A REVIEW OF PSYCHOPHARMACOLOGICAL AND BEHAVIORAL APPROACHES TO THE TREATMENT OF HYPERACTIVE CHILDREN

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Hyperactivity, a common behavior problem of childhood, has been estimated to affect five to ten percent of school-age children and up to 40% of children referred to mental health clinics. Impulse control and attentional deficits have been identified as most central to the syndrome; they lead to secondary difficulties in social adjustment and academic achievement, which may persist through adolescence and into adulthood. Stimulant medication has emerged as the treatment of choice for hyperactive children, and a large body of research documents the positive short-term effects of stimulants on laboratory and rating scale measures of impulse control, attention span, and behavior problems.

In spite of these convincing short-term effects, several potential limitations of medication have recently been stressed. Long-term follow-up studies of children treated almost exclusively with methylphenidate have revealed that they have not developed in a significantly different fashion from nontreated hyperactives, and there is little evidence of increased academic achievement with medication. Finally, some children fail to respond favorably to medication and some parents and physicians question pharmacological treatment on ethical or medical grounds.

Behavior therapy has been advocated as an adjunct or alternate to stimulant medication in the treatment of hyperactive children. It has also been demonstrated that parents and teachers can be taught behavioral techniques and may thus carry out much of the required intervention. Furthermore, it has been noted that such therapeutic approaches might enhance the development of self-control in these children.

There has been considerable debate about the relative merits of treating hyperactive children with medication, behavior therapy, or possibly with some combination of the two. However, these debates have been based, more often...
than not, on moral issues rather than data. This paper will briefly review a number of recent studies that have directly investigated the relative effectiveness of behavior therapy and stimulant medication.

**SYSTEMATIC CASE STUDIES**

A number of systematic case studies have described changes in a hyperactive child's behavior across medication and behavior therapy conditions, without introduction of experimental control procedures such as contingency reversals or multiple baseline techniques. All cases involved a gradual withdrawal of the child from medication, with concurrent or subsequent behavioral interventions. Essentially, each of the studies found that the child's hyperactivity during behavioral intervention was controlled as well as it had been during administration of stimulants, according to observational data or parent and teacher ratings. However, the nonexperimental nature of these case studies makes it impossible to conclude that behavior management and stimulant medication are equivalent in their effects.

The most frequent methodological flaw was a lack of on-and-off drug baseline assessments, before initiation of behavior therapy. Without such measures, it is not known whether a child was a medication "responder" or whether an appropriate dosage of medication was being utilized. The fact that most subjects in these studies were solicited volunteers for whom alternate forms of treatment were being sought increases the probability of this. One paper also found a high attrition rate with behavioral interventions, which was attributed, to resistance to treatment approaches that involve considerable parental effort. This may be a potential limitation of widespread behavior therapy programs with hyperactive children.

**SINGLESUBJECT EXPERIMENTS**

There are several single-subject experiments, in which control procedures allow more confidence in the finding that treatment manipulations are producing behavior change. Three such studies have compared the effectiveness of methylphenidate and reinforcement contingencies within a single subject. Again, these reports indicate that both treatment approaches may be successful in modifying hyperactivity, although their effects may vary depending upon which behavior is monitored, as well as the situational context of the behavior. For example, Ayllon et al. demonstrated that methylphenidate and behavior therapy were equally effective in reducing disruptive classroom behavior, but behavior therapy alone was associated with increased academic accuracy and productivity. In another study, medication was associated with a reduction in "ritualistic behavior" in the clinic, and with an increase in the same behavior at home, while decreased aggressive behavior evident in the clinic due to behavioral intervention did not generalize to the home.

Conclusions drawn from these single-subject experiments must be tempered by several considerations. In only one study was any attempt made to titrate the dosage of methylphenidate for optimal effectiveness, a common clinical practice due to individual differences in drug response. Follow-up measures were uniformly lacking in these studies,
so that no estimate of the persistence of the treatment effects is possible. Some children exhibited deviant behavioral symptoms not usually associated with hyperactivity; thus, generalization of these findings to less disturbed children would be difficult. Possibly the most serious criticism is that the behavioral treatment situations were largely unrealistic. For example, the adult-child ratios in the studies vary from one-to-one to one-to-three. This may limit adoption of the demonstrated techniques in most school settings.

GROUP OUTCOME STUDIES

The most methodologically sound comparisons of behavior therapy and stimulant medication have been group-outcome studies. To date, four studies have assessed the treatment outcomes of behaviorally and pharmacologically treated hyperactives. The data again indicate that both therapeutic approaches are effective; however, determining the relative effectiveness of the two treatments remains somewhat problematic.

In what is certainly the most comprehensive study to date, Gittelman-Klein and her colleagues found a consistent pattern across all dependent measures favoring a combination of behavior therapy and methylphenidate as the most effective treatment for reducing disruptive and inattentive classroom behavior, followed by methylphenidate alone, with behavior therapy plus placebo being the least effective. The differences between methylphenidate plus behavioral intervention and methylphenidate alone were, with one exception, not statistically significant. However, behavior therapy plus placebo was significantly less effective than the other treatments on several factors of the teacher's rating scale, as well as objective classroom observations, even though there was significant improvement from baseline on these measures.

Similarly, Loney et al. found that behaviorally-treated hyperactives, although improved with intervention, remained less attentive to academic tasks than average children in the same classroom, while those treated with methylphenidate were indistinguishable from their peers in this respect. The results of another study highlight once again the influence of the situational context and behavior specificity of the effects of intervention. Wolraich et al. found that while methylphenidate was more effective than a classroom token economy in reducing off-task and disruptive behavior during individual seat work, behavior modification was superior to medication when behavior was assessed during a group work situation. Moreover, only behavior therapy resulted in increased academic accuracy, a finding consistent with that of Ayllon et al.

These group-outcome studies may be commended for the careful subject selection, including only those children meeting quite stringent criteria for diagnosis of hyperactivity. Nevertheless, many of the same criticisms mentioned with respect to the single-case studies still apply: only two studies involved behavioral intervention in regular school classrooms and used individually titrated dosages, while only one investigation included a measure of academic performance in the assessment of treatment effectiveness. More consideration is required in the selection of appropriate dependent measures. Although instances of disruptive behavior and inattentiveness may de-
crease with other behavioral or pharmacological treatment, it must not be assumed that improvements in academic performance or quality of social interactions will necessarily follow. These "secondary" symptoms of hyperactivity appear to remain with most hyperactive children as they mature. There is also a paucity of data concerning generalization and follow-up in the literature. This is particularly necessary for the study of behavioral intervention, since there is no store of knowledge to fall back on as there is with stimulant drug research.

CONCLUSIONS

It is quite evident that behavior therapy is a far more expensive treatment than medication, requiring more time and effort on the part of the clinician, teacher, and parent. Just as medication is not effective with all hyperactive children, and is not acceptable to all parents, it is to be expected that it will be difficult to institute and maintain behavior therapy with some children due to a lack of cooperation and interest by their teachers and parents. Research addressing the psychological and situational characteristics that predict success with various behavioral and pharmacological interventions would be valuable in this respect.

The literature suggests that stimulant medication is more effective than behavior therapy in improving classroom and social behaviors, as well as attentional processes in hyperactive children, at least on a short-term basis. When the goal of treatment is improved academic performance, behavior therapy has been demonstrated in several studies to be superior to stimulant medication, at least in special research class-rooms. However, data concerning generalization and long-term benefits are lacking. It is quite probable that behavior therapy and medication influence different aspects of a hyperactive child's behavior. Perhaps the best conclusion is that we are expecting too much from any one drug and from any single treatment modality in dealing with hyperactive children. More realistically, effective treatment programs require some combination of various therapeutic techniques, such as medication, behavior therapy, family counseling, and educational intervention.

REFERENCES


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Hyperactivity is a common behavioural encephalographic sign which would substantiate a diagnosis of brain damage (11). The possibility that they suffer some sort of biochemical deficit, passed on genetically, has been suggested (5, 10), and a critical deficit of norepinephrine is postulated. Hyperactive children also show major Waldrop and her associates (11-13) have lent further credence to a physiological explanation for hyperactivity by showing that these children have more physical anomalies than normal children. In fact, in a recently published paper (8) significant correlation between dopamine-beta-hydroxylase (the final enzyme in the biosynthesis of norepinephrine) and physical anomalies was demonstrated. The present study is basically a replication of Waldrop and Goering's work (12), but there are some differences between the two studies. Waldrop and Goering chose their hyperactive subjects by asking teachers to select three children in the class "who seemed to be constantly on the move". The control group was made up of three children whom the teacher felt were "in the normal range of behaviour, being neither hyperactive nor lethargic". It is apparent then that the hyperactive and control subjects were not carefully matched groups, and attempts were made to ensure equivalence between groups by matching hyperactive and control children.

These authors also reported that there was a significant positive correlation between the number of anomalies and the
degree of hyperactivity, and this was based on the school principal’s rank ordering of the severity of hyperactivity and the number of anomalies evident in the subjects. In the present study attributes of hyperactive children were ranked more objectively, based on a well-validated rating scale for hyperactivity (2, 3).

Method

Subjects

Forty-eight male elementary school children, twenty-four hyperactives and twenty-four controls, all from the Chomedey School Board in Montreal took part. The two groups were matched for age and Peabody Picture Vocabulary Test IQ — all had to have an IQ of 80 or above.

Prior to the study teachers and principals were given a brief verbal description of the symptoms characteristic of hyperactive children which focused mainly on three traits — overactivity, short attention span and impulsivity. The teachers were then asked to fill out Conners’ behaviour rating scale (2). Those children whose average score on the Hyperactivity factor of the scale was 1.5 or greater were considered candidates for the hyperactive sample. A further selection was based on a parental report (by telephone) of the child’s behaviour at home. For the child to be included his hyperactivity had to be chronic and present since early childhood. Excluded from the sample were those who showed definite signs of brain damage, epilepsy or psychosis. None were taking psychotropic medication and all were living at home with at least one parent.

Each teacher of a hyperactive child was asked to go to the class register and choose the next male child on the list who was of approximately the same age and intelligence as the experimental subject. Children with a history of brain damage, epilepsy, psychosis or severe behaviour problems were not acceptable. Subsequently, the teacher was required to fill out Conners’ behaviour rating scale on the control child. None of the control children were taking psychotropic medication and all were living at home with at least one parent.

Rating Scales and Apparatus

Conners has developed a widely used rating scale for teachers, which has a scale of 39 items factor analysed to give five factors: Conduct Problem; Inattentive-Passive; Tension-Anxiety; Hyperactivity; Sociability. The teacher is told to observe the child in question for a few days and then to check the appropriate box for each item. The score for each factor is based on the mean score on items within the factor (a four point scale, 0-3 is used). The scale has been used extensively to assess the effectiveness of psychotropic medication with hyperactive children, and has been shown to be sensitive to drug effects (9).

Procedure

All children were seen individually during regular school hours. To eliminate bias the examiner (F.L.) was not told which children were hyperactive and which were control. The examiner also scored and analysed all data. A second examiner made independent judgements on the existence of anomalies in 10 of the 48 subjects so that a reliability estimate might be obtained.

Physical anomalies were tabulated on the basis of a total anomaly score and a weighted anomaly score — the weighting of a score depends on the degree to which the anomaly deviates from the normal. The method of examination for anomalies and the full scoring procedure is too lengthy to be included in the present report but may be found in Waldrop and Halverson (11).

Results

As indicated in Table I there was not a significant difference between the hyperactive and control group in age or IQ, but hyperactives were scored higher than controls on all factors of Conners’ scale — see Table II.

A Pearson correlation coefficient of .82 (p < .001) was obtained from the two independent judgements as to the occurrence of the anomalies, while the coefficient of the weighted scores was .88 (p < .001).

Waldrop and Goering found a correlation of .86 between the frequency of anomalies and the weighted score, and thus used only the weighted score when analysing their data for this study. The Pearson correlation coefficient between the total score and weighted score in the present study was also high (r = .88, p < .01), and therefore only the weighted score was used in the data analyses. The weighted scores ranged from 0 to 9 with a mean of 4 for the hyperactive sample, while in the control group they ranged from 0—8 with a mean of 2.89. The
difference between the means was significant \((t = 2.19, df = 47, p < .05)\).

The correlation between the Hyperactivity factor and physical anomalies was not significant \((r = .054, p < .05)\).

**Discussion**

These data support previous findings that hyperactive children have more physical anomalies than normal children, but they do not support previous findings suggesting significant correlations between anomalies and the degree of hyperactivity. This discrepancy may be attributed to differences in subject groups. In future it would be beneficial to utilize a well-validated rating scale, such as Conners', in order to compare populations under study.

Nevertheless, the findings do support the hypothesis that there is a physiological component to the hyperactive syndrome which may be either genetically determined or a result of abnormalities in fetal development. Further research might investigate the diagnostic and predictive potential of these anomalies as they relate to various treatment methods.

**Summary**

Hyperactive elementary school boys were matched for age and IQ to a group of normal control children, and the frequency of minor physical anomalies in each group was recorded. Although hyperactives had more of these anomalies than the control children there was not a significant correlation between the degree of hyperactivity and the frequency of anomalies.

**References**

3. Conners, C. K., Taylor, E., Meo, G., Kuntz, M. A., Fournier, M.: Magnesium pemoline and dextroamphetamine: A con-

**TABLE II**

**MEAN FACTOR SCORES OF HYPERACTIVES AND CONTROLS ON CONNERS’ RATING SCALE FOR TEACHERS**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Hyperactives</th>
<th>Controls</th>
<th>T-Values</th>
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<th>2-tail probability</th>
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<td>.14</td>
<td>12.3</td>
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<td>1.48</td>
<td>.43</td>
<td>7.4</td>
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<td>.88</td>
<td>.49</td>
<td>2.8</td>
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<td>2.13</td>
<td>.42</td>
<td>15.9</td>
<td>46</td>
<td>.001</td>
</tr>
<tr>
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<td>.82</td>
<td>.12</td>
<td>4.9</td>
<td>46</td>
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</table>


Résumé
On a fait une comparaison entre des garçons de niveau scolaire élémentaire hyperactifs de même âge que des enfants normaux, et possédant le même "I.Q." La fréquence des anomalies physiques ont été relevées dans les deux cas. Même si les enfants hyperactifs avaient plus d'anomalies que les autres, il n'existe pas de relation entre les différences niveaux d'hyperactivité et la fréquence des anomalies.

_Time to me this truth has taught
(Tis a treasure worth revealing),
More o'fend from want of thought
Than from any want of feeling._

_Want of Thought_

Charles Swain
1801-1874
Sleep Patterns in Hyperkinetic and Normal Children

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Summary: Sleep patterns in nonmedicated hyperkinetic (n = 11) and normal control (n = 11) male children (8–12 years old) were compared to document possible sleep disturbance in hyperkinetic children. Electroencephalographic, electro-oculographic, electromyographic, and autonomic measures were monitored continuously for five consecutive nights. Analysis of sleep pattern variables revealed a significantly longer rapid eye movement onset latency (p < 0.05) and marginally significant greater absolute and relative amounts of movement time (p < 0.07) for the hyperkinetic group relative to controls. No other sleep parameters differentiated the groups. It was concluded that baseline tonic sleep parameters do not indicate marked sleep disturbance in hyperkinesis. The results were discussed within the context of hypothesized arousal dysfunction underlying this disorder. Key Words: Hyperkinetic children—Hyperkinesis—NREM and REM sleep cycles—Spontaneous skin potential responses.

Of all childhood psychiatric disorders, hyperkinesis (HK) probably has generated the greatest amount of research and controversy in recent years. Prevalence estimates for this disorder have ranged from 1 to 20 percent for all school-age children (Stewart et al., 1966; Wender, 1971; Lambert et al., 1978), and it is one of the most common primary presenting symptoms of children referred for psychological difficulties (Patterson et al., 1965). Definition and diagnosis of HK have relied on a constellation of symptoms extending along a number of behavioral, perceptual-cognitive, and social dimensions. The core symptomatology includes excessive and often inappropriate activity, short attention span, distractibility, impulsivity, excitability, and poor scholastic performance despite scores within the normal range on various intelligence measures. In addition, several secondary signs such as aggressiveness, low frustration tolerance, and poor self-esteem are often present (Clements, 1966; Minde et al., 1972; Whalen and Henker, 1976).

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Reports of a relatively high incidence of "soft" neurological signs and borderline abnormalities in electroencephalographic (EEG) activity (Clements and Peters, 1962) have suggested a relationship of HK to brain damage, but recent critical evaluation of this research indicates that only a small subgroup of HK children show overt neurological abnormality (Dubey, 1976). However, although a specific etiology has yet to be found, a biological deficit is still considered to underlie this disorder.

The search for postulated differences in electrophysiological processes specific to HK has been directed toward the more global concept of arousal, and in this regard quite opposite explanations for this syndrome have been advanced. On the one hand, HK has been viewed as a reaction to excessive sensory stimulation (Strauss and Lehtinen, 1947). In this regard it has been argued that HK children may be unable to properly filter and organize stimulus input such that "stimulus overload" occurs, resulting in behavioral overactivity. The underlying physiological basis for this notion is thought to be over- or hyperarousal of various brainstem and subcortical structures (Laufer et al., 1957).

An alternative explanation has been offered (Zentall, 1975, 1977) in which increased motoric activity is viewed as stimulus-seeking behavior emanating from central nervous system hypoarousal. This view is based on the premise that homeostatic mechanisms function to maintain a level of stimulation within some optimal range (Hebb, 1955; Leuba, 1955; Berlyne, 1960).

Evaluation of physiological indices during wakefulness has not produced clear-cut conclusions regarding the state of arousal in HK children, although a recent investigation of variations in spinal reflex amplitude during wakefulness and sleep indicates reduced excitability during wakefulness (Mercier et al., 1980; Pivik and Mercier, 1981). Many of the inconsistent and conflicting results may be due to differences in experimental procedures and methodologies, including variations in number and symptomatology of subjects, and types and dosage levels of medication (cf. Hastings and Barkley, 1978; Rosenthal and Allen, 1978; Ferguson and Pappas, 1979). The electrophysiological data gathered during wakefulness, although not strongly supportive of either hyperarousal or hypoarousal, do continue to implicate a disorder in arousal-producing mechanisms as fundamental to the HK syndrome. The intimate relationship between sleep and arousal mechanisms suggests that studies of sleep patterns and events in HK children might provide information pertinent to the postulated dysfunction of arousal mechanisms under conditions free from waking-confounding variables such as stress, expectations, and undefined variations in level of arousal. Furthermore, sleep studies might reveal HK syndrome-related events and relationships obscured by, or not present during, wakefulness.

Sleep laboratory investigations of HK consist of seven studies which have reported on sleep patterns in a total of 39 HK children (Luisada, 1969; Small et al., 1971; Feinberg et al., 1974; Haig et al., 1974; Nahas and Krynicki, 1977; Khan and Rechtschaffen, 1978; Stahl et al., 1979). With one exception all studies agree that: (a) baseline sleep is not remarkably different in HK children relative to normal controls; and (b) stimulant medication administered to HK children does
not significantly alter their sleep patterns. In the one dissenting study, Luisada (1969) reported less rapid eye movement (REM) sleep and more REM sleep disruptions during baseline recordings. Across studies, symptomatology and subject selection procedures have varied. Diagnoses, for example, have ranged from those based solely on the presence of excessive restlessness to more complex symptom clustering, some of which may have had a strong organic foundation. In experiments in which stimulant medication was administered, varying types and dosage levels of drugs were employed making inter-study comparisons difficult. Differing design paradigms (e.g., number of nights recorded, medication/nonmedication, etc.) have further confounded cross-study comparability.

The purpose of the present study was to provide additional comparative information regarding sleep morphology in a relatively large sample of nonmedicated HK and normal children over a substantial baseline recording period. A homogeneous HK sample was selected with excessive motor restlessness not being the primary presenting symptom, in order that the more "typical" HK child would be studied.

