Table XVII

STEPWISE MULTIPLE REGRESSION* ON CHILDRENS' PERFORMANCE
ON THE GATES-MACGINNIE READING TEST: VOCABULARY (GMVG)
FOR POST-TEST THROUGH SECOND FOLLOW-UP

Post-Test	Predictor ($p < .01$)	Mult R	R ²	R ² Change	Simple R
(N=73)	AGE	.81	.66	.66	.81
	$\bar{X}$ RT1	.86	.74	.09	(-.75)
	IQ	.87	.77	.02	.12
	TCH1	.88	.79	.01	.10
First Follow-Up (N=53)	AGE	.80	.64	.64	.80
	$\bar{X}$ RT1	.83	.69	.05	(-.70)
	MMPI	.84	.71	.02	(-.21)
	MLW1	.86	.73	.02	.01
	TPQCP1	.87	.75	.02	.01
Second Follow-Up (N=27)	AGE	.69	.46	.46	.69
	MMPI	.73	.54	.08	(-.58)
	$\bar{X}$ RT1	.77	.59	.05	(-.45)
	FLW1	.79	.62	.03	.33
	MLW1	.82	.67	.04	.39

* $p < .01$
tolerance = .01

APPENDIX G

TABLES OF DISCRIMINANT FUNCTION
ANALYSES FOR EACH CRITERION

TABLE XVIII

DISCRIMINANT ANALYSIS OF POST-TEST RESULTS ON THE TEACHERS' CONNERS HYPERACTIVITY INDEX (TCHI)

N=73

P OF F TO ENTER = .1

GROUP 0 > X TCHI2

GROUP 1 < X TCHI2

DISCRIMINATOR	WILKS' λ p < (X)						DISCRIMINANT FUNCTION			
PTPL	.92	(.019)					EIGENVALUE	=	.46	
INC	.85	(.004)					CANONICAL R	=	.57	
GWG1	.80	(.002)					WILKS' λ FUNCTION	=	.68	
MMAIS	.77	(.001)					χ^2	=	26.29	
MED	.71	(.001)					D.F.	=	6	
FMPI	.68	(.001)					p	<	.001	
GROUP MEANS	PTPL	INC	GWG1	MMAIS	MED	FMPI	CLASSIFICATION RESULTS			
GROUP 0	.42	29	2.49	111.2	2.4	406	ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP	
GROUP 1	.17	23	3.02	107.4	2.2	433	0	33	21 (64%)	12 (36%)
TOTAL	.28	25	2.78	109.1	2.3	422	1	40	9 (22%)	31 (72%)
GROUP Ns	PTPL(N)	TOTAL N					% CORRECTLY CLASSIFIED = 71%			
GROUP 0	14	33								
GROUP 1	7	40								

TABLE XIX

DISCRIMINANT ANALYSIS OF FIRST FOLLOW-UP RESULTS ON THE TEACHERS' CORNERS HYPERACTIVITY INDEX (TCHI)

N=53

P OF F TO ENTER = .1

GROUP 0 $\bar{X}$ TCHI3GROUP 1 $\bar{X}$ TCHI3

DISCRIMINATOR	WILKS' λ p < (X)	DISCRIMINANT FUNCTION				
PTPL	.92 (.04)	EIGENVALUE	= .09			
		CANONICAL R	= .28			
		WILKS' λ (FUNCTION)	= .92			
		χ^2	= 4.10			
		D.F.	= 1			
		p	< .04			
GROUP Xs	PTPL	CLASSIFICATION RESULTS				
		ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP		
GROUP 0	.40	0	20	0	1	
GROUP 1	.15			8 (40%)	12 (60%)	
TOTAL	.26	1	33	5 (15%)	28 (83%)	
GROUP Ns		% CORRECTLY CLASSIFIED = 68%				
GROUP 0	8					
GROUP 1	5					

TABLE XX

DISCRIMINANT ANALYSIS OF SECOND FOLLOW-UP RESULTS ON THE TEACHERS' CONNERS HYPERACTIVITY INDEX (TCHI)

N=32

P OF F TO ENTER = .1

GROUP 0 > $\bar{X}$ TCHI4GROUP 1 < $\bar{X}$ TCHI4

DISCRIMINATOR	WILKS' λ p < (X)	DISCRIMINANT FUNCTION			
IQ	.86 (.032)	EIGENVALUE = .169 CANONICAL R = .910 WILKS' λ (FUNCTION) = .86 χ^2 = 4.59 D.F. = 1 P < .032			
GROUP Xs	IQ	CLASSIFICATION RESULTS			
GROUP 0	111.9	ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP	
GROUP 1	125	0	18	0	1
TOTAL	118	1	14	12 (67%)	6 (33%)
GROUP Ns		CORRECTLY CLASSIFIED = 69%			
GROUP 0	18				
GROUP 1	14				