METHODS

Subjects

Eleven nonmedicated HK male children (8—12 years old; X = 10.6, SD = 1.7) and 11 similarly aged nonmedicated male control (C) children (X = 10.6, SD = 1.3) participated in the study. Diagnosis of HK was based on positive indications (>15 on hyperactivity index) on Conners Parent (1970; X = 19.5, SD = 6.9) and Conners Teacher (1969; X = 19.1, SD = 5.5) behavioral rating scales, as well as the persistent or recurrent presence of the following core symptomatology (DSMIII criteria of attention-deficit disorder with hyperactivity): motor restlessness, short attention span, distractibility, impulsiveness, labile emotions, and poor academic performance (Stewart et al., 1966; Renshaw, 1974; Wender, 1972; Goyette et al., 1978). All HK subjects displayed this behavioral symptomatology prior to the age of three.

The control group of normal children was recruited from local school systems. All of these children scored negatively on the Conners Parent (X = 4.6, SD = 2.1) and Conners Teacher (X = 3.0, SD = 2.8) behavioral rating scales.

All children in the study were living at home with at least one parent. Children with the following symptoms or classifications were excluded from the study: major psychosis, over-anxious reaction, unsocialized aggressive reaction, peripheral sensory loss, epilepsy, normal constitutional hyperactivity, mental retardation, post-traumatic organic brain syndrome, encephalitis, toxic organic brain syndrome (drug), or major sleep disturbances (e.g., enuresis, somnambulism, pavor nocturnus).

Prior to acceptance into the study, each child underwent an I.Q. evaluation (WISC-R, lower limit of 80) and a baseline EEG recording. This EEG recording session served to screen for the presence of gross EEG abnormalities and to familiarize each child with the recording environment, procedures, and apparatus.
A full explanation of the study was given to parents and children and informed consent was obtained (parent's or legal guardian's signature).

**Polysomnographic Recordings**

Subjects reported to the sleep laboratory 1 hr before bedtime for electrode application. EEG (C3/A2), electro-oculographic (EOG; bipolar DC recordings of horizontal and vertical eye movements), and electromyographic (facial muscle) activity were recorded using a Grass (Model 78D) polygraph. Spontaneous skin potential responses (SSPR; volar surface of the left middle finger referenced to the forearm) were also recorded. All night sleep recordings were made for five consecutive nights. Total bed time was limited to 9.25 hr, with "lights out" occurring at approximately 9:30–10:00 each night. It was communicated to both children and their parents that napping should not occur during the course of the study.

**Data Analysis**

Sleep records were coded and scored blind by two individuals using standardized criteria (Rechtschaffen and Kales, 1968). High interrater agreement (%90%), established on pilot data prior to actual data scoring, was periodically checked and found to be consistent throughout data analysis. The first two recording nights were considered laboratory adaptation nights and separate group comparison analyses were made with data from these nights included and excluded.

The method of Feinberg and Floyd (1979) was used to compute non-REM (NREM) and REM cycle lengths within nights. Specifically, NREM cycles were measured as the duration of total sleep time (TST; time awake subtracted) from initial stage 2 onset in the first cycle to stage 2 onset in the second cycle, from the onset of stage 2 in the second cycle to stage 2 onset in the third cycle, etc. REM cycle length was measured as the duration of total sleep recorded (time awake subtracted) from the first REM period (REMP) onset to the onset of the second REMP, from the second REMP onset to the third, etc. These cycle durations were also measured with waking time included (real time).

Movement time during sleep was scored using the criteria of Rechtschaffen and Kales (1968), i.e., epochs in which EEG and EOG activity channels were obscured by muscle tension and/or amplifier blocking artifacts produced by subject movement lasting for more than half the epoch.

SSPRs were scored according to the method of Johnson and Lubin (1966); i.e., 1 mm pen deflection = 100µV potential change, with amplifier input impedance = one megohm. SSPR data from the first cycle of sleep on nights 1, 4, and 5 were pooled and within-group response rates/min determined for stages 2, 4, and REM. These rates were based separately on the total amount of scorable activity divided by the number of min of a particular stage, and the frequency of SSPR activity during 15 min samples (one sample/stage/subject) of stages 2 and 4. For the latter analysis, equivalent samples from REM sleep could not be obtained because initial REMPs were often less than 15 min in duration.
Latistical comparisons between groups and across nights for the measures were made using separate repeated measures analysis of var. program P2V, with orthogonal component analysis to test for trends), when appropriate, post hoc Newman-Keuls tests. The 0.05 level of s was used for all statistical comparisons.

RESULTS

Sleep Stages

Between-group analyses revealed no significant differences for absolute or percentage amounts of sleep stages on nights 3 through 5, and inclus nights 1 and 2 did not alter these results (see Table 1 for summary data). How both groups exhibited variations in sleep parameters across nights which indicative of adaptation to. the recording environment. For example, across ni 1 through 5 there were significant linear increases in TST (p < 0.01), sleep ciency index (p < 0.001), REM percentage (p < 0.01), and number of REMP < 0.01), and significant linear decreases in min and percentage of total wa time (p < 0.005), min and percentage of waking after sleep onset (p < 0.005 and NREM percentage (p < 0.005). Post hoc mean comparisons for variable showing a main effect for night are presented in Table 2. These results pro vide evidence for differentiating night 1 from subsequent recording nights, indicating the presence of a "first-night effect" (Agnew et al., 1966).

Since the duration of the first NREM sleep cycle differentia ted between groups (HK group REM onset latency > C group; p < 0.05), a more thorough analysis of the stage constitution was carried out (percentage amounts of stages 2, 4, and 3 + 4 [slow wave]), as well as stage progression (cumulative min) within this cycle. Based on data from all nights, the HK group had significantly more stage 2 (HK: 49.8%, C: 42.9%, p < 0.03), whereas the C group showed significantly greater amounts of stage 4 (HK: 32.0%, C: 40.8%, p < 0.04) and slow wave sleep (HK: 44.3%, C: 52.7%, p < 0.01) in the first cycle of sleep. When nights 1 and 2 were excluded from the analysis, these group differences became marginally significant (stage 2—p < 0.09; stage 4—p < 0.09; slow wave— p < 0.07), but the relationships remained the same. Figure 1 shows the cumulative amounts (min) of stages 2, 4, and slow wave sleep across the first four hours of sleep—the length of time necessary to include the initial cycle of sleep for all subjects.

Cycles

No significant group or night (3–5) differences were found for average REM or NREM. cycle lengths with waking included (real time) or excluded. With the addition of nights 1 and 2 to the analyses, REM cycle length (waking time subtracted) showed a main effect for night (F(4,80) = 2.82; p < 0.05) with a significant decreasing linear trend across nights (p < 0.03). Post hoc tests revealed a shorter REM cycle duration on night 1 relative to night 5 (p < 0.05). Summary results of the cycle analyses are presented in Table 3.
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<tr>
<th>Variable</th>
<th>Group</th>
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<td></td>
<td>2</td>
<td>3</td>
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<tr>
<td>TBT</td>
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<td></td>
<td>C</td>
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<td>WASO</td>
<td>HK</td>
<td>12.36 (3.11)</td>
<td>7.52 (2.36)</td>
<td>7.43</td>
<td>6.11 (1.94)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>20.29 (6.58)</td>
<td>13.00 (3.36)</td>
<td>10.85</td>
<td>1.96 (0.46)</td>
</tr>
<tr>
<td>SI</td>
<td>HK</td>
<td>33.71 (3.62)</td>
<td>35.16 (4.94)</td>
<td>29.62</td>
<td>34.07 (5.24)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>43.55 (7.01)</td>
<td>32.14 (5.52)</td>
<td>37.90</td>
<td>32.08 (5.20)</td>
</tr>
<tr>
<td>S2</td>
<td>HK</td>
<td>311.47 (14.02)</td>
<td>297.82 (10.67)</td>
<td>309.48 (12.73)</td>
<td>313.59 (8.39)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>276.11 (13.15)</td>
<td>286.46 (9.65)</td>
<td>289.96 (13.35)</td>
<td>305.06 (7.33)</td>
</tr>
<tr>
<td>S3</td>
<td>HK</td>
<td>30.48 (3.07)</td>
<td>28.47 (2.58)</td>
<td>30.62</td>
<td>35.73 (3.40)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>32.66 (2.94)</td>
<td>26.68 (4.68)</td>
<td>33.20 (4.85)</td>
<td>25.73 (4.66)</td>
</tr>
<tr>
<td>S4</td>
<td>HK</td>
<td>52.03 (7.80)</td>
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<td>50.98</td>
<td>50.80 (7.83)</td>
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<tr>
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<td>C</td>
<td>61.47 (10.14)</td>
<td>63.48 (8.05)</td>
<td>56.43 (6.31)</td>
<td>64.41 (9.82)</td>
</tr>
<tr>
<td>NREM</td>
<td>HK</td>
<td>427.70 (11.24)</td>
<td>416.98 (6.63)</td>
<td>420.71 (14.68)</td>
<td>434.20 (3.57)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>413.77 (13.58)</td>
<td>408.85 (8.88)</td>
<td>417.46 (11.68)</td>
<td>427.27 (7.60)</td>
</tr>
<tr>
<td>SW</td>
<td>HK</td>
<td>82.52 (6.67)</td>
<td>84.02 (4.63)</td>
<td>81.61</td>
<td>86.53 (5.69)</td>
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<tr>
<td></td>
<td>C</td>
<td>94.12 (10.41)</td>
<td>90.16 (6.95)</td>
<td>89.62</td>
<td>90.15 (8.70)</td>
</tr>
<tr>
<td>REM</td>
<td>HK</td>
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<td>102.03 (5.32)</td>
<td>99.84</td>
<td>100.09 (1.44)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>80.14 (5.09)</td>
<td>99.82 (3.59)</td>
<td>97.96</td>
<td>105.89 (6.02)</td>
</tr>
<tr>
<td>MT</td>
<td>HK</td>
<td>2.25 (0.63)</td>
<td>3.16 (0.81)</td>
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<td>3.26 (0.88)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1.57 (0.30)</td>
<td>2.23 (0.57)</td>
<td>1.96 (0.44)</td>
<td>2.17 (0.40)</td>
</tr>
<tr>
<td>No. of REMP s</td>
<td>HK</td>
<td>4.82 (0.30)</td>
<td>4.73 (0.27)</td>
<td>5.00</td>
<td>5.18 (0.23)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>4.46 (0.16)</td>
<td>5.18 (0.18)</td>
<td>4.91</td>
<td>5.18 (0.23)</td>
</tr>
</tbody>
</table>

Abbreviations used: SI, S2, S3, and S4, NREM stages 1, 2, 3, and 4; SEI, Sleep efficiency index; TBT, Total bed time; TWT, Total wake time; WASO, Waking after sleep onset. Abbreviations for other variables and for groups are defined in text.
TABLE 2. Post hoc night comparisons (pooled data) for variables showing an across-night effect

<table>
<thead>
<tr>
<th>Variable</th>
<th>Night differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>TST</td>
<td>night 1&gt; night 4</td>
</tr>
<tr>
<td>SEI</td>
<td>night 1&lt; night 4</td>
</tr>
<tr>
<td>TWT (min)</td>
<td>night 1&gt; nights 3, 4, 5</td>
</tr>
<tr>
<td>TWT (%)</td>
<td>night 1&gt; nights 3, 4, 5</td>
</tr>
<tr>
<td>WASO (min)</td>
<td>night 1&gt; nights 4, 5</td>
</tr>
<tr>
<td>WASO (%)</td>
<td>night 1&gt; nights 4, 5</td>
</tr>
<tr>
<td>REM (min)</td>
<td>night 1&lt; nights 2, 3, 4, 5</td>
</tr>
<tr>
<td>REM- (%)</td>
<td>night 1&lt; nights 2, 3, 4, 5</td>
</tr>
<tr>
<td>NREM (%)</td>
<td>night 1&lt; nights 2, 3, 4, 5</td>
</tr>
</tbody>
</table>

*p < 0.05.

FIG. 1. Cumulative minutes of stage 2, slow wave, and stage 4 across the first 4 hr of sleep for the HK and C groups.
<table>
<thead>
<tr>
<th>Sleep cycle definition</th>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMC</td>
<td>HK</td>
<td>85.23 (3.20)</td>
<td>91.48 (4.33)</td>
<td>84.55 (3.10)</td>
<td>90.44 (3.28)</td>
<td>92.66 (4.10)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>84.34 (2.81)</td>
<td>81.20 (3.19)</td>
<td>91.17 (3.35)</td>
<td>92.19 (2.90)</td>
<td>95.37 (7.41)</td>
</tr>
<tr>
<td>REMC (real time)</td>
<td>HK</td>
<td>88.13 (3.31)</td>
<td>95.08 (5.00)</td>
<td>89.95 (4.18)</td>
<td>93.12 (3.12)</td>
<td>96.03 (4.25)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>91.26 (3.90)</td>
<td>84.55 (3.72)</td>
<td>94.83 (3.51)</td>
<td>93.42 (2.92)</td>
<td>97.82 (7.28)</td>
</tr>
<tr>
<td>NREMC</td>
<td>HK</td>
<td>108.43 (6.13)</td>
<td>112.85 (5.07)</td>
<td>108.28 (3.70)</td>
<td>100.38 (3.46)</td>
<td>115.87 (7.83)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>107.33 (2.62)</td>
<td>96.16 (2.64)</td>
<td>102.81 (3.94)</td>
<td>107.66 (4.73)</td>
<td>104.46 (8.83)</td>
</tr>
<tr>
<td>NREMC (real time)</td>
<td>HK</td>
<td>112.51 (6.81)</td>
<td>116.29 (5.71)</td>
<td>113.03 (5.11)</td>
<td>102.86 (3.23)</td>
<td>119.81 (8.15)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>112.03 (2.56)</td>
<td>99.46 (3.06)</td>
<td>106.16 (4.37)</td>
<td>108.64 (4.74)</td>
<td>106.75 (8.71)</td>
</tr>
</tbody>
</table>
Successive NREM and REM sleep cycles within nights were subjected to trend analyses. Analyses were limited to the first four cycles from nights 3-5 since all subjects had at least that many cycles for each of these nights.

Table 4 presents the successive REM and NREM mean cycle durations and results from trend analyses. Again, no group differences were found, but significant trends were present across cycles for both REM and NREM cycle durations. There was a strong linear trend (p < 0.001) toward shorter REM cycle lengths across the night, even though in the control group the third REM cycle was equal in duration to the first. NREM cycle duration showed a significant (p < 0.01) cubic trend component. In both groups the first NREM cycle was the longest, and of significantly (p < 0.05) greater duration in the HK group. The HK group also evidenced a slight increase in the duration of the third cycle.

Similar REM and NREM cycle configurations were observed when time awake was included; i.e., a significant linear trend was present for this real-time REM cycle (p < 0.005), and a significant cubic trend was found in the real-time NREM cycles (p < 0.01) across the night (see Figs. 2 and 3).

**Latencies**

Summary data for latencies to sleep onset, NREM sleep stages, and the initial REMP are presented in Table 5. No significant group or night differences were obtained for latencies to sleep onset or any NREM sleep stage. A significant main effect for group (F(1,20) = 4.46; p < 0.05) was present for REM onset latency on nights 3-5 with the HK group showing a more extended latency. When nights 1 and 2 were included in the analysis, the group effect was maintained (F(4,80) = 7.08, p < 0.05) and a significant night effect emerged (F(4,80) = 2.69, p <

**TABLE 4.** Means and (SEM) of intranight REM and NREM cycle lengths (min) and results of trend analyses

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(min)</td>
<td>(min)</td>
<td>(min)</td>
<td>(min)</td>
</tr>
<tr>
<td>REMC</td>
<td>HK</td>
<td>96.96</td>
<td>(3.85)</td>
<td>91.48</td>
<td>(6.36)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>97.29</td>
<td>(4.73)</td>
<td>94.03</td>
<td>(4.83)</td>
</tr>
<tr>
<td>REMC</td>
<td>(real time)</td>
<td>HK</td>
<td>100.35</td>
<td>(4.56)</td>
<td>93.94</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>101.02</td>
<td>(5.05)</td>
<td>95.68</td>
<td>(4.61)</td>
</tr>
<tr>
<td>NREM</td>
<td>HK</td>
<td>150.76</td>
<td>(8.40)</td>
<td>99.66</td>
<td>(5.50)</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>128.38</td>
<td>(10.36)</td>
<td>104.37</td>
<td>(4.59)</td>
</tr>
<tr>
<td>NREM</td>
<td>(real time)</td>
<td>HK</td>
<td>152.97</td>
<td>(8.67)</td>
<td>103.16</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>129.04</td>
<td>(10.33)</td>
<td>108.16</td>
<td>(4.75)</td>
</tr>
</tbody>
</table>

**F values**

<table>
<thead>
<tr>
<th>F values</th>
<th>Among</th>
<th>Linear</th>
<th>Quadratic</th>
<th>Cubic</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMC</td>
<td>5.65&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.10&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.44</td>
<td>1.26</td>
</tr>
<tr>
<td>REMC (real time)</td>
<td>5.74&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1239&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.04</td>
<td>1.86</td>
</tr>
<tr>
<td>NREM</td>
<td>22.99&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4131&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.67&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>NREM (real time)</td>
<td>19.99&lt;sup&gt;a&lt;/sup&gt;</td>
<td>38.53&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.08&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.10&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>p < 0.01; <sup>b</sup>p < 0.005; <sup>c</sup>p < 0.001.
0.05; night 1 > night 5, p < 0.05). Mean latency values for REM onset across nights for both groups are presented in Fig. 4. Although increased REM latencies were associated with longer durations of the first REMP (Pearson r = 0.62, df = 21, p < 0.01), there was no significant between-group difference in first REMP length.

Motor Activity
HK subjects exhibited greater amounts of movement time (min and percentage) compared to controls (p < 0.07; see Table 1). Between-group comparisons were
TABLE 5. Mean latencies and (SEM) for time to initial onset of NREM and REM sleep stages for nights 3—5

<table>
<thead>
<tr>
<th>Groups</th>
<th>Variables</th>
<th>HK</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lights out to sleep onset</td>
<td>15.17 (2.60)</td>
<td>11.43 (1.60)</td>
</tr>
<tr>
<td></td>
<td><strong>Lights out to stage 1</strong></td>
<td>14.20 (0.44)</td>
<td><strong>10.48 (1.54)</strong></td>
</tr>
<tr>
<td></td>
<td>Sleep onset to stage 2</td>
<td>3.99 (0.42)</td>
<td>3.11 (0.24)</td>
</tr>
<tr>
<td></td>
<td>Sleep onset to stage 3</td>
<td>14.38 (0.63)</td>
<td>14.94 (0.73)</td>
</tr>
<tr>
<td></td>
<td>Sleep onset to stage 4</td>
<td>21.41 (1.08)</td>
<td>20.74 (1.14)</td>
</tr>
<tr>
<td></td>
<td>Sleep onset to 1st REMP</td>
<td>140.13 (7.48)</td>
<td>115.3 (6.71)</td>
</tr>
</tbody>
</table>

Sleep onset latency is defined as the time from "lights out" to 5 min of continuous sleep (stage I). *p < 0.05.

made on motor activity in the first cycle of sleep to determine whether such activity may have contributed to the significantly longer REM onset latency by disrupting sleep. However, significant group differences were not found (HK: \( X = 6.64 \) min; C: \( X = 4.77 \) min; \( t = 1.15, \) NS), and this motility measure was not related to REM onset latency (Pearson \( r = 0.26 \)).

**Autonomic Activity**

No significant group differences were found in SSPR frequency in stages 2 or 4, or REM (t-tests for independent samples). Mean rates/min were then compared among stages (pooled subjects) using t-tests for correlated samples. Significant differences (\( t = 5.89, df = 21, p < 0.001 \)) were found between stage 2 (\( X = 3.30, SD = 1.67 \)) and stage 4 (\( X = 5.08, SD = 2.49 \)), stage 2 and REM (\( X = 1.71, SD = 1.38; t = 5.30, df = 21, p < 0.001 \)), and stage 4 and REM (\( t = 7.25, df = 21, p < \).

![FIG. 4. Means and SEM of REM onset latencies across nights for the HK and C groups.](image-url)
These results for SSPR NREM rates were mirrored by the analysis of data based on 15-min samples which showed no group differences for stage 2–stage 4 comparisons, but significantly higher ($t = 4.85$, $df = 21, p < 0.001$) response rates in stage 4 ($X = 5.27, SD = 2.63$) than stage 2 ($X = 3.27, SD = 2.15$) in the pooled subject data.

**DISCUSSION**

**Sleep Stages**

In agreement with previous reports (Small et al., 1971; Feinberg et al., 1974; Haig et al., 1974; Nahas and Krynicki, 1977; Khan and Rechtschaffen, 1978; Stahl et al., 1979), no significant group differences were found in baseline absolute (min) or percentage amounts of the various sleep stages. In the present study, these results were based on recordings taken after an initial two nights allowed for adaptation. Data from these initial nights have been routinely discarded in these studies to avoid the influence of anticipated variations in sleep amounts and patterning. Reduced amounts of REM sleep and increased waking time on the first recording night compared to subsequent nights provides evidence for the existence of a "first-night effect" for nonclinical and HK subjects of this age group similar to that observed in normal adults and children (Rechtschaffen and Verdone, 1964; Dement et al., 1965; Agnew et al., 1966; Kales et al., 1968; Schmitt and Kaelbling, 1971).

**Cycles**

Significant group differences were not found for either NREM or REM average cycle durations, suggesting that mechanisms governing periodic alternation of
these two states are intact in these HK children. Trends in sleep cycle durations within nights agree with previous findings for human sleep indicating that intra-sleep cycles are not constant in duration (Feinberg et al., 1967; Feinberg, 1974; Feinberg and Floyd, 1979).

There has been a consuming interest in the REM sleep cycle to the exclusion of adequate considerations of NREM sleep oscillations. Feinberg and Floyd (1979) have argued for a comprehensive description of the cyclicity within sleep. As is evident from the intra-sleep cycles in the present study, REM cycle durations ($X = 90.5$ min) are much shorter than NREM cycle durations ($X = 109.7$ min). These different periodicities may indicate varying functional properties for these two rhythms and provide information pertinent to the general significance of variable oscillatory phenomena.

The NREM cycle durations across the night are consistent with those observed in previous studies, with the first cycle showing a longer duration typical of children's sleep (Feinberg et al., 1967; Williams et al., 1974; Feinberg and Floyd, 1979). The first NREM cycle was exaggerated in the HK group, which showed a significantly longer REM onset latency.

The present results do differ from previous reports with regard to REM cycle duration across the night. Feinberg and Floyd (1979) reported a curvilinear ("umbrella-shaped") trend in this measure. The same analysis applied to REM cycle data in the present study revealed a steadily declining linear trend for the HK group, and decreasing duration from the first to the second cycle, lengthening in the third, and finally decreasing again in the fourth cycle for the control group. The longer first REM cycle shown for both groups may be related to REM onset latency. A positive relationship was found between REM onset latency and duration of the first REMP, suggesting that the increased first REMP length may have affected the subsequent REM cycle by extending its duration.

### Latencies

Previous studies examining sleep onset latencies in HK children have reported no differences (Feinberg et al., 1974), longer latencies (Haig et al., 1974), and shorter latencies (Small et al., 1971). The present study found no significant differences in sleep onset latency, although mean values were longer for the HK group.

In the present study, latencies to the onset of the first REMP were significantly longer in the HK group relative to controls. Although in younger children's (e.g., 7–12 year olds) sleep the first REMP appears to be "missed" (Roffwarg et al., 1966), the differential distribution of latencies in the present study, together with previous reports of extended REM onset latencies in HK subjects (Haig et al., 1974), suggest this finding is not spurious.

A number of naturally occurring and experimentally induced conditions are known to influence latency to the first REMP. Reduced REM latencies have been reported in neonates and infants (Roffwarg et al., 1966), in depressives and narcoleptics (Kupfer, 1976; Montplaisir et al., 1978), and in subjects recovering from REM deprivation (Dement, 1960). The ontogenetic and REM deprivation literature suggests that increased CNS excitability (hyperarousal) is associated with reduced
REM onset latencies and increased REM amounts. By this reasoning, the increased REM latencies in the present study might be indicative of central hypoarousal in these HK children.

REM onset latencies are known to vary as a function of other factors such as time of day (Moses et al., 1975) and maturation (Williams et al., 1974). With regard to time of day effects, naps occurring in the morning show decreased REM latencies and more REM sleep relative to afternoon naps. In relation to maturational factors, it is interesting to note that REM onset latencies of control children in the present study were comparable to those of similarly aged children studied by Feinberg et al. (1967), whereas latencies for the HK group were more similar to those of a younger group of normal children in that study. This relationship is suggestive of a developmental lag in the hyperkinetic children—a notion which has received considerable attention as a possible underlying factor in the hyperkinetic syndrome (Kinsbourne, 1973; Rosenthal, 1973).

Extended REM onset latencies have been observed following the administration of REM-suppressing pharmacological agents (Rechtschaffen and Maron, 1964; Kales et al., 1969; Johnson et al., 1970), stage 4 deprivation (Agniew et al., 1964), and exercise during wakefulness (e.g., Baekeland, 1970; Browman and Tepas, 1976). From the perspective of hyperkinetic symptomatology, these latter studies involving the effects of exercise on subsequent sleep are most relevant. Such studies have generally reported enhanced NREM sleep (specifically slow wave) after exercise (Baekeland and Lasky, 1966; Hobson, 1968; Matsumoto et al., 1968; Zloty et al., 1973; Shapiro et al., 1975; Browman, 1980). Increased REM latencies have also been observed under these conditions (Hobson, 1968; Matsumoto et al., 1968; Desjardins et al., 1974; Browman and Tepas, 1976; Home and Porter, 1976; Baekeland, 1970), but not consistently (Baekeland and Lasky, 1966; Hauri, 1968; Walker et al., 1978; Browman, 1980). There is support, then, for an association of increased presleep activity with longer REM onset latencies. This relationship is intuitively appealing with respect to HK, since increased motor activity is a cardinal feature of the syndrome. Moreover, motility data, derived from waking measures of limb and whole body movement detectors for the subjects in the present study, indicate significantly greater (p < 0.01) movement in HK children relative to controls (Busby and Broughton, in preparation).

The results of the stage analysis for the first cycle are also relevant to the finding of an extended REM onset latency in this sample of HK children. Proportionately, control subjects exhibited more (marginally significant) stage 4 and consequently more slow wave sleep in the initial cycle, whereas HK subjects exhibited greater amounts (proportionately and absolutely) of stage 2 during this time. Analyses revealed that both groups displayed parallel increases in the cumulative amounts of stages 2, 4, and slow wave sleep during the first 4 hr of sleep (see Fig. 1)—and, therefore, the significantly greater stage 2 can be accounted for by the increased length of the first sleep cycle in the HK group. Alternative possibilities exist to explain these findings within the context of hyper- versus hypoarousal. Hyperaroused HK children might be expected to display greater amounts of lighter sleep (stage 2) since this might reflect an endogenously hyperaroused CNS.
However, hypoaroused HK children may show more light sleep in response to a general decrease in sensory stimulation accompanying sleep.

Of the several factors associated with increased latency to the first REMP, then, those most consonant with the data from the present investigation are increased motoric activity during wakefulness and maturational factors influencing CNS development and differentiation. Still, there may be unknown factors influencing events occurring specifically within sleep which may selectively alter slow wave or REM sleep initiation and maintenance mechanisms in the first cycle.

Motility

Although increased sleep motility in HK children was observed in the present study, the effects were not as strong as those obtained by Small et al. (1971). However, the latter investigators based their selection of HK subjects primarily on overt motoric restlessness, whereas subject selection in the present study did not emphasize this feature. The observation of greater restlessness during sleep in these studies could reflect the continuation of HK children's waking overactivity into sleep in a degree proportional to that present during wakefulness.

A greater frequency of movement arousals may reflect a centrally hyperaroused state influencing motor systems throughout sleep. Alternatively, falling asleep could potentiate further reductions in level of arousal in an already hypoaroused nervous system and could initiate internally generated stimulation in HK children to counter this sleep-related decrease in sensory stimulation. This process could be manifested in more frequent arousals from sleep in an attempt to facilitate the general level of activation.

Autonomic Activity

This is the first study to report data on an autonomic index (SSPR) during sleep in HK children. The finding that SSPR activity failed to differentiate between HK and control children complements the previous literature investigating spontaneous or nonspecific SSPR activity during wakefulness in HK children (Conners, 1975; Firestone and Douglas, 1975; Zahn et al., 1975). Furthermore, these observations parallel those for children and normal young adults in previous sleep studies (Broughton et al., 1965; Johnson and Lubin, 1966; Lester et al., 1967; Koumans et al., 1968). All of these studies, the present one included, found the highest SSPR frequency in stage 4, moderate rates in stage 2, and the lowest rates occurring during REM sleep. The present results add developmental data relevant to the maturation of autonomic nervous system response patterns in this age range, showing them to be comparable to those displayed by normal adults.

Conclusion

The sleep of HK children does not differ significantly from that of normal children with respect to amounts of conventional sleep stages, cycle durations (with the exception of the initial NREM cycle), or autonomic nervous system activity as indexed by SSPR frequency. The nature of the group differences which
were found in the increased REM onset latency and greater motility during sleep evidenced by HK children does not permit a clear choice regarding the basis of the postulated arousal dysfunction underlying this syndrome. Although an arousal disorder may be fundamental to the HK syndrome, the existence of such a dysfunction of major proportion is not reflected in comprehensive sleep pattern evaluation.

ACKNOWLEDGMENTS

We are grateful for the cooperation of the Psychology Department of the Children's Hospital of Eastern Ontario, and thank J. Kelly for his help in data acquisition and analysis. This study was supported by an Ontario Mental Health Foundation Research Scholarship to Dr. R. T. Pivik and a grant from the Physicians Services Incorporated Foundation.

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Sleep, Vol. 4, No. 4, 1981


FACTORS ASSOCIATED WITH CHILDREN'S ADHERENCE TO STIMULANT MEDICATION

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School of Psychology, University of Ottawa, Ontario

Hyperactive children and their families were studied to assess adherence to a regimen of stimulant medication. Of those agreeing to participate for one year, 20% had discontinued medication by the fourth month and 44% by the tenth month. Findings are discussed in relation to child and parent characteristics, the unique nature of using medication to treat behavior problems in children, and the difficulty of carrying out such long-term investigations with children.

Since hyperactivity is evident in eight to ten percent of school age children, and there is ample evidence that many of their problems persist into adolescence and early adulthood, it is not surprising that there is considerable interest in the development of effective treatment programs for this population. Presently, stimulant medication is the most widely used treatment for hyperactive children. In fact, the effects of stimulant medication on hyperactivity is the most thoroughly researched treatment in child psychiatry. However, several puzzling aspects concerning its effectiveness remain.

Several suggestions have been made concerning the seeming paradox of enhanced attentional abilities and improved classroom behavior and the lack of accelerated academic gain. It is possible that placing a child on medication does improve attention and behavior but does not compensate for the lack of...
skills and other variables that predispose a child to academic achievement. Another suggestion is that the demonstrated lack of academic achievement while taking medication may be due to the insensitivity of the tests or to the relatively brief intervention periods utilized in this research.  

A rarely mentioned but nonetheless glaring deficit in the utilization of medication for hyperactivity is that of adherence. A survey by Solomons found that 43% of the children on stimulant medication were not being adequately monitored by a physician. Furthermore, there are virtually no data indicating the percentage of hyperactive children who do not take their prescribed medication appropriately. Briant suggested that the failure of patients to take medication as prescribed has probably accounted for more variability or lack of consistency in outcome data than any other factor in drug intervention. Investigations with other populations support this claim. It is currently estimated that 50% of adult patients do not take medication as prescribed. Children may fare even worse. Bergman and Werner studied the compliance rate of children diagnosed as suffering from streptococcal pharyngitis, acute otitis media, and skin infections thought to be caused by streptococci. The prescribed treatment consisted of orally ingested penicillin for a ten-day period. It was discovered that 56% had stopped taking the medication by the third day, 71% by the sixth, and 82% by the ninth day. Similar results were obtained by Mattar, Markello and Yaffe, who found that only 7.3% of 300 pediatric outpatients completed their course of antibiotics for otitis media.

Another serious deficit in the literature on the treatment of hyperactive children is that of subject selection. There is rarely any mention of the solicitation procedures used or the number of children and families meeting criteria, who for one reason or another reject the offer of treatment. This type of selection bias has been shown to affect the results and limit the generalization of research with schizophrenic adults. As Loney and Halmi cogently argued, research that does not take exclusion variables into account does not provide much information with which to specify predictors of treatment response. Neither does this type of research allow for a matching of patient variables with the various treatment modalities available.

In order better to understand the problems inherent in the pharmacological treatment of children in general, and hyperactive children in particular, this paper will examine the demographic and psychological factors associated with attrition and adherence.

The issue of adherence to drug regimens has been addressed in several recent works. These reviews pinpointed the strengths and weaknesses of several of the popular methods of assessing adherence such as clinician ratings, pill counts, blood or urine sampling, record keeping, and outcome. In the end it is quite clear that one should use a combination of approaches to assess compliance because any single method has serious limitations.

The primary goal of the present project was not to increase compliance rates. Rather, it was to ascertain what the normal drug usage patterns in an outpatient child population might be. Since it was felt that the implementation
of intrusive monitoring practices might,
in fact, change these patterns, adherence was gauged largely through verbal reports from the parents.

**METHOD**

**Subjects**

Seventy-six children (68 boys and 8 girls) between five and nine years of age, referred to the psychology department of the Children's Hospital of Eastern Ontario, were participants in the investigation. The hospital is the pediatric center of the region, with a catchment of 600,000 children. The children had as their prime difficulties, overactivity, short attention span, impulsivity, inability to delay gratification, and aggressiveness, tantrums, or oppositional behavior (attention deficit disorder with hyperactivity). They were required to have a score of 15 or higher on the Hyperactivity Index (HI) of Conners's behavior rating scale for teachers (TRS). "Peabody Picture Vocabulary IQs were at least 80, and the children were living at home with at least one parent. The hyperactivity had to be in evidence prior to 2'4 years of age and be present at home and at school. Excluded from the sample were children who showed definite signs of brain damage, epilepsy, or psychosis. Families in which either parent was psychotic, or in which the parental discord was so great that the parents openly admitted intervention would be impossible, were excluded.

**Procedure**

All children were referred by physicians. Parents and children were then interviewed by the author and each parent was asked independently to fill out Conners's rating scale for parents, a marital satisfaction questionnaire, and to supply demographic data. The identified patient's teacher was then contacted and asked to complete the TRS. If the family met the criteria, they were randomly assigned to a medication-only condition (methylphenidate, hydrochloride) or to a group in which parents received instruction in behavior modification techniques while their children received medication. (A description of the parent training is available elsewhere.) Parents were told their child would be assessed prior to treatment, after about four months, immediately after the parent training, then approximately every six months after that for three years. If parents agreed to participate, their MMPI and IQ data were collected and arrangements for testing the hyperactive child were made. If they rejected treatment, the reasons for this were explored and they were also asked to complete the above measures and tests.

**Medication**

Medication was provided free of charge for approximately the first four months of the study. After that, patients were required to purchase medication through regular procedures. Parents were instructed to give their children 5 mg. of the medication morning and noon every day including weekends, until a correct dosage was established. Medication was raised or lowered in 5 mg. gradations, based upon parental and teacher telephone reports, over a three to four week period. Dosages were determined either by a reported significant decrease in problematic behavior or indications of negative side effects (e.g., headaches, stomachaches, irritability,
insomnia). Once the appropriate dosage was established, children generally received medication only on school days. The same person (the author) was responsible for the titration procedure and for maintaining contact with the parents. All medication changes were carried out in consultation with the referring physicians. The average number of contacts per family by a project person during the first four months was 16 in the parent training condition and 13 in the medication only group. The average dosage of methylphenidate was 22 mg. per day with a minimum of 10 mg. and a maximum of 40 mg.

Project personnel attempted at all times to be supportive of the parents' wishes concerning medication use. The parents were informed of medication effects and their child's progress on medication. If, however, parents wanted to take their child off medication they were not subjected to any coercion. Rather, they were informed that the project would still like to follow the child's progress in order to advise the parents concerning academic planning and emotional development.

The duration of the investigation was 12 months. Therefore, since most children were kept off medication during the summer vacation, full compliance entailed taking medication for ten months. Families rejecting pharmacological intervention or terminating its use prior to the end of the fourth month were classified as nonadherents (N=32). Adherents were those families who complied with the intervention, for nine months or more (N=26). Seven subjects who took medication from five to eight months were excluded to ensure independence of the groups.

**Rating Scales and Tests**

**Conners's rating scales.** Conners developed a widely used rating scale for teachers. The TRS, a scale of 39 items has been factor-analyzed to produce five factors. Only the HI was analyzed in this experiment and the score is based on the total score within the factor (a four-point scale, 0-3, is used). This factor has been utilized extensively to assess the effectiveness of psychotropic medication with hyperactive children and has been repeatedly shown to be sensitive to drug effects. Conners also developed a rating scale for parents (PRS) that discriminates among hyperactive, neurotic, and normal control children. This 93-item scale has been factor-analyzed to produce eight factors but only the HI was used. The HI is scored in the same manner as is the TRS.

**Assessment of emotional adjustment.** Weiss et al developed this scale to assess the emotional adjustment of hyperactive children in a long-term follow-up of children on methylphenidate or chlorpromazine. This is a three-point scale based upon an interview with the parents by a senior psychologist (1, normal; 2, slightly disturbed; 3, severely disturbed). The score is based on a total of seven factors—peer relations, mood, sexual adjustments, relationship with adults, adjustment to authority, number of nervous symptoms, and rate of delinquency.

**Locke-Wallace marital adjustment test.** Locke and Wallace devised a questionnaire to measure marital adjustment which reliably discriminated between good and poor marriages. The mean adjustment score for the well-adjusted group was 135.9 and for the
maladjusted group, 71.1. Only 17% of the maladjusted group received scores of 100 or higher, whereas 96% of the well-adjusted group achieved scores of at least 100. This scale has been used extensively in research."

Minnesota Multiphasic Personality Inventory. The MMPI is the most widely used objective test of personality. It allows for a symptomatic self-assessment covering a wide range of complaints and fears; in addition, it taps a number of areas of distress and allows for an actuarial classification of acknowledged concerns. The test is self-administered, with the subject answering true or false to a large number of short, structured narrative, statements. It is the most widely used personality inventory in research.

Shipley Institute of Living Scale. This instrument, introduced as a measure of intellectual performance, consists of a vocabulary test and an abstract reasoning test; it is administered in 20 minutes. The scale has been found to correlate highly with other tests of intellectual functioning.

RESULTS

Seventy-six families met the inclusion criteria and were offered treatment. Of these, three children improved so dramatically during the pretests that they no longer required treatment; nine families rejected any form of treatment; eleven families declined the offer of treatment if it included stimulant medication, but accepted parent training as an alternative; ten children responded adversely to methylphenidate and were switched to dextroamphetamine, and eight of these responded adversely to dextroamphetamine and were dropped from the study, while the other two children remained on this medication.

FIGURE 1 depicts the compliance rates of the families in the two treatment groups. By the fourth month, 80% of the children were still taking medication. A chi-square analysis did not reveal a differential drop-out rate in the two treatment groups, $\chi^2(1)=.21, p>.10$, at the end of the fourth month. By the tenth month, 44% of the children were no longer on medication. Once again, a chi-square analysis did not reveal a differential drop-out between groups, $\chi^2(1)=.38, p>.10$.

Although there were some minimal side effects in both the adhering and nonadhering groups (lack of appetite at lunch, some difficulty falling asleep), the nonadherents did not report these factors as very important in their decision to stop administering medication. The major reasons given were that par-
ents were not comfortable with the idea of medicating their children or that the children were reluctant to take their medication. With a few patients in both groups there was some pressure from teachers to take children off medication, despite its seeming to help them. It should be noted that all but three families stopped giving their children medication prior to consulting the project or their physician.