TABLE XXI

DISCRIMINANT ANALYSIS OF POST-TEST RESULTS ON THE TEACHERS' PETERSON-QUAY CONDUCT PROBLEMS (TPQCP)

N=73

P OF F TO ENTER = .1

GROUP 0 > X TPQCP2

GROUP 1 < X TPQCP2

DISCRIMINATOR	WILKS' λ p < (X)	DISCRIMINANT FUNCTION				
TCHI1	.879 (.002)	EIGENVALUE	= .323			
PTPL	.833 (.001)	CANONICAL R	= .49			
MLW1	.788 (.001)	WILKS' λ (FUNCTION)	= .76			
MAIS	.755 (.001)	χ^2	= 19.1			
		D.F.	= 4			
		p	< .001			
GROUP Xs	PTPL	TCHI1	MLW1	MAIS	CLASSIFICATION RESULTS	
GROUP 0	.41	2.05	96.7	111	ACTUAL GRP	N
GROUP 1	.28	1.81	107.5	107	0	0
TOTAL	.29	1.92	102	109	1	1
					32	20 (63%)
					40	10 (25%)
					% CORRECTLY CLASSIFIED = 69%	
GROUP Ns	PTPL(N)	TOTAL N				
GROUP 0	13	32				
GROUP 1	8	40				

TABLE XXII

DISCRIMINANT ANALYSIS OF FIRST FOLLOW-UP RESULTS ON THE TEACHERS' PERSONAL-QUALITY CONDUCT PROBLEMS (TPQCP)

N=52

P OF F TO ENTER = .1

GROUP 0 > X TPQCP3

GROUP 1 < X TPQCP3

DISCRIMINATOR	WILKS' λ p (X)	DISCRIMINANT FUNCTION
NO VARIABLES QUALIFIED FOR ANALYSIS		

TABLE XXIII

DISCRIMINANT ANALYSIS OF SECOND FOLLOW-UP RESULTS ON THE TEACHERS' PETERSON-QUAY CONDUCT PROBLEMS (TPQP)

N=32

P OF F TO ENTER = .1

GROUP 0 > X TPQP4

GROUP 1 < X TPQP4

DISCRIMINATOR	WILKS' λ	$p < (X)$	DISCRIMINANT FUNCTION			
TCHI1	.89	(.067)	EIGENVALUE	= .12	1	"
			CANONICAL R	= .33		
			WILKS' λ (FUNCTION)	= .89		
			χ^2	= 3.35		
			D.F.	= 1		
			p	< .0670		
GROUP Xs	TCHI1	CLASSIFICATION RESULTS				
		ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP		
GROUP 0	1.99			0		1
GROUP 1	1.75	0	18	10 (56%)	8 (44%)	
TOTAL	1.89	1	14	5 (36%)	9 (64%)	
GROUP NS		% CORRECTLY CLASSIFIED = 59%				
GROUP 0	18					
GROUP 1	14					

TABLE XXIV

DISCRIMINANT ANALYSIS OF POST-TEST RESULTS ON THE MEAN REACTION TIME (XRT) TASK

N=73

P OF F TO ENTER = .1

GROUP 0 > X XRT2

GROUP 1 < X XRT2

DISCRIMINATOR	WILKS' λ	$p < (X)$	DISCRIMINANT FUNCTION			
AGE	.557	(.001)	EIGENVALUE	= .970		
PTPL	.529	(.001)	CANONICAL R	= .70		
TIMPR1	.507	(.001)	WILKS' λ (FUNCTION)	= .51		
			X^2	= 45.7		
			D.F.	= 3		
			P	< .001		
GROUP Xs	PTPL	TIMPR1	AGE	CLASSIFICATION RESULTS		
				ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP
GROUP 0	.37	31	75	0		1
GROUP 1	.19	12	100	0	30	23 (78%)
TOTAL	.27			1	41	5 (12%)
GROUP HS				% CORRECTLY CLASSIFIED = 83%		
GROUP 0	11			(2 UNGROUPED CASES)		
GROUP 1	8					