In order to assess whether symptomatic improvement may have led to the high drop-out rate, the HI scores as rated by mothers and teachers, taken as soon as possible after the cessation of medication, were compared to children's premedication scores. Generally, the off-medication ratings were collected within two months of terminating pharmacotherapy. As Table 1 indicates, teachers did, in fact, rate the children as significantly improved compared to when they entered the study. There was a similar trend report by the mothers. However, it is also clear that the children were still quite problematic at the time of assessment while off medication. The adherents' most recent scores while still on medication also showed that they improved significantly as rated by both mothers and teachers.

Table 2 reveals that the adherents were rated by teachers as significantly more improved while on medication than the nonadherents off medication. However, the mothers in the two groups did not differ in their ratings of the children. The characteristics of the children just prior to treatment, in the two compliance groups, are presented in Table 3. There was a trend suggesting that nonadherents were younger and scored significantly lower on the intelligence test. No other differences were evident between the groups. A significant chi-square of the sex distribution within the groups was revealed (Table 4). It ap-

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### Table 1

MOTHERS' AND TEACHERS' HYPERACTIVITY RATINGS FOR THE NONADHERENTS AND ADHERENTS PRE AND POST MEDICATION

<table>
<thead>
<tr>
<th>GROUP</th>
<th>NONADHERENTS</th>
<th>ADHERENTS</th>
<th>t</th>
<th>df</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRE</td>
<td>POST</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers</td>
<td>20.94±4.22,</td>
<td>14.18±1.77</td>
<td>3.51</td>
<td>16</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>(17)</td>
<td>(17)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mothers</td>
<td>18.88±4.78</td>
<td>14.00±7.48</td>
<td>1.98</td>
<td>16</td>
<td>.06</td>
</tr>
<tr>
<td>ADHERENTS</td>
<td>Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17.83±4.52</td>
<td>7.08±3.31</td>
<td>10.19</td>
<td>23</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>Mothers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>22.48±5.52</td>
<td>13.00±5.24</td>
<td>7.18</td>
<td>23</td>
<td>.00</td>
</tr>
</tbody>
</table>

---

### Table 2

MOTHERS' AND TEACHERS' HYPERACTIVITY RATINGS FOR THE ADHERENTS AND NONADHERENTS

<table>
<thead>
<tr>
<th>GROUP</th>
<th>ADHERENTS</th>
<th>NONADHERENTS</th>
<th>t</th>
<th>df</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers HI</td>
<td>7.08±3.81</td>
<td>14.18±1.77</td>
<td>3.73</td>
<td>22</td>
<td>.00</td>
</tr>
<tr>
<td>Mothers HI</td>
<td>13.00±5.24</td>
<td>14.00±7.48</td>
<td>.48</td>
<td>26</td>
<td>NS</td>
</tr>
</tbody>
</table>
Table 3
CHARACTERISTICS OF THE CHILDREN

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>NONADHERENTS</th>
<th>ADHERENTS</th>
<th>t</th>
<th>df</th>
<th>p&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>7.05= 1.54</td>
<td>7.67= 1.22</td>
<td>1.07</td>
<td>54</td>
<td>.10</td>
</tr>
<tr>
<td>IQ</td>
<td>109.90=15.78</td>
<td>116.35:13.58</td>
<td>1.80</td>
<td>49</td>
<td>.04</td>
</tr>
<tr>
<td>Mothers’ HI</td>
<td>19.82= 5.34</td>
<td>10.84: 6.83</td>
<td>.01</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Teachers HI</td>
<td>19.41(27)</td>
<td>18.77: 4.38</td>
<td>.52</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>Emotional Adjustment</td>
<td>12.63= 3.48</td>
<td>12.09: 2.76</td>
<td>.52</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Table 4
NUMBER OF CHILDREN IN NONADHERENT AND ADHERENT GROUPS BY SEX

<table>
<thead>
<tr>
<th>SEX</th>
<th>NONADHERENTS</th>
<th>ADHERENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>Females</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

\(X^2(1)=3.50\) p<.05.

It appears that families were more likely to prematurely discontinue medication if the child was female.

TABLE 5 presents the characteristics of the families in the compliance groups. Since the literature concerning drop-out in adult psychotherapy indicates that premature terminators, tend to have lower IQs and fewer completed years of schooling,4 and since similar findings were evident in a study comparing the families of hyperactive children who stayed in parent training programs with those discontinuing prematurely,5 one-tailed t tests were conducted on these data. Mothers and fathers in the nonadherent group were significantly younger than those who complied with the medication regimen; There was also a trend indicating that these parents scored more poorly on intelligence tests. There were no other significant differences between the groups. Nor were there any significant differences between groups on any of the subscales of the MMPI.

DISCUSSION

The most clear-cut finding in the present study is that a large number of parents cannot or will not use the stimulant medication prescribed for their children. Approximately 26% of the total group refused treatment altogether. Of those agreeing to have their children placed on medication (excluding children who responded with adverse side effects sufficient to preclude continuation on medication), 20% stopped using it by the end of the fourth month. By the end of the tenth month only 55% of the children were still taking their prescribed medication. It is important to note that less than 10% of the families sought consultation prior to terminating pharmacological intervention. Nonadherence was generally discovered when project personnel routinely contacted the families. It is quite likely that less diligent supervision of these families would have led to inflated estimates of compliance rates.
The reasons for termination of medication use are not clear. It does not seem that undesirable side effects or symptom remission were major factors. Although there was a significant reduction in problematic behavior' in children off medication, as perceived by both mothers and teachers, their behavior was still seen as quite troublesome. As reported in numerous other studies, the mothers in the adherent and nonadherent groups found their children equally hyperactive. This is not unexpected since the short-lived nature of stimulant medication results in the children being relatively drug-free after school and on weekends.

A significant differential attrition rate by treatment group (parent training plus medication vs. medication-only) was not found. However, visual inspection of the data does indicate that parents in the parent training groups may have been slightly more inclined to take their children off medication. It is possible that the larger number of contacts with this group simply revealed nonadherence more accurately. An alternate explanation, based upon parental comments, is that these parents gained a great deal of confidence in their ability to deal with children and hence felt they could deal with their child without the use of "drugs."

The findings that younger children, males, children with lower IQs, and younger parents who tend to have lower IQs are less likely to adhere to medication prescriptions parallels previous work in this area, comparing those who drop out of parent training groups with those who remain.* However, unlike
this previous work, the personality characteristics of the parents did not predict compliance. Early research with several review hyperactive children reported that they concerned adherence of adults to "outgrow" their problems by the time medication regimens supported the lack of personality profile characteristic of research now exists indicating that nonadherents. 

The reasons for and uK. of stimulant medication with children differ considerably from the manner in which long-term medications are formally administered to adults, and, tray increase nonadherence. Hyperactive children rarely seek assistance for the problems they are experiencing at home or at school. More often than not parents bring a child to a physician for consultation because of the difficulty the child is experiencing at school. However, this difficulty is defined by the school rather logical treatment of their children. This than expressed by the child. Therefore, group is rarely mentioned in the research adults act as the intermediary complainants between the home or school and the physician. In fact, the most frequently used diagnostic aids are not the subjective reports of the child but behavior rating scales filled out by parents and teachers in addition to a developmental history. Neither is the hyperactive child responsible for taking the medication, and the child is only a consultant when it comes to the titration process. Unless the child is suffering from undue side effects, dosages of stimulant medication are raised or lowered based upon adults' reports of the child's behavior. The child is not seen as a reliable reporter of their own behavior. Research into medication usage with adults suggests that the seeming paradox of improved abilities due to stimulant medication being found in short-term studies but not in long-term outcome studies may be due to maturation, sometimes con-
Neuropsychiatric Institute of the Hartford Retreat, Hartford, Conn.


partially due to "nonadherence to the prescribed medication."

REFERENCES

A Comparative Study of the Efficacy of ACTH<sub>4-9</sub> Analog, Methylphenidate, and Placebo on Attention Deficit Disorder with Hyperkinesis

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Departments of Psychiatry, Pharmacology, and Psychology, University of Ottawa, Ottawa, Ontario; 4Centre Hospitalier Pierre-Janet, Hull, Quebec; and Royal Ottawa Hospital, Ottawa, Ontario, Canada

The present study compared the behavioral performance of 30 children with attention deficit disorder (11K) on electrophysiological, biochemical, behavioral, and psychometric measurements. 11K children were partitioned into cells of 10 and were then treated with placebo, methylphenidate, and adrenocorticotropic hormone fractions (ACTH<sub>4-9</sub> analog), respectively, in a double-blind randomized cell sequence according to body weight. The results revealed that 11K children on methylphenidate manifested a significantly greater vasomotor reactivity, behavioral improvement, and learning receptivity than did 11K children taking ACTH<sub>4-9</sub> analog and/or placebo. Future research implications with ACTH<sub>4-9</sub> and HK children are discussed.

Attention deficit disorder with hyperkinesis (HK) is now quite well recognized as a clinical syndrome in children who manifest difficulties in attention, memory, and motivation, with or without hyperactivity. (The term "hyperkinetic syndrome" is used here because it encompasses not only the amount of activity but also other behavioral, physiological, and pharmacological correlates that may differentiate HK children from other children.) Studies investigating the management of the disorder have reported that methylphenidate reduces distractibility and impulsivity and improves selective attention in both home and school environments. Consequently, methylphenidate has become the usual chemotherapeutic strategy for children with this syndrome.

Recently, Tiwary and co-workers found that two hyperkinetic children who were previously poor responders to methylphenidate exhibited improvement in all aspects of their HK behavior when injected with 0.2 mg of the tripeptide thyrotropin-releasing hormone. ACTH<sub>4-9</sub>, on the other hand, has been reported by Ferris' and Willner to improve social competence and friendliness in the elderly. A similar improvement in social behavior was reported in mentally retarded adults by Sandman and colleagues. These improvements occurred at sub-chronic doses ranging from 5 to 20 mg daily.

The objectives of the present investigation were (1) to compare ACTH<sub>4-9</sub> with placebo to determine whether or not the peptide improves measurements of attention and behavior in hyperactive children, and (2) to compare methylphenidate to ACTH<sub>4-9</sub> and placebo to establish the sensitivity of the method to standard therapy.

Materials and Method

This was a double-blind efficacy study comparing three groups of 10 boys, each group receiving a different drug over a 1-week period. Dosage was adjusted for body 226
These testing sessions were at the end of the placebo held at the same time for each child on each occasion. The medication was administered 90 min prior to the testing session, which was on the days of assessment. The medication was administered each morning at 7:30 a.m. in a single capsule and ingested in the morning. The dosage of 0.5 mg/kg was arrived at in order to allow adjustment for body weight for the reported effective adult dose, ranging from 5 to 20 mg. This regimen had been observed to produce behavioral changes in the elderly and mentally retarded adults after 5 days of administration in single and twice daily administration. The same dosage range is compatible with what is generally being used for methylphenidate. The three different treatments were stratified within each "weight group" so that nearly equal drug treatment groups could be obtained for each weight group.

Thirty children were included in the study. They were all male, aged 6 to 12 years, and had a clinical diagnosis of attention deficit disorder with hyperkinesis.

For inclusion, the hyperkinesis rating required a score of 15 or more on the Conners' Short Form Rating Scale and hyperkinetic behavior had to be apparent throughout most of the day. The untreated behavior had to be a cause of severe difficulty both at home and at school.

All children with an intelligence quotient (Wechsler Intelligence Scale for Children) of 85 or less and/or abnormal perceptual functioning were excluded.

The 7-day drug-free period was followed by a week of placebo treatment. After the placebo washout, treatment was assigned in a double-blind and random manner to either ACTH₄₋₉, methylphenidate, or placebo.

Visual, auditory, and tactile screening assessments were made during the drug-free period.

Informed signed consent was obtained from both parents and/or legal guardians of each child. A familiarization session with the testing procedure was held prior to the placebo washout.

The parents or guardians were instructed to administer the experimental medication each morning at 7:30 a.m. on the days of assessment. The medication was administered 90 min prior to the testing session, which was held at the same time for each child on each occasion. These testing sessions were at the end of the placebo week and after a week of double-blind medication administration. In each of the two testing sessions each child did the same tests with the same assessor. The total testing time including breakfast averaged 120 min and ranged from 90 to 135 min.

**Psychophysiological assessment**

Skin conductance and finger pulse amplitude. The children were seated in a sound-attenuated room with controlled temperature and humidity. The electrodermal activity was recorded on a Beckman 611 dymograph at a paper speed of 5 mm/sec. Skin conductance was recorded as a direct current phenomenon via Beckman silver-silver chloride electrodes, filled with Beckman sodium chloride paste and taped to the terminal phalanx of the first and third fingers of the dominant hand.

Finger pulse amplitude was recorded with a Beckman photoplethysmograph from the first phalanx of the second finger of the nondominant hand. Pulse amplitude measures were employed to a time constant of 0.03 sec.

Reaction time. The reaction time apparatus was triggered by preprogrammed auditory and visual stimuli presentations. The first tone acted as a warning signal. This was a 500-Hz tone of 70-dB intensity and of 1-sec duration. Onset of the warning signal marked the beginning of a 10-sec preparatory interval, at the end of which another tone activated the reaction signal. This consisted of a protected 7.5 watt light bulb located, along with the response button, on the right arm of the subject's chair. Trials were separated by a 50-sec interval. The circuit was constructed so that the reaction signal would not appear unless the response button was depressed. The reaction time was thus measured using an electric clock timer. The onset and termination of the warning and reaction signals and the subjects' responses were automatically recorded on the polygraph chart record.

**Psychometric assessment**

Conners' Short Form Rating Scale (CSS). Conners shortened his original 39-item rating scale to 10 items. Conners and colleagues were able to differentiate between hyperactive subjects receiving dextroamphetamine, magnesium pemoline, and placebo with this scale. Sprague and Sleator found the CSS sensitive enough to pick up dosage effects in a study using methylphenidate with hyperactive children. In the present study the CSS, which is scored on a four-point (0-3) scale, was completed by both parents and clinicians. The score for a child is the sum over the 10 items.

Conners' Rating Scale. Conners has developed a widely used rating scale for teachers. That scale was factor analyzed to give five factors: (1) hyperactivity, (2) conduct-problem, (3) inattentive-passive, (4) tension-anxiety, and (5) sociability. The score for each factor is

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**Table 1. Dosage for 30 children with attention deficit disorder with hyperkinesis, who were grouped according to weight**

<table>
<thead>
<tr>
<th>Weight ranges (kg)</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of subjects</td>
<td>10</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>Fixed doses of drug (mg)</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Dose ranges (mg/kg)</td>
<td>0.62-0.40</td>
<td>0.57-0.43</td>
<td>0.56-0.44</td>
</tr>
</tbody>
</table>
based upon the mean of the items within the factor; a four-point scale (0-3) is used. The teachers were asked to rate the classroom behavior of the HK children during the placebo and active drug phase of the study.

Matching Familiar Figures Test (MFF). The children’s form of the MFF consists of 12 standard pictures familiar to children and six variants of each standard. The subject is required to point to that variant which is identical to the standard, which remains in view. Two scores are thus obtained for each subject: (1) the mean latency to the first response on each of the 12 items, and (2) the total number of errors on each item.

Campbell and associates18 have reported that hyperactive subjects receive higher impulsivity scores than normal subjects on this test and that methylphenidate significantly improved the performance of the hyperactive subjects on both the latency and error measures.

Memory for Design Test. In this test, which assesses attention and visual memory, a series of 15 designs for 5 sec are presented and then each child was asked to draw them from memory. The test takes 10 min to administer. The same set of designs was always used on the first (pretreatment).

Physical assessment
At the end of the drug-free period, each subject underwent a physical assessment of hematological and biochemical functions. This included a complete blood count, urinalysis, and liver and kidney function tests. Blood pressure and pulse were recorded and a standard 16-channel clinical electroencephalogram was done. These same procedures were repeated after the double-blind treatment period. The electroencephalogram was interpreted by a neurologist who was blind to drug conditions.

Data quantification
Table 2 illustrates the type and procedure of quantification used for each index in the current study. In order to explore the preresidual and postresidual drug change, the BMPD-P2V program was used."

Results
The results of the current study were explored as separate sets. The following sets were analyzed: psychophysiological, psychometric, and clinical. The autonomic psychophysiological set consisted of digital blood flow and skin conductance being measured at the beginning and at the end of the testing session. The mean reaction time, memory for design test errors, MFF latency errors, and the number of correct responses on the first trial made up the psychometric set. The clinical set was composed of the Conners’ hyperkinesis index and the teachers’ rating scale scores.

Tables 3 to 5 illustrate the results obtained comparing the three treatment groups on each of the dependent variables. Only the digital blood flow measured at the end of the experimental session and the Conners’ HK index were significantly different on the predrug and postdrug comparisons. HK children treated with methylphenidate had a significant lower digital blood flow and hyperactivity index after 1 week of drug administration than HK children on placebo and ACTH4-9 analog. Although not illustrated in Tables 3 to 5, there were no drug-weight group interactions.

Electroencephalogram, hematology, blood chemistry, and urinalysis were within normal limits prior to treatment and remained so after treatment for all three weight and drug groups.

<p>| TABLE 2. Summury description of ACTH4-9-dependent variables |</p>
<table>
<thead>
<tr>
<th>System</th>
<th>Index</th>
<th>Quantification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychometric</td>
<td>Memory for design</td>
<td>msec</td>
</tr>
<tr>
<td></td>
<td>Matching familiar figures:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>sec</td>
</tr>
<tr>
<td></td>
<td>Errors</td>
<td>errors</td>
</tr>
<tr>
<td></td>
<td>Reaction time</td>
<td>msec</td>
</tr>
<tr>
<td></td>
<td>Mean reaction time</td>
<td>cosec</td>
</tr>
<tr>
<td>Clinical</td>
<td>Conners’ rating</td>
<td>0-30 points</td>
</tr>
<tr>
<td></td>
<td>Conners’ teacher</td>
<td>0-50 points</td>
</tr>
<tr>
<td>Psychophysiology</td>
<td>Digital pulse volume (DPV) (individual range corrections):</td>
<td>Mean number of run over a period of every 10 sec during 10-min relaxation</td>
</tr>
<tr>
<td></td>
<td>( \frac{\text{DPV}_i - \text{DPV} \text{min}}{\text{DPV} \text{max} - \text{SE} \text{min}} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Skin conductance (SC) (individual range corrections):</td>
<td>Mean SC level in mho every 10 sec during 10-min relaxation</td>
</tr>
<tr>
<td></td>
<td>( \text{SC}_i - \text{SC} \text{max} - \text{SC} \text{min} )</td>
<td></td>
</tr>
</tbody>
</table>

228 JOURNAL OF CLINICAL PSYCHOPHARMACOLOGY Butter and Associates
TABLE 3. Mean electrodermal activity and digital blood flow

<table>
<thead>
<tr>
<th>Variable</th>
<th>Placebo</th>
<th>Before methylphenidate</th>
<th>ACTH&lt;sub&gt;4&lt;/sub&gt;-9</th>
<th>Placebo</th>
<th>After methylphenidate</th>
<th>ACTH&lt;sub&gt;4&lt;/sub&gt;-9</th>
<th>F&lt;sup&gt;*&lt;/sup&gt;</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital blood flow (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning</td>
<td>85.5 (9.4) &lt;sup&gt;*&lt;/sup&gt;</td>
<td>85.6 (14.4)</td>
<td>85.6 (18.1)</td>
<td>78.8 (6.7)</td>
<td>94.4 (11.0)</td>
<td>81.4 (13.4)</td>
<td>0.29</td>
<td>0.74</td>
</tr>
<tr>
<td>End</td>
<td>95.2 (8.2)</td>
<td>91.4 (11.5)</td>
<td>81.0 (18.1)</td>
<td>85.0 (7.1)</td>
<td>79.3 (23.6)</td>
<td>85.9 (12.4)</td>
<td>3.62</td>
<td>0.02*</td>
</tr>
<tr>
<td>Skin conductance (mho)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beginning</td>
<td>9.2 (2.3)</td>
<td>5.2 (3.8)</td>
<td>6.3 (2.9)</td>
<td>9.1 (2.9)</td>
<td>7.4 (5.7)</td>
<td>9.2 (3.5)</td>
<td>0.10</td>
<td>0.98</td>
</tr>
<tr>
<td>End</td>
<td>9.2 (2.4)</td>
<td>6.3 (4.8)</td>
<td>6.2 (3.4)</td>
<td>9.3 (3.1)</td>
<td>7.6 (5.4)</td>
<td>8.9 (3.9)</td>
<td>9.11</td>
<td>0.97</td>
</tr>
</tbody>
</table>

<sup>*</sup> F values of weight-drug groups repeated.
Numbers in parentheses are standard deviations.
The high standard deviation is attributable to one subject having a grossly deviant reading.
Significant between methylphenidate pre-treatment and posttreatment.

TABLE 4. Psychometric testing with the Memory for Design Test (MFD) and the Matching Familiar Figures Test (MFF) before and after treatment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Placebo</th>
<th>Before methylphenidate</th>
<th>ACTH&lt;sub&gt;4&lt;/sub&gt;-9</th>
<th>Placebo</th>
<th>After methylphenidate</th>
<th>ACTH&lt;sub&gt;4&lt;/sub&gt;-9</th>
<th>F&lt;sup&gt;*&lt;/sup&gt;</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFD</td>
<td>2.1 (1.5)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>4.9 (2.7)</td>
<td>2.7 (2.5)</td>
<td>1.9 (1.8)</td>
<td>4.7 (2.4)</td>
<td>2.53 (2.81)</td>
<td>0.39</td>
<td>0.81</td>
</tr>
<tr>
<td>MFF latency (sec)</td>
<td>7.3 (2.2)</td>
<td>8.1 (2.9)</td>
<td>8.6 (3.7)</td>
<td>11.6 (5.3)</td>
<td>8.2 (3.7)</td>
<td>7.9 (4.6)</td>
<td>0.61</td>
<td>0.65</td>
</tr>
<tr>
<td>MFF errors</td>
<td>6.8 (2.0)</td>
<td>7.8 (3.0)</td>
<td>8.2 (2.5)</td>
<td>4.8 (2.2)</td>
<td>7.5 (2.2)</td>
<td>8.3 (3.5)</td>
<td>0.08</td>
<td>0.98</td>
</tr>
<tr>
<td>MFF first trial (sec)</td>
<td>2.6 (0.23)</td>
<td>2.3 (1.5)</td>
<td>2.5 (1.03)</td>
<td>3.0 (1.0)</td>
<td>2.2 (0.56)</td>
<td>2.3 (0.78)</td>
<td>0.14</td>
<td>0.96</td>
</tr>
<tr>
<td>Mean reaction time (m/sec)</td>
<td>0.52 (0.2)</td>
<td>0.59 (0.0)</td>
<td>0.80 (0.4)</td>
<td>0.51 (0.2)</td>
<td>0.59 (0.1)</td>
<td>0.82 (0.4)</td>
<td>0.76</td>
<td>0.56</td>
</tr>
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</table>

<sup>*</sup> F values of weight-drug groups repeated.
Numbers in parentheses are standard deviations.

TABLE 5. Conners’ rating scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>Placebo</th>
<th>Before methylphenidate</th>
<th>ACTH&lt;sub&gt;4&lt;/sub&gt;-9</th>
<th>Placebo</th>
<th>After methylphenidate</th>
<th>ACTH&lt;sub&gt;4&lt;/sub&gt;-9</th>
<th>F&lt;sup&gt;*&lt;/sup&gt;</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conners’ Short Form Rating</td>
<td>17.7 (3.7)&lt;sup&gt;*&lt;/sup&gt;</td>
<td>17.0 (6.3)</td>
<td>21.7 (4.0)</td>
<td>16.4 (3.8)</td>
<td>8.4 (6.6)</td>
<td>16.7 (5.2)</td>
<td>8.10</td>
<td>0.009*</td>
</tr>
<tr>
<td>Scale (0-30 points)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conners’ Rating Scale</td>
<td>42.7 (14.2)</td>
<td>41.4 (18.3)</td>
<td>39.1 (17.1)</td>
<td>46.1 (20.6)</td>
<td>30.47 (17.3)</td>
<td>37.3 (14.7)</td>
<td>0.46</td>
<td>0.76</td>
</tr>
<tr>
<td>(0-50 points)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>*</sup> F values of weight-drug groups repeated.
Numbers in parentheses are standard deviations.
Significant between methylphenidate pretreatment and posttreatment.

Discussion

The primary purpose of the present investigation was to compare three groups of HK children on placebo, methylphenidate, and ACTH<sub>4</sub>-9 in a randomized group design. This is the first reported attempt at clarifying the effect of ACTH<sub>4</sub>-9 on behavioral, psychometric, and autonomic characteristics of hyperkinetic children. Although dosage was adjusted for weight to reflect reported effective adult dosage, this did not appear to be a significant factor in the treatment of these children.

Despite the limitations of the sample size, short time exposure, and difficulties of available psychometric instruments, these results suggest that methylphenidate produces a significantly higher pulse rate and lower skin conductance in comparison to ACTH<sub>4</sub>-9 and/or placebo. This is consistent with earlier reported findings on methylphenidate efficacy.<sup>20</sup>

Although a short-term screening study such as this one with ACTH<sub>4</sub>-9 analog does allow one to speculate that longer administration may secondarily produce improved attentional performance, the present findings do not support this at the moment.

However, an interesting observation made by the parents of three HK children on ACTH<sub>4</sub>-9 was that their children were more sociable while on the peptide. That observation was supported by a reduction in the Conners’ HK index as rated by the teachers. That is, these children were more sociable while on the peptide. That longer administration may secondarily produce improved attentional performance, the present findings do not support this at the moment.

Additionally, no physical and/or psychological side effects were reported and observed by any HK child while on ACTH<sub>4</sub>-9 analog. On the other hand, HK chil-
Bren who were on methylphenidate reported the usual side effects such as diminished appetite and difficulties in falling asleep.

The implications of these findings for future studies with ACTH analog suggest that single case studies with a time-series orientation may be more specific in detecting treatment effect. Such designs would permit a staircase increase of dosage levels over time and may thus confirm the therapeutic trends observed in these findings for other subgroups of hyperkinetics as well as for children and adults who manifest an attention deficit.

Acknowledgments

The authors wish to thank Drs. Jean-Paul Bouchard, André Côté, and Faury Pierre-Louis for clinical support; Ken Laprade, Ginette Pharan-Lefebvre, and Louise Blais for technical assistance; and R. Sawdon and N. LeQuéré for secretarial assistance. They also thank the Scientific Development Group, Organon International B.V., Oss, The Netherlands, for supplies of ACTH analog and for financial support.

References

VICISSITUDES OF FOLLOW-UP STUDIES:
Differential Effects of Parent Training and Stimulant Medication with Hyperactives

Philip Firestone, Ph.D., David Crowe, Ph.D., John T. Goodman, Ph.D.,
Patrick McGrath, Ph.D.

A two-year outcome study of 73 hyperactive children supports both previous short-term studies which suggested that stimulant medication is superior to parent training and long-term studies which found no differences between the two interventions. The discrepancy is discussed in light of complications that inevitably arise in outcome studies and that tend to preclude meaningful outcomes in long-term studies. The development of new research strategies is called for.

Despite the fact that hyperactivity is one of the most common behavior disorders of childhood, there are relatively few outcome studies reported in the literature. Problems associated with subject selection, subject attrition, and the cost of intervention are primary factors in this deficit. Nevertheless, the last few years have seen reports of several meaningful intervention studies.

Perhaps it is because of difficulties and costs associated with the more behaviorally or psychologically oriented interventions that stimulant medication became the most widely used treatment for hyperactive children in the 1960s and 1970s. However, despite the fact that stimulant medication has been demonstrated to have positive effects on the deficits of hyperactive children in the short-term, several problems are associated with its use. Approximately 25% of hyperactive children do not respond or respond adversely to stimulant medication and there is little or no indication that medication aids academic progress. Finally, long-term investigations have not been able to replicate the dramatic benefits of medication evidenced in short-term studies.

Behavioral interventions have also shown some success in ameliorating various aspects of the behavioral problems associated with hyperactivity. As a result there have been a few reports

A revised version of a paper submitted to the Journal in January 1985. Research was supported by grants DM-304 and DM-425 from the Ontario Ministry of Health. Authors are at: School of Psychology, University of Ottawa (Firestone); Queensway-Carleton Hospital (Crowe); and Department of Psychology, Children's Hospital of Eastern Ontario (Goodman, McGrath).
of group studies comparing the effectiveness of stimulant medication and behavioral interventions with hyperactives. In general, the results suggest that, on a short-term basis, the use of stimulant medication alone is more effective than behavioral interventions alone in improving classroom and social behavior and attentional deficits of hyperactive children. When the goal of treatment is improved academic performance, behavioral intervention is superior to stimulant medication, at least in special research classrooms. However, data concerning generalization and long-term benefits are lacking.

Firestone reported the results of a three-month intervention study comparing stimulant medication alone, stimulant medication plus parents trained in behavior modification, and placebo plus parent training. Like the previous research in this area, stimulant medication resulted in greater improvement in classroom behavior, attention, and impulse control when compared to parent training. Unlike the previous work, improvement in some aspect of academic achievement was also reported. In short, there was no evidence of significant benefit from the addition of parent training to stimulant medication. The present report extends the prior study by extending follow-up of the cohort to two years. Before a description of the method and presentation of the results is undertaken, consideration must be given to one of the most problematic areas in therapy outcome research, namely, attrition. The relative significance of lost subjects with respect to the overall results of an outcome study is often ignored and this has become increasingly more problematic in the interpretation of long-term results. Researchers often fail to report the number of subjects solicited for an experiment and how many refused to participate. Many reports can also be faulted for not presenting data on the number of subjects who drop out once they agree to participate in a study and the reasons for this attrition. In the present study, for example, there are 73 subjects in the pre-post analysis, but only 30 subjects are considered for the two-year follow-up analysis. This is a loss of 43 subjects, more than half the initial sample. Only 19 of these children lacked second follow-up data because of staggered entry into the study (i.e., they did not make it to the second-year mark by the time of this reporting). Only two children were lost because their families relocated during the course of the project. Thus, of the "lost" 43 subjects, only 21 (19+2) actually lacked two-year follow-up data. There were 22 children who remained in the study throughout, but whose data are not considered because of movement from their original experimental condition. These children were either placed on or removed from medication according to their treatment progress after the initial pre-post period. In essence, the reality of the child as a patient superseded the child's role as a subject. In many cases, children's treatment programs were modified a number of times in an attempt to provide optimal benefit. Clinicians recognize this as more typical of actual treatment conditions than the discrete treatment categories usually reported in the literature.

In the present report of results, only one such "switch" group was included. These were subjects who were put on medication as a result of very poor progress with parent-training plus placebo. The number of subjects in this group varies from seven at pre-post analysis to five at two-year follow-up. Thus, their inclusion is primarily for heuristic purposes.
Another problematic group of subjects in terms of design, analyses, and interpretation are the dropouts. These individuals dropped out before the post-testing (three months). Their reasons varied and included parents agreeing to participate in the study in order to obtain an assessment of their child and parents being opposed to the treatment of their children with medication. In the present study, this category includes 61 subjects, all of whom participated in the pretest but who for one reason or another, did not participate in the actual program. As well, there were 20 subjects who had been referred to the program, but who, upon initial contact, declined even the pre-test. It was not possible to ascertain the characteristics of these families in any systematic fashion, although anecdotal evidence revealed that a frequent comment from parents reflected the general theme of "It's not what I thought it would be."

In total, therefore, 154 families (73+61+20) had initially accepted the referral to the research program. Of these, 134 families (73+61) participated in the pretest: Only 73 families actually carried through to post-treatment assessments. Of the 73, only 52 families have two-year follow-up data; of those 52, only 30 are considered in the analysis at the two-year follow-up. In other words, 22% of the initial sample survived the two-year study in their assigned treatment conditions. The comparable figure for the pre-post analysis is 54% (73 of 134). It is proposed that subject attrition in the present study would not be dissimilar to that in other work with hyperactives, but for various reasons this information has often not been reported, resulting in misleading information or interpretations.

It should be noted that in the Province of Ontario, like the rest of Canada, the cost of medical services and psychological services provided within medical settings is fully covered by the provincial health care plan. One might speculate that results with "patient-subjects" who receive payment for participation in research, or "patient-subjects" who are required to pay for services, might differ from those reported here.

METHOD

Subjects

Children between the ages of five and nine years, referred to the learning, psychiatry, or psychology outpatient services of the Children's Hospital of Eastern Ontario, were considered for participation in the study. Each child was referred by a physician who suggested a diagnosis of hyperactivity and each was judged by a clinical psychologist to fit the DSM-III criteria for Attention Deficit Disorder with Hyperactivity. All subjects demonstrated these symptoms of hyperactivity, both at home and at school and before three years of age. Additionally, only those children with a rating of 1.5 or higher on the Teachers Hyperactivity Index were included. Each child was required to have a Peabody Picture Vocabulary IQ of 85 or higher, and all children who showed definite signs of brain damage, epilepsy, or psychosis were excluded from the sample. There was a total of 73 subjects for the pre-post analysis, 52 for first follow-up analysis, and 30 for the second follow-up analysis.

Procedure

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 regarding methylphenidate. Further appointments for data collection and obtaining signed informed consent were scheduled once
the family agreed to participate. Following an initial pretesting, children were randomly assigned to one of three groups: parent training plus medication (PTMED), parent training plus placebo (PTPL), or medication only (MED). The placebo was identical in size, color, and shape to the methylphenidate used in the study. None of the pertinent research staff (therapists and those testing the children), parents, or teachers was aware of the medication conditions during the pre-post period.

All intervention was carried out by senior doctoral-level interns in clinical psychology, supervised by registered psychologists. Parents of children in the parent training groups (PTMED and PTPL) were provided with initial consultations averaging three sessions. During this time, they were asked to read a book on child management and demonstrate a reasonable understanding of the behavioral principles contained therein. Having completed this, they were asked to join a parents' group in which more specific child-rearing behavior management programs were discussed for six sessions. Finally, the parents were taught how to cooperate efficiently with school personnel. In addition, two consultations were provided to the teachers involved.

Only those parents of children in the MED group were not told of the parent training groups and not provided with behavioral consultations. All parents were given the same instructions regarding medication. Medication regimens began just prior to the initiation of the group meetings. Parents were instructed to give their children medication 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 of children's behavior by telephone over a three to four week period. Once having established an optimal dosage for a particular child (decrease in problematic behavior and absence of negative side effects), children were given medication only on school days. The average dosage of methylphenidate was 22 mg/day with a minimum of 10 mg and a maximum of 30 mg.

Predictor Variables

The predictor variables were separated into treatment, familial, and subject categories. The treatment categories consisted of PTMED, PTPL, and MED. The familial categories included total family income plus, for each parent, age, IQ (WAIS), educational level, Locke-Wallace Marital Adjustment Score, and the MMPI Psychopathology Index. The child categories were age at referral, IQ, mean reaction time, total impulsive responses, school performance, Hyperactivity Index, and the Conduct Problem factor of the Quay-Peterson Questionnaire. In fact, a greater number of subjects was anticipated at the beginning of the study; this would have rendered the data more amenable to stepwise multiple regression and discriminant function analyses. While these statistics are available, they are not reported here due to the small sample size.

Criterion Variables

In order to decrease the number of dependent measures, given the modest number of subjects available, the criterion variables were chosen a priori based upon theoretical considerations. The variables selected were: mean reaction time, total impulsive responses, school performance, Hyperactivity Index, and Conduct Problem—all at follow-up. There are three follow-up periods in question: post-test (three months); first follow-up (10–12
months), and second follow-up (22-24 months).

Mean reaction time (XRT) was measured using the delayed reaction time apparatus previously shown to discriminate between hyperactive and normal children. This provides two measures: mean reaction time and total impulsive responses. School performance was measured by the Gates-MacGinitie Reading Test Vocabulary Grade (GMVG). Hyperactivity was measured by the Hyperactivity Index, from the Conners Rating Scale for teachers. The conduct problem factor was taken from the Peterson-Quay Behavior Problem Checklist.

RESULTS

Statistical comparison of treatment groups was accomplished through analysis of variance with repeated measures. The level of significance for all statistical analyses was set at .05 or less and all significant analyses of variance (ANOVAs) were further analyzed using Tukey's procedure. Total impulsive responses was excluded from the present analysis, however, as it was the only criterion which failed to meet the assumption of equal correlations (based on the Box's M statistic). As stated earlier, multiple regression and discriminant function analyses are not presented in this paper, although significant findings were not in evidence for predictions.

In Table I, the group means and standard deviations for pre-post results are described with regard to the Hyperactivity Index. Analysis of variance with repeated measures revealed a significant effect only on the Condition x Time interaction at post-test F(2,70)=4.71, p<.05. Tukey's procedure indicated that while there was no significant difference between the performance of the two medication groups, both these groups differed significantly (i.e., more improved) from the placebo group. Similar results were found for Conduct Problem and Reaction Time at post-test, with significant Condition x Time interactions F(2,69)=3.21, p<.05 and F(2,70)=3.93, p<.05, respectively. In both cases, Tukey's test indicated that children in the two medication groups performed significantly better than children in the placebo group.

With the Gates-MacGinitie verbal

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>PRE-TEST</th>
<th>POST-TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD (N)</td>
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<tr>
<td>Hyperactivity Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MED</td>
<td>1.96</td>
<td>.37 (30)</td>
</tr>
<tr>
<td>PTPL</td>
<td>1.93</td>
<td>.35 (21)</td>
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<td>PTMED</td>
<td>1.85</td>
<td>.31 (22)</td>
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<tr>
<td>Conduct Problem</td>
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<tr>
<td>MED</td>
<td>9.50</td>
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<td>PTPL</td>
<td>9.57</td>
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<td>PTPL</td>
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<tr>
<td>MED</td>
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<tr>
<td>PTPL</td>
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<td>2.27 (20)</td>
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*p<.05.
grade score, however, there were no significant changes or between-group differences at post-testing. It is evident, as with each of the other criteria, that within-groups changes remain significant throughout the follow-up period. This is not a remarkable finding considering that grade level can be expected to improve to some degree with the child’s attendance at school.

The data for subjects remaining in the study through the first follow-up are presented in Table 2 and those remaining for the second follow-up in Table 3. The treatment groups did not differ in their two-year rate of attrition (40%, 38%, and 45%, respectively, for MED, PTPL, and PTMED). Although demographic and dependent variables might have been analyzed to examine whether certain characteristics might distinguish the group with respect to those who did not terminate their participation, the small Ns prohibit any meaningful comparisons. Clinical experience would suggest, for example, that both symptom amelioration (e.g., success on medication) and symptom deterioration (e.g., failure to respond to parent training) might account for patients electing to discontinue treatment.

There was no statistical evidence of long-term difference among the three groups. Nevertheless, the progress of

### Table 2

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**FIRST FOLLOW-UP**

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</table>

Each of the groups throughout the study is illustrated in Figures 1-4. The progress of a fourth group is also plotted. This is the placebo-changed-to-medication group (PTPL-to-PTMED), which represents all subjects who were changed from their original PTPL condition after the post-tests were administered (N=7 at post-test; N=5 at second follow-up). What appears in each of these figures, therefore, are the separate plots for the "pure" groups (i.e., those groups comprising subjects who remained in their original condition throughout the study). It should be mentioned that when the data from these pure groups are subjected to analyses of variance with repeated measures at the three-month post-testing, all previous significant comparisons vanish. Based on the pure groups alone, there is no evidence even for a short-term advantage for children treated with medication. It is possible, however, that the loss in degrees of freedom on the pure group pre-post ANOVA may account, at least in part, for the failure to find significant differences among treatment groups. The eta² coefficients for the total group (N=73) on the interaction term in the analyses for TCHI, TPQCP, and XRT are .13, .11, and .10, respectively. The coefficients for the same analysis on pure groups alone,
however, are considerably smaller at .03, .03, and .005, respectively. It is evident, therefore, that the magnitude of treatment effect has been reduced considerably in the pure group comparisons. In any event, changes in a child's experimental group were made because of very poor clinical progress by children which necessitated a change in treatment. It is of interest to note with regard to the Hyperactivity Index (FIGURE 1) that this poor progress resulted in a mean rating at three-month post-test of 1.60 in the "change group compared with means in MED, PTPL, and PTMED of 0.98, 1.20, and 0.88, respectively. It was at this point that the change from placebo to medication was made and from this point the change group showed dramatic improvement, with a mean rating of 1.05 at first follow-up compared with a mean rating of 1.27 for the PTPL group. One might speculate that, had the three original groups been held steadfast in their as-signed conditions, the differences found at post-test may have endured through first follow-up. On the other hand, it is evident that the switch to medication was of some benefit to the change-group children, judging by the slope of their progress not only on the Hyperactivity Index but on each of the other criteria as well. Moreover, the benefit appears to be quite stable insofar as the improvement in the change group seems to surpass the performance of the three original groups on each of the criteria. The specific analyses of the Conduct Problem and Reaction Time data are similar to those already presented for the Hyperactivity Index. The progress of the groups on these measures is presented in FIGURES 2-4.