TABLE XXV

DISCRIMINANT ANALYSIS OF FIRST FOLLOW-UP RESULTS ON THE MEAN REACTION TIME (XRT) TASK

N=52

P OF F TO ENTER = .1

GROUP 0 > X XRT3

GROUP 1 < X XRT3

DISCRIMINATOR	WILKS' λ	p < (X)	DISCRIMINANT FUNCTION			
AGE	.62	(.001)	EIGENVALUE	=	.70	
FPI	.58	(.001)	CANONICAL R	=	.64	
			WILKS' λ (FUNCTION)	=	.58	
			χ^2	=	25.9	
			D.F.	=	2	
			p	<	.001	
GROUP Xs	AGE	FPI	CLASSIFICATION RESULTS			
			ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP	
GROUP 0	77	530	0	0	1	
GROUP 1	99	552	0	21	16 (76%)	5 (24%)
TOTAL	90	543	1	31	6 (19%)	25 (81%)
GROUP Ns			% CORRECTLY CLASSIFIED = 79%			
GROUP 0	21					
GROUP 1	31					

TABLE XXVI
DISCRIMINANT ANALYSIS OF SECOND FOLLOW-UP RESULTS ON THE MEAN REACTION TIME (XRT) TASK

DISCRIMINATOR	WILKS' λ p < (X)	DISCRIMINANT FUNCTION			
		EIGENVALUE	CANONICAL R	WILKS' λ (FUNCTION)	χ^2
AGE	.74 (.004)	.89	.69	.53	17.9
TCHI1	.53 (.001)				2
					p < .001
GROUP XS	AGE	TCHI1	CLASSIFICATION RESULTS		
			ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP
GROUP 0	79.6	1.73	0	16	0
GROUP 1	94.3	2.03	1	15	14 (88%)
TOTAL	86.7	1.87			4 (27%)
GROUP HS					11 (73%)
GROUP 0	16				2 (12%)
GROUP 1	15				11 (73%)
					% CORRECTLY CLASSIFIED = 81%

N=31
 P OF F TO ENTER = .1
 GROUP 0 < X XRT4
 GROUP 1 < X XRT4

TABLE XXVII

DISCRIMINANT ANALYSIS OF POST-TEST RESULTS FOR CHILDREN'S TOTAL IMPULSIVE RESPONSES (TIMPR)

N=73
 P OF F TO ENTER = .1
 GROUP 0 > X TIMPR2
 GROUP 1 < X TIMPR2

DISCRIMINATOR	WILKS' λ p < (X)		DISCRIMINANT FUNCTION			
XRT1	.85	(.001)	EIGENVALUE	= .254		
FVAIS	.80	(.001)	CANONICAL R	= .45		
			WILKS' λ (FUNCTION)	= .79		
			χ^2	= 15.6		
			D.F.	= 2		
			p	< .001		
GROUP Xs	XRT1	FVAIS	CLASSIFICATION RESULTS			MEMBERSHIP
			ACTUAL GRP	N	PREDICTED GRP	
GROUP 0	.999	102.6	0	18	12 (67%)	6 (33%)
GROUP 1	.771	111.2	1	54	14 (25%)	40 (75%)
TOTAL						
GROUP Ns					% CORRECTLY CLASSIFIED _c = 72%	
GROUP 0	18		(1 UNGROUPED CASE)			
GROUP 1	54					

TABLE XXVIII

DISCRIMINANT ANALYSIS OF FIRST FOLLOW-UP RESULTS FOR CHILDRENS' TOTAL IMPULSIVE RESPONSES (TIMPR)

N=53
 P OF F TO ENTER = .1
 GROUP 0 > X TIMPR3
 GROUP 1 < X TIMPR3

DISCRIMINATOR	WILKS' λ	p < (X)	DISCRIMINANT FUNCTION			
XRT1	.91	(.02)	EIGENVALUE	= .19		
PTPL	.84	(.01)	CANONICAL R	= .40		
			WILKS' λ (FUNCTION)	= .84		
			χ^2	= 8.68		
			D.F.	= 2		
			p	< .013		
GROUP Xs	XRT1	PTPL	CLASSIFICATION RESULTS			
			ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP	
GROUP 0	.97	.50	0	8	0	1
GROUP 1	.77	.20	0	8	6 (75%)	2 (25%)
TOTAL	.80	.24	1	45	10 (22%)	35 (78%)
GROUP Ns			% CORRECTLY CLASSIFIED = 77%			
GROUP 0	8	4				
GROUP 1	45	9				

TABLE XXIX

DISCRIMINANT ANALYSIS OF SECOND FOLLOW-UP RESULTS FOR CHILDRENS' TOTAL IMPULSIVE RESPONSES (TIMPR)