The issues raised by consideration of these data relate more to the decision as to which data most accurately reflect the clinical phenomena. For example, analyses of variance on pure groups only at post-test reveal no differences. On the other hand, it is evident that had subjects been confined to their original treatment, differences would be found not only at three-month post-test but likely at later follow-ups as well. Furthermore, there is the curious but evi-
dently consistent performance of at least one of the groups of children (PTPL-to-PTMED) that were switched out of the planned experimental design. On the basis of simple ANOVAs they showed no pretest differences compared to the PTPL group except for greater difficulties of inattention. (This analysis is not presented due to the small N and limited space.)

DISCUSSION

There are a number of important considerations arising from the present study. In the first place, the pre-post results of the 73 subjects who participated in the study essentially replicate the findings reported by Firestone, and those reported by Gittelman-Klein. The only exception is that the present study did not find improved academic performance in the medication group, which suggests that this finding in the original study was probably spurious. There is little doubt, on the basis of these reports, that stimulant medication offers effective short-term amelioration for problems of attention, behavioral disturbance, and hyperactivity for certain children. Having said that, however, there are some mitigating elements in this present report. For example, when the pre-post comparisons are made with only those subjects remaining in their assigned treatment conditions throughout the study, eliminating dropouts and subjects who changed conditions, the pre-post differences vanish. This is, of course, also true for the pure groups at two-year follow-up. This raises perhaps the most important consideration for further study. It is evident from the present research that analyses of dropouts and subjects who change experimental conditions are crucial to an overall understanding of the interaction between treatment and outcome. For example, had the Gittelman-Klein study extended its data collection several months, it might well have found a similar phenomenon insofar as retroactive comparisons of pure groups may have failed to support the findings of the short-term investigation. The fact that, in the present
study, only 22% of the initial sample is considered at two-year follow-up does not answer the question as to the meaningfulness of the other 78%, the majority of whom were dropouts before the post-test. It is additionally important to note that, whatever the possible outcomes with full participation and full adherence, there is a characteristic of the 22% that is not easily integrated with the outcome data, except for its acknowledgment, and that is their "decision" to remain in the program and whatever motivation or perseverance that might reflect.

A final consideration from the present study is the analysis of the "change" group. Subjects in this group showed consistent improvement throughout the study once they were placed on medication, having been removed from the parent-training-plus-placebo group. Their only pre-test difference from the other subjects in the placebo group was on the measure of attention. One might speculate as to the possibility of retrieving evidence from unwieldy outcome data which could support post-facto hypotheses. In this case, it might be argued that the change group represents more homogeneous "true" or "constitutional" hyperactives that might be more accurately diagnosed if better diagnostic criteria were available. These data may also lead to the interpretation that to maximize medication responsiveness in a group of hyperactive children, medication should only be prescribed after behavioral intervention is shown ineffective.

In conclusion, it is clear that the results reported by others with respect to short-term outcome studies comparing stimulant medication and behavioral parent training are supported by the present results. Stimulant medication alone leads to improved attention and behavior, with parent training adding little in
terms of the dependent measures. In addition, the long-term outcome results of the present study also support the bulk of previous reports suggesting no long-term benefit of stimulant medication on the major deficits of the hyperactive child. However, a finer analysis of the events transpiring during the long term, in the present study, provides meaningful data concerning all long-term outcome research. It appears evident that dropout data and information concerning children who change from the experimentally assigned conditions are essential to understanding clinical phenomena. Presentation of this information is a necessary component of outcome studies. Furthermore, the strict analysis of criteria evidence vis-a-vis a priori hypotheses in intervention studies may inappropriately confine outcome results. The development by scientific journals of new conventions concerning research design, statistical analyses, and publication criteria is necessary if intervention research is to continue developing. For example, perhaps more details should be required concerning subject selection, refusal to participate, and dropouts throughout the duration of a study. In addition, descriptive data on small groups of subjects who may have violated experimental procedures, under supervision of investigators, may provide useful insights and might be included for heuristic purposes. As well, the prediction of dropouts and of those who are likely to require a change in treatment regimen (via discriminant function analysis, for example) may be quite informative, particularly if research protocols are sufficiently similar to allow for the pooling of data.

REFERENCES
1. BACKMAN, J. AND FIRESTONE, P. 1979. A review of psychopharmacological and behav-
ATTENTION AND IMPULSIVITY CHARACTERISTICS OF THE BIOLOGICAL AND ADOPTIVE PARENTS OF HYPERACTIVE AND NORMAL CONTROL CHILDREN

Jody Alberts-Corush, Ph.D., Philip Firestone, Ph.D., John T. Goodman, Ph.D.

On tests comparing 176 biological and adoptive parents of hyperactive and normal control children, biological parents of hyperactives evidenced more attentional difficulties, slower mean reaction times, and fewer correct recognitions than did the other parents. They showed no significant differences in impulsivity. A familial association between childhood hyperactivity and attentional deficits in the biological parents was suggested, as was the persistence of attentional difficulties as compared to impulse control problems.

Hyperactivity is a leading cause of child clinical referrals, accounting for approximately one-third of all diagnosed psychiatric disorders in school age children. Studies of the incidence of hyperactivity in the general population is variably estimated to range from 3% to 10%. Although physical overactivity has historically been identified as the major component of hyperactivity, the recent diagnostic category revisions in the DSM-III indicate a shift in viewpoint from overactivity to a disorder of attention as the most central factor in the disorder.

As Whalen aptly pointed out, it is no longer necessary to prove that hyperactivity exists. Nevertheless, despite the general acceptance of the reality of
hyperactivity as a clinical phenomenon, relatively little is known of its etiological roots although recent theories have focused on biologically-based factors. Of particular interest to the present investigation has been the work on family morbidity and risk. Several papers have reported a higher incidence of psychopathology in the parents of hyperactive children when compared with control groups. When the parents of hyperactive children were compared to the parents of psychiatric out-patient children, a higher incidence of antisocial personality and hysteria was found in the former than in the latter group. Both groups appeared to have a higher than normal incidence of alcoholism and the parents of the psychiatric
population evidenced a higher incidence of schizophrenia and schizophreniform psychoses than the parents of hyperactives.26

In support of a genetic hypothesis to explain the higher incidence of psychopathology in the parents of hyperactives as compared to controls, several adoption studies have found support for a greater frequency of disorders in the biological parents of hyperactive children when compared to the adoptive parents of hyperactives.2,28,3 Finally, further but limited support for a genetic etiology for hyperactivity has been presented by Lopez,27 whose study of ten sets of twins found a 100% concordance rate for hyperactivity in the monozygotic pairs and only a 17% concordance in the dizygotic pairs.

In addition to the family risk studies, research concern as to the course and long-term prognosis of hyperactivity into adolescence and adulthood has served to broaden the area of study of this complex disorder. The findings of an increasing number of prospective longitudinal studies since 1970 indicate that while the problems of physical overactivity and distractibility evidence some improvement, the attentional deficits and impulse control problems endure into adolescence and adulthood.6,9,4 Impulsive and immature-dependent personality disorders have been reported to be more frequently diagnosed in hyperactives than in controls.9 Independent investigators examining other areas of psychopathology have retrospectively linked adult impulse and personality disorders with childhood hyperactivity.12,33 The recent studies suggest that there is a chronic, developmental component to hyperactivity. Moreover, the findings raise important questions regarding the role that familial and environmental factors may play in the psychosocial outcome in hyperactive teenagers and adults.

Reviews by Dubey10 and McMahon23 have pointed out several flaws in the family risk research, including poor diagnostic procedures for the populations being studied, lack of homogeneity of the groups, poor sampling procedures, lack of "blindness" as to diagnostic groups being studied by the investigators, and the lack of well-known standardized assessment tools in the measurement of the psychological characteristics in question. Despite these criticisms, the large number of studies involved strongly suggests a familial association for hyperactivity in which genetic factors are of major importance.

In the present study more empirical measures of psychological functioning were utilized in an attempt to answer one major question: do the parents of hyperactive children show the same cognitive deficits as the hyperactive children? In order to answer this, the biological and adopted parents of hyperactives and normal controls were set the experimental tasks on which hyperactives have demonstrated poor performance—namely, those related to attention and impulse control.

METHOD

Subjects

Forty-three hyperactive children and their families participated in the study. The children were selected from the files of the department of psychology of the Children's Hospital of Eastern Ontario (CHEO) in Ottawa. Twenty-five were the biological offspring of the parents under investigation and 18 were adopted before six months of age. The children were required to meet the following criteria for the study: 1) having been referred by a pediatrician who suspected hyperactivity; 2) having...
diagnosed as hyperactive by a registered psychologist (PF) in accordance with DSM-III criteria for Attention Deficit Disorder with Hyperactivity; 3) having received a Conners's Teacher Hyperactivity Index (HI) score of 1.5 or higher on the teachers' rating scale.'

A total of 25 biological and 20 adopted normal-control children and their parents participated in the study. The 25 biological and two of the adopted normal controls were selected from the medical records of CHEO. After the identification and acceptance of participation by the parents of the hyperactive index case, the name of a prospective normal control child was drawn from the next medical record to occur chronologically after that of the hyperactive child. Another 18 adopted normal controls were solicited through an advertisement in the local newspapers. These children met the following criteria: 1) no history of learning or behavior problems; 2) no history of psychotropic medication; 3) no hospitalization for more than one four-day period during the previous 36 months; 4) Conners's Teachers' Hyperactivity Index less than 1.0; 5) Peabody Picture Vocabulary Test (PPVT) IQ at least 85. The subjects in the study were the 176 (88 sets) biological and adoptive parents of these children. The parenting couples had maintained intact relationships from the time of birth or adoption at six months of age or earlier. Adoptions by biological relatives were excluded.

Rating Scales

Shipley Institute of Living Scale. This scale was originally devised as a measure of organic pathology and cognitive deterioration but is presently used as a brief screening measure of the subject's current level of intellectual functioning. Several investigators have found correlations between the Shipley Scale and
the full-scale WAIS score to range from .78 to .90.

**Porteus Maze Test.** The test was originally developed as a supplement to the Stanford-Binet Intelligence Scale in identifying mental retardation. More recently, it has been reported to be a valid and reliable measure of planning ability, judgment, impulsiveness, attention, and ability to delay gratification. In a discriminant analysis of 27 measures frequently used to distinguish between hyperactive and normal control children, Homatidis and Konstantareas found that the Porteus Maze Test was one of only three measures needed to discriminate accurately between their sample of hyperactive and normal control boys. An automated version of the Porteus Maze Test was used in the investigation. The instrument automatically recorded three scores: the number and duration of contacts with the sides of the maze pathway, and the total time to the completion of the maze.

**Span of Apprehension.** The Span of Apprehension is a task which measures the amount of information that can be simultaneously processed during a brief visual presentation. Based on early signal detection procedures, Estes developed a measure that taps the variability of attention span. The task was designed to minimize the effects of memory or motivational influences. The subject is required to make a forced-choice letter recognition response to one of two signal letters (i.e., the letter T or F) upon a tachistoscopic exposure of short duration.

The Span of Apprehension Task has frequently been used in research with schizophrenic children and adults. Neale and his coworkers asserted that the reduction in correct detections on the Span task represents a true deficit in attention. Recently, Denton found differences between hyperactive and normal control
boys on the Span test. In the present study, the target stimuli were embedded in arrays containing either 0, 4, or 8 additional irrelevant letters (i.e., matrices of 1, 5, or 9 letters).

Reaction Time Apparatus. The delayed reaction time task (DRT) has often been used as a measure of attentional processes. The task has been found to discriminate between hyperactive and normal children\(^4\) as well as to be drug-sensitive\(^2\) (see Firestone\(^6\) for a full description). This task results in two dependent measures. The first is of mean reaction time (RT) measured in milliseconds. The second is of unnecessary responses to the various stimuli; these are recorded and designated Extraneous Responses (RTEXT).

Procedures

Following the telephone contact and the family's acceptance of involvement in the study, a Conners's Teachers' Rating Scale was sent to the index child's teacher for completion and return. After the rating scale was returned and an appropriate hyperactivity criterion was achieved, the parents were contacted to arrange an appointment at their family's convenience.

Each hyperactive and normal control index child was tested alone in a small room free of extraneous visual and auditory stimuli. The PPVT was administered in one period of approximately 15 minutes. The parents were tested separately with a battery of five tests. These were presented in random order for each partner, all five in a single session of approximately two hours. All tests were administered in accordance with standard instructions.

RESULTS

Analyses of variance (ANOVAs) significant at .05 or less were followed by tests of simple effects. The analyses revealed significant differences between the groups on the PPVT 'and the HI, \(F(1,84) = 5.21, p<.03\), and \(F(1,84) = 7.57.27, p<.001\) respectively (TABLE 1). The results indicated that the normal control children had higher IQs than the hyperactives and, not surprisingly, the hyperactive children were rated as more hyperactive. -There was no difference between the groups on the age factor.

Demographic Variables

The ANOVAs on the demographic variables (TABLE 2) revealed that the adoptive parents as a group were older than the biological parents, \(F(1, 168) = 26.92, p<.001\), and that mothers were younger than fathers, \(F(1,168)=4.27, p<.04\).

---

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<th>VARIABLE</th>
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<th>ADOPTED HYPERACTIVE CHILDREN</th>
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Standard Deviations are given in parentheses.
Table 2

MOTHERS’ AND FATHERS’ GROUP MEANS AND STANDARD DEVIATIONS FOR AGE, IQ, AND LEVEL OF EDUCATION

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<td>12 (12.69)</td>
<td>10 (10.61)</td>
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BH: Biological parents of hyperactive children (N=25) AH: Adoptive parents of hyperactive children (N=18)
BC: Biological parents of normal control children (N=25) AC: Adoptive parents of normal control children (N=20)
Standard Deviations are given in parentheses.

The analyses of the IQs revealed a significant Group x Relationship interaction, F(1,68)=4.81, p <.03. Results of the simple main effects analyses indicated that the biological parents of hyperactive children (BH) had lower IQs than the adoptive parents of hyperactive children (AH) and the biological parents of normal control children (BC). No IQ differences were found between the adoptive parents of normal control children (AC) and the AH group or between the AC and BC groups. In addition, there was a significant main effect for Sex, indicating that fathers obtained higher IQ scores than mothers, F(1,168)=5.58, p<.02. Correlational analyses were undertaken and several correlations, all low, were found to exist between the demographic and the attention variables, ranging from r=.17 to r=.28, irrespective of sign. The amount of variance shared in common between any combination of demographic and dependent measure was also low, ranging from r²=.03 to r²=.06. Keppel has proposed that "the main criterion for a control variable is a high correlation with the independent variable." Similarly, Winer has cautioned about the employment of co-variates in factorial designs. Because the correlations between the dependent variables and the demographic variables were so low and the shared variance so small, it was decided that analysis of variance would be the preferred procedure.
Dependent Measures

A MANOVA was conducted on the five attention variables resulting in a significant Group effect $F(5,164)=8.03$, $p<.1$; Relation effect $F(5,164)=3.56$, $p<.004$; Sex effect $F(5,164)=2.90$, $p<.2$; and Group x Relation interaction $F(5,164)=3.77$, $p<.003$. Therefore, 2 x 2 x 2 ANOVAS were undertaken for each attention variable. TABLE 3 contains the scores on the DRT and Span Apprehension tasks.

ANOVAS on the RT achieved significance for Group $F(1,168)=28.61$, $p<.001$; for Relation $F(1,168)=8.24$, $p<.01$; and for Sex $F(1,168)=11.88$, $p<.001$; and on the Group x Relation interaction $F(1,168)=9.88$, $p<.002$. The tests of simple main effects revealed the BH had slower mean reaction time than
the AH and the BC. No differences in reaction time were found between the AC and the BC or between the AC and the AH groups (FIGURE 1). In addition, mothers had slower mean reaction times than fathers. The analyses of the RTE and Span Size 1 yielded no statistically significant effects.

The ANOVA on Span Size 5 (FIGURE 2) indicated statistically significant differences for Group F(1,168)=4.21, p<.04 and on the Group x Relation interaction F(1,168)=6.44, p<.01. Tests for simple main effects revealed that the BH had fewer correct recognitions than the BC and the AH. The AC were not different from the BC and the AH.

The Span Size 9 ANOVA (FIGURE 3) produced a significant Group effect F(1,168)=13.32, p<.001; a significant

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>BH</th>
<th>AH</th>
<th>BC</th>
<th>AC</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>RT</td>
<td>367.50</td>
<td>306.92</td>
<td>306.08</td>
<td>295.19</td>
<td></td>
</tr>
<tr>
<td>Mothers</td>
<td>(59.04)*</td>
<td>(40.56)</td>
<td>(44.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathers</td>
<td>328.57</td>
<td>270.62</td>
<td>284.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(54.72)</td>
<td>(38.26)</td>
<td>(33.18)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Span Size 1 |          |          |        |       |
| Mothers     | 29.96    | 29.89    | 30.00  | 29.90  |
|            | (.20)    | (.32)    | (.00)  | (.31)  |
| Fathers     | 29.96    | 30.00    | 29.96  | 29.95  |
|            | (.20)    | (.00)    | (.20)  | (.22)  |

| Span Size 5 |          |          |        |       |
| Mothers     | 29.28    | 29.83    | 29.76  | 29.70  |
|            | (94)     | (34)     | (60)   | (80)   |
| Fathers     | 29.28    | 29.78    | 29.84  | 29.70  |
|            | (1.28)   | (55)     | (.63)  | (.80)  |

RH TEXT

| Mothers     | 2.92     | 2.22     | 2.04   | 2.20   |
|            | (2.78)   | (1.83)   | (2.13) | (2.29) |
| Fathers     | 2.56     | 2.58     | 2.24   | 2.35   |
|            | (2.57)   | (2.36)   | (2.07) | (1.93) |

Table 3
MOTHERS AND FATHERS GROUP MEANS AND STANDARD DEVIATIONS FOR THE FIVE ATTENTION VARIABLES

BH: Biological parents of hyperactive children (N=25) AH:
Adoptive parents of hyperactive children (N=18)
BC: Biological parents of normal control children (N=25) AC:
Adoptive parents of normal control children (N=20) Standard Deviations are given in parentheses.
Relation effect \( F(1,168)=7.02, p<.01 \); and a significant Group x Relation interaction \( F(1,168)=9.96, p<.002 \). Results of the tests of simple main effects indicated that the BH had fewer correct recognitions on Span Size 9 than the BC and the AH. No differences in correct recognitions on Span Size 9 were found between the AH and the AC or between the AC and the BC.

A MANOVA conducted on the impulsivity variables of the Porteus Maze Test proved to be nonsignificant and consequently no further analyses were conducted.

**DISCUSSION**

The results of the present study provide strong evidence for a familial association between childhood hyperactivity and attentional deficits in the biological parents of hyperactive children. As anticipated, the biological parents of hyperactive children exhibited more attentional difficulties than

the other groups of parents as reflected by slower mean reaction times on the DRT task and fewer correct recognitions with increasing matrix size on the Span of Apprehension Task. In addition, it was confirmed that the adoptive parents of normal controls did not differ from the adoptive parents of hyperactives or the biological parents of controls on these attention measures. The hypothesis of greater impulsivity, as measured by the Maze test, in the biological parents of hyperactive children was not confirmed.

The demographic variables also yielded interesting findings. The biological parents of children were found to be significantly younger than the adoptive parents. Thus may be explained by the fact that adoptive parents often have spent time trying to conceive their own child and then have to undergo a lengthy screening process by adoption
agencies. Mothers in general were also found to be younger than fathers and this has been reported in family studies by other workers.24, 28

The biological parents of hyperactive children obtained significantly lower scores on intellectual functioning and completed fewer years of education than the other parental groups. Level of education in this study was found to correlate highly and positively with the Paulson-Lin IQ estimates of the Shipley Institute of Living Scale (r=.62, r^2=.38). The high degree of interdependence suggests that these two demographic variables are probably measuring aspects of the same factor or factors. The total sample of parents was found to obtain an above average, relatively narrow range of scores of intellectual functioning. While the scores of the biological parents of hyperactive children fell at the upper end of the average range of intelligence, the parents in the three comparison groups obtained scores in the high average range of intelligence. Although no significant difference was found among the groups with respect to total family income, the biological parents appeared to have a somewhat lower family income than the other parent groups. It is noteworthy, however, that the mean ($27,850) of the biological parents of hyperactive children is comparable to the combined family income ($28,290) for the Ottawa-Carleton metropolitan area reported by Statistics Canada (Bulletin Number 13207, 1980). The IQ and educational—differences reported in this study may be explained in terms of the different sample solicitation procedures employed, as well by type of parental relationship and differences in utilizing medical facilities. Miller and Keirn24 reported similar findings in educational levels of parents of mentally retarded and emotionally disturbed children compared with parents of non-clinic control children.

Comparing the accepting and the invited samples who met the previously defined inclusion criteria, 25 of the 32 (approximately 78%) invited biological parents of hyperactive children (drawn exclusively from an assessment and treatment program of the CHEO department of psychology) agreed to participate. In contrast, the biological parents of normal controls were selected solely from the medical records department of CHEO; their acceptance rate was 25 out of 65 (approximately 39%) of those invited. A high proportion of adoptive families participated in the study: 18 of the 20 (90%) adoptive families of hyperactives and 20 of the 33 (61%) adoptive families of normal controls agreed to participate. The adoptive parents of hyperactive children were selected predominantly from the assessment files of the department of psy-
chology (i.e., 17 adoptive families of hyperactives, with one adoptive family selected from response to media advertisement). The adoptive parents of control children were mainly selected from response to media advertisement (i.e., 18 adoptive control families, with two adoptive controls selected from the medical records department. It may be that of families with non-clinic children contacted to participate in a psychological study, greater curiosity and voluntary involvement was shown by the control group population who had completed more formal education. In the adoptive population, parents who have made a personal commitment and emotional investment in adoption and parents who already have close involvement in a treatment program for their child may be more motivated to participate voluntarily in a study. Adoption agencies may also tend to place children with couples who are older as well as with those who have more education.

The sex differences with respect to education and IQ may be linked with a systematic bias due to assortative mating whereby husbands are not only older but more educated. Another explanation of the mothers' lower IQ scores may be their lesser education and test-taking experience.

In general, there is a concern about the effect of pre-test family differences with respect to IQ and educational level in the groups. ANOVAs were undertaken in view of the factorial design of the study. As a point of interest, however, analyses of covariance were performed on the dependent measures, incorporating years of education and IQ as covariates. The separate ANACOVAs yielded similar results, at the .05 level of confidence based on a two-tailed test, insofar as the biological parents of hyperactives exhibited slower mean reaction times on the DRT task and...
made fewer correct recognitions on matrices of five and nine letters on the Span task. However, it is presently unclear as to whether the IQ and educational differences may be the cause or the outcome of the attentional finding. Other studies have reported that hyperactive children obtain lower IQ scores than control children. Minde and co-workers' reported that although hyperactive adolescents did not differ from controls with respect to IQ scores derived from individually administered tests, the hyperactives had lower scores on a group IQ test, suggesting no differences in intellectual functioning per se. Furthermore, this suggests that hyperactive subjects may do better in one-to-one, interactive situations where attentional processes may be better monitored. This, then, is a possible explanation of the poorer performances of the biological parents of hyperactive children in the present study on an independent, form-administered intellectual test with little active monitoring of attentional processes. Follow-up studies have suggested that the persistence of attentional and stimulus-processing deficits may, in part, explain the poorer academic classroom functioning of hyperactive adolescents.

The performance of the parents of hyperactive children on the measures of attention duplicate in essence the findings of numerous studies with hyperactive children. On three of four measures of attention, the biological parents of the hyperactives performed significantly more poorly than the other parents. They evidenced 15% slower mean reaction times on the DRT task and achieved fewer correct recognitions on the Span tasks for matrix sizes of five and nine letters, although not for that of one letter. (Interestingly, the mothers in the present study were found to be consistently slower than the fathers, suggest-
persists into adulthood. Their extraneous responses on the DRT task and on the Porteus maze test, which are often seen as measures of impulsivity, were not significantly different from other parents’ responses, although the results were in the expected direction. This may be reflective of the poor power of these tests or may indicate that impulsivity in the parents is not problematic. It is also possible that impulse control may be moderated by a variety of learning and maturation factors. Certainly, DSM-III finds attention to be central to the problem of hyperactive children and perhaps it is this deficit that rate types of attention measures, both protracted vigilance and visual search strategies. Although highly suggestive, our data nevertheless raise questions about the specificity of the relationship between hyperactivity and attentional deficits in the parents and about the methodological aspects of the research design. In general, the specificity of the attentional relationship will require a more detailed study of these parental characteristics in terms of cross-group comparisons involving non-hyperactive psychiatric index groups as well as parents of normal controls. Cross-fostering studies involving the biological and adoptive parents of the same hyperactive child would assuredly provide a more definitive analysis of the gene-environment interaction.

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THE ROLE OF PARENT TRAINING IN TREATMENT OF PRESCHOOLERS WITH ADDH

Susan Pisterman, Ph.D., Philip Firestone, Ph.D., Patrick McGrath, Ph.D.,
John T. Goodman, Ph.D., Ikuko Webster, Ph.D., Risa Mallory, M.A., Bea Goffin, M.A.

The efficacy of group parent training was assessed in improving compliance and
time on task in preschoolers with attention-deficit disorder with hyperactivity.
Positive effects were obtained on measures of child compliance, but not on measures
of attention. Parental compliance-management skills and overall style of interaction
were also positively affected. The use of parent training for early intervention with
ADDH children is discussed.

The treatment of attention-deficit disorder
with hyperactivity (ADDH) (this term is
used throughout this article to reflect the
diagnostic criteria used in the selection of the
sample studied: the current diagnostic term is
attention-deficit hyper-activity disorder)
in school-age children has focused on
behavioral, pharmacological, cognitive, and
nutritional interventions. Numerous outcome
studies have been conducted, and short-term
benefits have been consistently found for
behavioral and pharmacological treatments.
The outcome for cognitive approaches is
mixed (Abikoff, 1985), and there is little
empirical support for the benefits of dietary
changes.

The intervention outcome literature on
preschoolers with ADDH is extremely limited.
The failure of pharmacological and
cognitive self-control interventions (Co-he.n,
Sullivan, Minde, Novak & Helwig, 1981:
Conners, 1975; Schleifer et al., 1975) as
treatments for the core deficits of ADDH in
preschoolers has raised the question of
which mode of early intervention is most
appropriate for this age group. Parent-
mediated behavioral intervention has been
found effective in improving compliance in
ADDH preschoolers (Pisterman et al., 1989),
thus providing preliminary evidence
for the potential usefulness of this treat-ment
modality. However, the results of the 1989
study failed to find €eneralization of
treatment effects to behavior that was not
targeted in treatment. Hence, any attempt

to provide comprehensive treatment to ADDH
preschoolers may require the specific
targeting of the core characteristics of
inattention, impulsivity, and motor restless-
ness.

The goal of the study presented here was
to determine whether parent-mediated beha-

vioral intervention could ameliorate others
of the core deficits of ADDH in
preschoolers besides the associated behavioral
problems of noncompliance. To this end, a
parent training program based on the suc-

cessful compliance model was developed.

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to increase children's on-task behavior, which has been used as an index of sustained attention (Ruff & Lawson, 1990). Behavioral intervention targeting on-task behavior and task completion in older children has focused on classroom contingency management strategies (Gittelman-Klein et al., 1980; Pfiffner, O’Leary, Rosen, & Sonn, 1985). However, the use of parents as modifiers of these specific types of behavior in preschoolers has not been studied.

METHOD
The study was conducted in the Psychology Department of the Children's Hospital of Eastern Ontario, a large pediatric hospital. All the subjects were referred by physicians for assessment and treatment of suspected ADDH.

Children's Inclusion Criteria
1. The child met the criteria of DSM-III (American Psychiatric Association, 1980) for the diagnosis of ADDH, as reported by the parent or teacher on the SNAP checklist (Pelham & Bender, 1982), which is derived from the DSM-III criteria for ADDH and includes all items central to the syndrome: five for overactivity, six for inattention, six for impulsivity, and six related to peer interaction. This was substantiated by the parent's report in a comprehensive semi-structured diagnostic interview. No independent reliability checks for diagnosis were conducted. However, the supervising Ph.D. psychologist was consulted in cases of questionable diagnoses. Concurrent diagnoses were not determined, but diagnostically relevant information about co-occurring problems was gathered through the Conners Rating Scales (Conners, 1989) and the Child Behavior Checklist (Achenbach & Edelbrock, 1983) (see Table 1).
2. The child scored at least one rating of 1.5 standard deviations above the age and gender mean on the Conners Hyperactivity Index (Conners, 1989; Goyette, Conners, & Ulrich, 1978). Each child was rated by at least one parent. Questionnaires completed by another significant caregiver (teacher or another caregiver) were also available on attention (Ruff & Lawson, 1990). Behavioral 60% of the sample at pretreatment. Eight intervention targeting on-task behavior and children qualified on the basis of both parent task completion in older children has focused and other caregiver ratings, while three on classroom contingency management qualified on the basis of ratings by only another caregiver.
3. The mean time taken on a task in a standardized parent-supervised attention task at the pretreatment assessment was 163 seconds. A pilot study of this connect-dots task with children who were suspected of being hyperactive determined that this time was two standard deviations above the mean.
4. The child's standard score was equivalent to 80 on the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981) if the child spoke only English (N=49) or ? 76 if the child was bilingual (N= 8).
5. The child was between 3 and 6 years old and not yet attending first grade.
6. The child's hyperactivity medication status (stimulant medication) was constant throughout participation. Of the four children who were on medication at the pre-treatment assessment, three completed the study with no reported change in dosage.

Subjects
Over a 23-month recruitment period, 212 families were referred and 95 met the eligibility criteria. Of these 95 families, 57 (60%) agreed to participate. Reasons for noneligibility were failure to meet inclusion criteria or language requirements—i.e., conversant in English—(60): abatement of the presenting problems (28); and others, such as residential move or failure to keep the initial appointment (29). Nonparticipation was due to preference for individual treatment, as opposed to the experimental group program (38).
Of the 57 families who agreed to participate, five from the treatment group and seven from the control group withdrew after being assigned to the groups, resulting in an overall dropout rate of 21.1%. The characteristics of the 23 treatment-group families, the 22 control-group families, and
the 12 dropout families are presented in Table 1. ANOVAs carried out on the continuous variables in Table 1 revealed a significant group effect on educational level. Scheffé's test was performed on two contrasts: drop-outs versus the other two groups, and the treatment versus the control group. Only the first contrast yielded a significant difference, $F(2,54) = 6.76, p < .05$, indicating that the target parents who dropped out had lower levels of education than did those who completed the study. Chi-square analyses on the dichotomous variables revealed a significant difference among the three groups on gender ratio; there was a higher proportion of girls in the dropout group.

### Procedure

**Screening.** Screening consisted of three sessions attended by the child and the parent group and withdrew after attending only one session.

### Characteristic of the Sample: Dropout and Participant Families

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>DROP-OUTS</th>
<th>TREATMENT GROUP</th>
<th>CONTROL GROUP</th>
<th>$F(2,54)$</th>
<th>$X^2(2, N=57)$</th>
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<td>CBCL Total Behavior Problem $M$</td>
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</table>

*Note: CBCL = Child Behavior Checklist.

* Standard score equivalent for Peabody Picture Vocabulary Test-Revised.
* Rated by target parent.
* Based on compliance task.
* Based on parent-supervised attention task.
* Years of schooling from first grade on.

*p<.05.
ent who spent the most time with the child during free play provided additional (the target parent). In all but two families, the measures of sustained attention to assess target parents were mothers. Nontarget parents generalized from the attention training.

Typically attended initial diagnostic interviews. **Coded behavior.** The parent-child interaction was observed during both behavioral assessment sessions. All assessment sessions were conducted by a graduate student with a master's degree and took place in a room equipped with a one-way mirror, informed of the group assignments. A list of age-appropriate toys and living room furniture. The coded behavior types appears in the first column of TABLE 2. All identified behavior

Session 1 involved a comprehensive diagnostic interview. In Session 2, the parents completed questionnaires and consent forms while the child was administered the Peabody Picture Vocabulary Test. The behavioral assessment was conducted in the last session.

The behavioral assessment consisted of 20 minutes each of free play and a compliance task and 10 minutes each of parent-supervised and unsupervised attention tasks. The assessment began with ten minutes of free play during which the child was instructed to read a magazine and let the child play with the toys in the room. This free-play period was followed by the compliance task, in which the parent was instructed to issue 15 predetermined simple commands, adapted from Barkley (1981). The parent-supervised attention task followed a short break. In this task, the parents were instructed to provide assistance as desired to their children in performing a paper-and-pencil task. The task involved copying a series of increasingly complex dot-to-dot designs. The child's mean time on the task in this activity determined his or her eligibility on the attention criterion and served as the primary outcome measure. For parent alpha (appropriate) commands, and the next ten minutes, the child engaged in a frequency of parent beta (inappropriate) commands. The different attention task that was not parent-supervised. The parent was requested to read a magazine while the therapist instructed the child on a paper-and-pencil cancellation task and then left the child to complete the task independently. The assessment concluded with a second ten-minute period of free play. The child's on-task behavior during the unsupervised attention task and sustained activities during free play provided additional measures of sustained attention to assess generalization of the attention training.

Coded behavior. The parent-child interactions during the behavioral assessment were coded from videotapes by a rater who was not informed of the group assignments. A list of the coded behavior types appears in the first column of TABLE 2. All identified behavior

**Behavioral Outcome Measures**

**Child compliance variables.** The primary measure of compliance was child compliance relative to total number of parental commands, that is, percentage of compliance (Forehand & McMahon, 1981). Changes in percentage of compliance could reflect changes in any one or a combination of the measure's three behavioral components: frequency of child compliance, frequency of parent alpha (appropriate) commands, and frequency of parent beta (inappropriate) commands. Higher scores on this measure reflected more cooperation between parent and child with respect to parental commands. The second measure, absolute frequency of child non-compliance, focused more specifically on child behavior. The third measure, time to complete the compliance task command list, was the actual time the parent and child re-
required to complete 15 commands during the 20-minute period. The fourth measure, derived from percentage of compliance, was created as a dichotomous criterion measure of clinical improvement. As in the previous study (Pistennan et al., 1989), the criterion was established as a minimum increase of 50% from pretreatment to post-treatment in percentage of compliance during the compliance task.

Child attention variables. The primary measure of the child’s sustained attention was mean time on the task in the ten-minute parent-supervised attention task. The second measure was mean time on the task for the unsupervised attention task for which the child was instructed to stay alone on the task. The third measure was mean time on the task in the ten-minute parent-supervised attention task.

Parental self-report measures. The following measures were used to assess target parents’ self-reported parenting stress and self-esteem: Child Domain and Parent Domain of the Parenting Stress Index (Loyd & Abidin, 1985) and the Skills and Valuing subscales of Mash and Johnston’s (1983) version of the Parenting Sense of Competence Scale (Gibaud-Wallston & Wandersman, 1978).

Intervention

The 12-session attention-training treatment program was an extension of a group parent-training program for compliance (Pisternan et al., 1989). The rationale for the sequence of instruction was that establishing compliance was a necessary first step in shaping on-task behavior. A parent manual...

...
with guided readings, instructions, and homework assignments was provided.

The initial group sessions included the presentation of educational material and discussion of the etiology, developmental course, and treatment of ADDH. They were followed by compliance training, which involved instruction in reinforcing compliance and implementing a time-out procedure for noncompliance. In the final segment of treatment, the parents were taught to apply the same behavioral strategies to rein-

### Table 2
DESCRIPTIVE STATISTICS AND GROUP X ASSESSMENT INTERACTIONS FOR BEHAVIORAL OUTCOME VARIABLES

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>PRETREATMENT</th>
<th>ASSESSMENT</th>
<th>FOLLOW-UP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance in Task</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent°</td>
<td>28.7</td>
<td>10.5</td>
<td>49.5</td>
</tr>
<tr>
<td>Treatment</td>
<td>34.7</td>
<td>12.8</td>
<td>42.0</td>
</tr>
<tr>
<td>Control</td>
<td>5.9</td>
<td>4.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Noncompliance frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>6.0</td>
<td>5.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Control</td>
<td>5.9</td>
<td>4.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Time to complete command list</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>17.3</td>
<td>3.1</td>
<td>12.3</td>
</tr>
<tr>
<td>Control</td>
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<td>14.1</td>
</tr>
<tr>
<td>Attention (mean time)</td>
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<td></td>
</tr>
<tr>
<td>Parent-supervised (on task)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
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<td>80.0</td>
</tr>
<tr>
<td>Independent (on task)</td>
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<td>36.3</td>
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<tr>
<td>Control</td>
<td>26.1</td>
<td>24.0</td>
<td>36.9</td>
</tr>
<tr>
<td>Free play (on activity)</td>
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<td>72.0</td>
<td>51.1</td>
<td>76.5</td>
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<tr>
<td>Control</td>
<td>59.9</td>
<td>30.8</td>
<td>79.4</td>
</tr>
<tr>
<td>Parent Skills</td>
<td></td>
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<td>Compliance Task</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent alpha commands°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>35.2</td>
<td>11.4</td>
<td>55.1</td>
</tr>
<tr>
<td>Control</td>
<td>42.6</td>
<td>14.0</td>
<td>48.1</td>
</tr>
<tr>
<td>Percent reinforced°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>21.0</td>
<td>12.7</td>
<td>32.6</td>
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<tr>
<td>Control</td>
<td>19.4</td>
<td>9.1</td>
<td>19.1</td>
</tr>
<tr>
<td>Attention Task</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of directives°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>99.6</td>
<td>27.3</td>
<td>65.4</td>
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<td>Control</td>
<td>88.9</td>
<td>30.9</td>
<td>77.1</td>
</tr>
<tr>
<td>Negative feedback frequency</td>
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<tr>
<td>Treatment</td>
<td>22.0</td>
<td>12.6</td>
<td>10.6</td>
</tr>
<tr>
<td>Control</td>
<td>18.9</td>
<td>10.5</td>
<td>17.2</td>
</tr>
<tr>
<td>Style of Interaction</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Percent directive°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>69.4</td>
<td>5.7</td>
<td>54.1</td>
</tr>
<tr>
<td>Control</td>
<td>66.4</td>
<td>6.9</td>
<td>62.1</td>
</tr>
<tr>
<td>Percent positive°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>18.3</td>
<td>6.6</td>
<td>38.2</td>
</tr>
<tr>
<td>Control</td>
<td>22.5</td>
<td>7.9</td>
<td>26.8</td>
</tr>
<tr>
<td>Percent negative°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>12.3</td>
<td>4.6</td>
<td>7.6</td>
</tr>
<tr>
<td>Control</td>
<td>11.1</td>
<td>4.5</td>
<td>11.1</td>
</tr>
</tbody>
</table>

* Group x assessment interaction. ° Relative to total commands. † Relative to total child compliance. ° Commands and questions. ‡ Relative to total parental behavior types; based on entire behavioral session.

p<.05; * p<.01.
force increasing longer periods of their children's on-task behavior, that is, attention training. They were provided with a baseline of on-task behavior that was derived from the individual behavioral assessments at pretreatment and were instructed initially to reinforce their children's on-task behavior every time the children reached criterion based on their baseline rate. When ever a child went off task, the parent was instructed to issue a "refocusing" command—an instruction to the child to resume the task. The child's failure to return to task was considered a noncompliant act, and the parent was instructed to use the contingency management strategies previously taught for noncompliance.