N=31

P OF F TO ENTER = .1

GROUP 0 $\bar{X}$ TIMPR4GROUP 1 $\bar{X}$ TIMPR4

DISCRIMINATOR	WILKS' λ p < (X)	DISCRIMINANT FUNCTION				
GMVG1	.88 (.056)	EIGENVALUE	= .136			
		CANONICAL R	= .35			
		WILKS' λ (FUNCTION)	= .88			
		χ^2	= 3.64			
		D.F.	= 1			
		p	< .056			
GROUP Xs	GMVG1	CLASSIFICATION RESULTS				
		ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP		
GROUP 0	2.03			0	1	
GROUP 1	2.94	0	12	7 (58%)	5 (42%)	
TOTAL	2.59	1	19	8 (42%)	11 (58%)	
GROUP Ns		% CORRECTLY CLASSIFIED = 58%				
GROUP 0	12					
GROUP 1	19					

TABLE XXX

DISCRIMINANT ANALYSIS OF POST-TEST RESULTS FOR THE
GATES-MACGINNIE GRADE ACHIEVEMENT: VOCABULARY (GNVG)

N=73

P OF F TO ENTER = .1

GROUP 0 $\geq$ X GNVG2GROUP 1 $<$ X GNVG2

DISCRIMINATOR	WILKS' λ p < (X)					DISCRIMINANT FUNCTION	
AGE	.558	(.001)				EIGENVALUE	= 1.41
XRT1	.496	(.001)				CANONICAL R	= .77
IQ	.463	(.001)				WILKS' λ (FUNCTION)	= .415
TPQCP1	.440	(.001)				χ^2	= 57.6
MPI	.415	(.001)				D.F.	= 5
						p	< .001
GROUP Xs	AGE	XRT1	IQ	TPQCP1	MPI	CLASSIFICATION RESULTS	
						ACTUAL GRP	N
GROUP 0	104	.66	115	9.7	529		
GROUP 1	79	.99	110	9.2	550		
TOTAL	90	.84	113	9.5	540		
GROUP Ns							
GROUP 0			33				
GROUP 1			37				
						% CORRECTLY CLASSIFIED = 86%	
						(3 UNGROUPED CASES)	
						ACTUAL GRP	PREDICTED GRP MEMBERSHIP
						0	0
						1	31 (94%)
							2 (6%)
							31 (84%)

TABLE XXXI

DISCRIMINANT ANALYSIS OF FIRST FOLLOW-UP RESULTS ON THE
GATES-MAGGINITIE GRADE ACHIEVEMENT: VOCABULARY (GNVG)

N=51

P OF F TO ENTER = .1

GROUP 0 > X GNVG3

GROUP 1 < X GNVG3

DISCRIMINATOR	WILKS' λ p < (X)			DISCRIMINANT FUNCTION			
XRT1	.61	(.001)		EIGENVALUE	= 1.18		
AGE	.54	(.001)		CANONICAL R	= .74		
IQ	.46	(.001)		WILKS' λ (FUNCTION)	= .46		
				χ^2	= 37.1		
				D.F.	= 3		
				p	< .001		
CLASSIFICATION RESULTS				CLASSIFICATION RESULTS			
GROUP Xs	XRT1	AGE	IQ	ACTUAL GRP	N	PREDICTED GRP MEMBERSHIP	
GROUP 0	.65	101	118	0	26	23 (89%)	3 (11%)
GROUP 1	.96	86	112	1	25	3 (12%)	22 (88%)
TOTAL	.80	92	115				
GROUP Hs						* CORRECTLY CLASSIFIED = 88%	
GROUP 0		26					
GROUP 1		25					

TABLE XXXII

DISCRIMINANT ANALYSIS OF SECOND FOLLOW-UP RESULTS ON THE
GATES-MACGINNIE GRADE ACHIEVEMENT: VOCABULARY (GVVG)

N=28
P OF F TO ENTER = .1
GROUP 0 > X GVVG4
GROUP 1 < X GVVG4

DISCRIMINATOR	WILKS' λ p < (X)				DISCRIMINANT FUNCTION			
AGE	.64	(.001)			EIGENVALUE	= 2.34		
IQ	.48	(.001)			CANONICAL R	= .84		
TPQCP1	.30	(.001)			WILKS' λ (FUNCTION)	= .29		
PTRIT	.30	(.001)			χ^2	= 28.9		
					D.F.	= 4		
					p	< .001		
GROUP Xs	AGE	IQ	TPQCP1	PTRIT	CLASSIFICATION RESULTS			
GROUP 0	96.6	124	9.4	.36	ACTUAL GRP	N	PREDICTED GRP	MEMBERSHIP
GROUP 1	80.8	115	8.7	.29	0.	14	14 (100%)	0 (0%)
TOTAL	88.7	119	9.0	.32	1	14	3 (21%)	11 (79%)
GROUP Ns					% CORRECTLY CLASSIFIED = 89%			
GROUP 0		14		5				
GROUP 1		14		4				