The second major strategy was a shaping procedure. Parents were given specific criteria for increasing the period of time on task before providing reinforcement. They were taught to focus their praise specifically on the children's maintenance of attention to task and to avoid asking questions, issuing commands other than for refocusing, or giving corrective or negative feedback. As children's attention span increased, parents extended their reinforcement to other aspects of performance, such as neatness and accuracy.

All behavioral instruction was provided through modeling, role-playing, and two individual in-clinic instruction sessions in which the parent and child were videotaped performing standardized tasks. Parents reviewed the tapes and received individual feedback. Control-group families were seen in the clinic at comparable points in time. They were given the same standardized tasks to perform, followed by a brief interview about their children's behavior. No video-tape feedback was provided.

Design

Parents of eligible children were randomly assigned to an immediate treatment group (experimental group) or a delayed treatment group (control group), with the constraint that the two groups were balanced in terms of sex of child, family composition (single- or two-parent family), educational level of the parent, and medication status of the child.

Behavioral assessments were conducted at pretreatment, at posttreatment, and at the three-month follow-up for both groups. Parent-completed child behavior rating measures and parent self-report measures were also obtained at the three assessments. The results presented in this article involve only the behavioral assessments.

Families in the control group received the equivalent treatment after the three-month follow-up assessment. Control parents were told that normal developmental changes needed to be monitored to determine what effects treatment had beyond maturation gains. Both the treatment and the control families attended all assessments. Parents were queried at each assessment about other interventions received during that period for their children's behavioral problems.

RESULTS

Behavioral Outcome Measures

A series of 2 x 3 (group x assessment) repeated-measure multivariate analyses of variance (MANOVAs) were used to assess treatment effects on the four sets of outcome variables (child compliance variables, child attention variables, parent skills variables, and parental style of interaction variables). Treatment effects were reflected in significant group x assessment interactions. Analyses of variance (ANOVA) were then conducted on the individual variables within each set of outcome measures. Post hoc between-assessment comparisons in each of the two groups were also performed, using Sjostrom and Stone's modification of the Tukey's Honestly Significant Difference test for unequal Ns to control for experiment-wise error for multiple tests, \( p \) (number of means) = 6, \( df \) (for the error term) = 86 (Kirk, 1982).

Child compliance. The means, standard deviations, and results of the ANOVAs for
Table 3
SUMMARY OF POST HOC MULTIPLE COMPARISONS

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>BETWEEN-ASSESSMENT COMPARISON</th>
<th>TREATMENT GROUP</th>
<th>CONTROL GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRE- VS POST- TREATMENT</td>
<td>PRE- VS FOLLOW-UP</td>
<td>PRE- VS POST-</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td></td>
<td>Treatment</td>
</tr>
<tr>
<td>Child Compliance in Task</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>9.14*</td>
<td>10.15*</td>
<td>3.17</td>
</tr>
<tr>
<td>Time to complete command list</td>
<td>-8.44*</td>
<td>-8.69*</td>
<td>-3.19</td>
</tr>
<tr>
<td>Parent Skills</td>
<td>Compliance task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of aloha commands*</td>
<td>8.85</td>
<td>9.29*</td>
<td>2.47</td>
</tr>
<tr>
<td>% of compliance reinforced*</td>
<td>5.52*</td>
<td>4.92</td>
<td>-.14</td>
</tr>
<tr>
<td>Attention task</td>
<td>Frequency of directives*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-8.58*</td>
<td>-8.08*</td>
<td>-2.96</td>
</tr>
<tr>
<td></td>
<td>Frequency of neg. feedback</td>
<td>-8.12*</td>
<td>-6.76*</td>
</tr>
<tr>
<td>Style of interaction</td>
<td>% directive**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-13.28*</td>
<td>-13.99*</td>
<td>-3.78</td>
</tr>
<tr>
<td></td>
<td>% positive<em>negative</em></td>
<td>15.68*</td>
<td>16.18*</td>
</tr>
<tr>
<td></td>
<td>-7.37</td>
<td>-7.12*</td>
<td>.05</td>
</tr>
</tbody>
</table>

*Relative to total commands.
* Relative to total child compliance. Commands and questions.
* Relative to total types of parental behavior.
* p<.05; **p<.01.

The child compliance measures are presented in TABLE 2. TABLE 3 contains the results of the post hoc multiple comparisons. The MANOVA on the three child compliance measures revealed a significant interaction effect, $F(6.168) = 3.90$, p<.01. A subsequent ANOVA indicated a highly significant treatment effect for percentage of compliance. The treatment group showed a marked increase from pre- to posttreatment and from pretreatment to follow-up. The changes in the control group were not statistically significant (TABLES 2 and 3).

The ANOVA for frequency of noncompliance failed to yield a significant treat-ment effect. However, the ANOVA for time to complete the command list in the compliance task showed a significant treatment effect (TABLE 2). The time that treatment-group families required to complete the 15 commands decreased significantly from pre-to posttreatment and from pretreatment to follow-up (TABLES 2 and 3). Control-group families, on the other hand, did not show a significant decrease at posttreatment or at follow-up.

Data on the criterion for clinical improve-ment on percent compliance are presented in TABLE 4. Significantly more treatment families than control families met this criterion for clinical improvement at posttreatment, follow-up, and both posttreatment and follow-up.

Child attention variables. The MANOVA conducted on the three child attention variables failed to yield a significant treatment effect.

Parent skills variables. The means, standard deviations, and results of the ANOVAs for parent skills variables are presented in TABLE 2. TABLE 3 contains the results of the post hoc multiple comparisons. The MANOVA revealed a significant interaction effect, $F(8.166) = 5.03$, p<.001, and subsequent ANOVAs indicated significant treatment effects for all the variables.

For percentage of alpha commands in the compliance task, the mean for the treat-ment group rose significantly from pre- to posttreatment and was maintained at follow-up. In contrast, there was no significant change across assessments in the control-group mean.

For the percentage of compliance rein-
forced in the compliance task. The mean for the treatment group rose significantly from pre- to posttreatment, and this gain over the pretreatment level was maintained at follow-up, despite a slight decrease from posttreatment. The mean for the control group did not change significantly.

In the parent-supervised attention task, there was a highly significant decrease in frequency of directives (commands and questions) in the treatment group from pre-to posttreatment, and this diminished level was further maintained at follow-up. In the control group, there was a gradual but steady decline across assessments. Although the difference from pretreatment to follow-up was significant at the .05 level, it was of a much smaller magnitude than was its counterpart in the treatment group.

For the frequency of negatives in the parent-supervised attention task, the mean for the treatment group was significantly lower at posttreatment and follow-up than at pretreatment. In contrast, there was no significant change across assessments in the control group.

The MANOVA revealed a significant interaction effect, F(6,168) = 8.70, p<.001, and subsequent ANOVAs indicated significant treatment effects for all the variables. Parental style of interaction in both groups at pretreatment was characterized by a high percentage of directive behavior (pooled mean = 67.9%), followed by a substantially smaller percentage of positive behavior (pooled mean = 20.4%). Negative behavior (pooled mean = 11.7%) contributed the smallest proportion. Following treatment, there was significant decrease in the percentage of directive behavior and in the percentage of negative behavior among treated parents. and these lower levels were maintained at follow-up. At the same time, there was a significant increase in the percentage of positive behavior, and this higher level was again maintained at follow-up. In contrast, there was

| Table 4 |
|------------------|------------------|
| CHILDREN IN EACH GROUP MEETING TWO CRITERIA FOR CLINICAL IMPROVEMENT |
| | TREATMENT | CONTROL GROUP |
| | % | N | % | N |
| Percentage Compliance* | | | | |
| Posttreatment | | | | |
| Improved | 65.2 | 15 | 22.7 | 5 |
| Not improved | 34.8 | 8 | 77.3 | 17 |
| Follow-Up | | | | |
| Improved | 65.2 | 15 | 27.3 | 6 |
| Not improved | 34.8 | 8 | 72.7 | 16 |
| Posttreatment and Follow-Up | | | | |
| Improved | 52.2 | 12 | 13.6 | 3 |
| Not improved | 47.8 | 11 | 86.4 | 19 |
| Mean Time on Task* | | | | |
| Posttreatment | | | | |
| Improved | 30.4 | 7 | 22.7 | 5 |
| Not improved | 69.6 | 16 | 77.3 | 17 |
| Follow-Up | | | | |
| Improved | 21.7 | 5 | 13.6 | 3 |
| Not improved | 78.3 | 18 | 86.4 | 19 |
| Posttreatment and Follow-Up | | | | |
| Improved | 8.7 | 2 | 9.1 | 2 |
| Not improved | 91.3 | 21 | 90.9 | 20 |

*Criteria for clinical improvement on percentage of compliance (compliance task) and on mean time on task (parent-supervised attention task) were a minimum of 50% and 100% increase, respectively, over pretreatment level. *p<.05; **p<.01.
no significant change in any of these variables across assessments in the control group.

DISCUSSION

The results of this study confirm that parent training is effective in improving compliance in ADDH preschoolers; they revealed a significant increase in the percentage of compliance and a significant decrease in the time taken to complete the compliance task command list. The parent training approach used did not differ substantially from the process and goals of other well-known programs (Barkley, 1987; Forehand & McMahon, 1998). In general, it is easily taught to mental health professionals and is cost efficient in terms of time and personnel. Unfortunately, the data revealed a higher dropout rate for less educated parents. This is not an uncommon finding (Firestone, 1982) and presents another challenge in program development. Nevertheless, the majority of families, regardless of their educational status, completed the treatment sessions and returned for the follow-up visits, which attest to the palatability and usefulness of the approach.

Parental behavior also changed significantly as a result of treatment. Parents issued proportionately more appropriate commands and more consistently reinforced compliance. In addition to these specific compliance-management skills, parents overall style of interaction improved in that they issued proportionately fewer directive statements and increased the proportion of positive feedback to their children. These results replicate the previous findings of Pisterman et al. (1999) and provide strong sup-port for the usefulness of this mode of intervention for dealing with noncompliance in ADDH preschoolers and improving parent-child interaction.

Furthermore, given the number of sessions involved and the resulting habituation to the testing room. as well as the time elapsed from the pretest to the three-month follow-up, it seems likely that the changes observed in both children and parents were now part of their general behavioral repertoires. evidenced at home as well as in the testing sessions. Nevertheless, the issue of generalizability to other locations and over other periods was not addressed. Undoubtedly, instructing parents to train teachers in the procedures utilized and providing booster sessions after the termination of treatment would be of benefit. The implementation and study of these factors was beyond the scope of this investigation, however.

The study also provides evidence of improved parenting skills directed at increasing a child's attention to task. The parents in the treatment group issued fewer directive statements and negative comments during the parent-supervised attention task. This is a desirable change in parenting style and may well enhance parents' self-esteem related to parenting (Mash & Johnston, 1990; Pisterman et al., 1992); therefore, it is important in its own right.

Despite the general improvement in compliance and the enhanced attention-training skills of parents, however, there was no evidence of a treatment effect on any of the attention measures. An examination of the group means and standard deviations of the attention measures provides data for speculation (TABLE 2). Generally, children's attention improved over time, although a time effect reached significance (p < .05) only in the parent-supervised task. This finding is consistent with developmental data, which characterize the preschool period as one of fairly rapid maturation in sustained and focused attention (Levy, 1980; Ruff & Law-son, 1990). Another important observation is the extremely high standard deviations associated with the attention measures. Although this finding may reflect the instability of the particular measures used, it is more probably a realistic reflection of a key characteristic of ADDH children, especially preschool children. Namely, variability of functioning and consequent behavioral unpredictability (Barkley, 1981).

Thus, behavioral parent training may be a potent intervention) behavior during the preschool years be much less costly and effective than other treatment modalities. The present rest intervention is to be effective in treating ADDH children with attention deficits with benefits extending beyond the schoolchildren with attention deficits. The present rest intervention is to be effective in treating ADDH children with attention deficits with benefits extending beyond the schoolchildren with attention deficits.
a potent intervention for children's misbehavior during the preschool years. but may be much less effective with types of behavior that are more biologically driven. This conclusion is consistent with the finding that pharmacological intervention appears to be superior to cognitive-behavioral strategies in improving sustained attention in older ADDH children. Recent preliminary data suggest that methylphenidate may also be effective in treating attentional difficulties in schoolchildren who are experiencing attention deficits without hyperactivity. with benefits extending to scholastic achievement (Famularo & Fenton, 1987).

It may be necessary to reexamine the potential usefulness of well-monitored medication with reliably diagnosed preschoolers. The present results suggest that if early intervention is to be comprehensive, different treatment modalities will be required to target specific deficits and problems.

Alternatively, the treatment of ADDH may need to take a developmental perspective. Behavioral parent training that targets compliance may be the treatment of choice during the preschool years when behavioral problems peak and parents' stress and low parenting self-esteem are acute. Group training of parents provides immediate benefits on all fronts (Pisterman et al., 1992). The amelioration of attentional problems may be more appropriately addressed during the school years if attentional problems begin to have a deleterious effect on children's academic success and classroom functioning.

REFERENCES


To identify child oral and developmental difficulties, major strides in understanding the correlates of these disorders have been made. While major strides have been made in understanding the factors associated with ADHD, more research is needed to identify these difficulties. Major strides have been made in understanding the factors associated with ADHD, such as those identified by Kopp (1983), who found that children with ADHD were more likely to have difficulties with impulse control, hyperactivity, and inattention. These findings support the notion that ADHD is a spectrum disorder, with a wide range of severity.

Maternal and environmental factors have been found to influence the development of ADHD. For example, maternal depression and stress have been linked to an increased risk of ADHD in children (Link, 1983). Although the etiology of ADHD is complex, it is characterized by a wide range of symptoms.
ABSTRACT One hundred sixty-one children between 9 and 17 years of age who had migraine headaches participated in a behaviorally oriented treatment programme. Data were collected on factors related to staying in treatment and adherence to treatment instructions. The results revealed that older children were less likely to drop out during treatment. In addition, children with fewer headaches were more likely to adhere to treatment regimen. Demographic data on the families and personality measures on the migraineurs did not distinguish between those subjects who stayed in the programme or dropped out and those who were good or poor adherents.

RÉSUMÉ Cent soixante et un enfants âgés entre 9 et 17 ans sujets à des migraines ont participé à un programme de traitement behavioral. Des données furent recueillies concernant des facteurs reliés au fait de demeurer dans le programme et à l'adhérence aux directives du traitement. Les résultats ont révélé que les enfants plus âgés étaient moins portés à abandonner le programme durant le traitement. En plus, les enfants avec moins de migraines étaient plus susceptibles à adhérer aux directives du traitement. Des données démographiques sur les familles et les mesures de personnalité des migraineurs ne permirent pas de distinguer entre les enfants qui persistèrent dans le programme et ceux qui abandonnèrent celui-ci, ni entre ceux qui adhérèrent aux directives du traitement et ceux qui ne le firent pas.

Compliance to therapeutic regimens has become an increasingly important issue as health care (Dunbar, 1983; Sackett & Snow, 1979). Research has demonstrated that patients have a great deal of difficulty in carrying out even simple health care instructions such as taking a pill once or twice per day (Firestone, 1982; Sackett, 979). In a compliance study of children diagnosed as suffering from streptococcal

-narvngitis and acute otitis media. Bergman and Werner (1963) discovered that 56% ad stopped taking the medication by the third day. 71% by the sixth. and 82% by ne ninth day. Similarly. Mattar. Markello, and Jaffe (1975) found that only 7.3%

4' 300 pediatric outpatients completed their course of antibiotics for otitis media. Overall. it has been estimated that 50% of adults and children do not take medica-. on as prescribed (Briant. 1978; Dunbar. 1983) and thus reduce its effectiveness.

Given the relative ease of taking medication as compared to the more time-consuming and demanding requirements of a psychologically based intervention,
it is not inconceivable that these therapies are even less adhered to than medication-taking (Firestone, 1982). However, there is a dearth of information in the area of compliance to psychologically based intervention programmes in general, and with children and adolescents in particular. Those studies that have been concerned with pediatric populations have largely dealt with parents' management of their child's health care. Less attention has been directed to the child's own compliance with behaviourally oriented treatment programmes.

In the present study, various factors associated with staying in a behaviourally oriented treatment programme and good or poor adherence to the programme were examined. The subjects were a group of children and adolescents involved in a behaviourally oriented psychological treatment programme for migraine headaches. This programme required a considerable commitment from the children and relatively little input from the parents.

Subjects: One hundred sixty-one children (58 males, 103 females), between 9 and 17 years of age referred by pediatricians, family physicians, and neurologists in the Ottawa-Hull area participated in this investigation. Each child was seen by a neurologist to confirm the diagnosis of migraine according to the diagnostic criteria outlined by the Ad Hoc Committee on Classification of Migraine (1962).

The diagnostic criteria were for intermittent paroxysmal headache and any two of the following four symptoms: throbbing pain, photophobia, nausea, and vomiting. There were no minimum headache history of 3 months. The frequency of occurrence was once or twice a week. No new prophylactic medication was given during the previous 2 months, and a minimum IQ of 80 on the Wechsler Picture Vocabulary Test (WPPVT). Children with an IQ of 70 or less were eliminated, as were those with unstable emotional or medical problems likely to interfere with treatment of the programme.

Behavioural Treatment Programmes: The study involved four treatment programmes: a relaxation training group, a cognitive-coping training group, a nonspecific treatment group, and a self-monitoring control group. The trained therapists were required to follow a treatment protocol for each of the groups. The written report of the therapist on the content of each session ensured compliance with the treatment protocol. All sessions were tape-recorded and spot checks were made by a psychologist on 20% of the sessions to ensure compliance to treatment protocol. Subsequent analyses revealed no differential treatment effects but that all interventions were equally effective (McGrath, Humphreys, Goodman, Keene, Firestone, Jacob, & Cunningham, 1988).

Relaxation (mining, "noap). Each child in this group received six training sessions for muscle relaxation following the procedure described by Cautela and Groden (1978). Each child was given a 20-min taped version of the relaxation procedure and instructed to practice at home once daily during the next 6 weeks. They were also instructed in differential relaxation and self-cuing relaxation.

Cognitive coping. This programme, called Thinking Straight, was developed by the author as a downward extension of Holroyd and Andreas’s (1978) cognitive self-control programme and 12akal's (1982) cognitive-behavioural treatment. It emphasized altering maladaptive thought processes which mediate unpleasant emotions and biochemical concomitants which may precipitate the headache process. The programme used elements of cognitive restructuring, cognitive control of pain, fantasy, simple problem-solving, and stress-inoculation training (Mcinich, 1975). Children were taught to monitor their stress reactions on a daily basis, to record and restructure thought processes, and to note the emotional correlates of their cognitive patterns. They were instructed to use the procedures in all stress-provoking situations as well as for the control of headache pain. Personalized cards containing coping statements were prepared for each subject (e.g., "I’m an O.K. kid even if I don’t do so well in math," or, "I can cope with this headache: I won’t let it get to me.").

Nonspecific treatment group. Each child in this group participated in stress reduction therapy which consisted of the administration (without interpretive feedback) of objective and protective psychological tests. The rationale explained that evidence indicated that many headaches are precipitated by a strong emotional reaction to stress and these tests helped ameliorate these reactions.

Self-monitoring control group. Each child in this group was informed that there would be a weekly headache diary, and that self-monitoring alone frequently caused reduction in headaches. Instructions on helping the child understand and control the course of their headaches was presented. The child was contacted by telephone once per week for 6 weeks.

Rating Scales: Headache diary. The headache diary required that the child record headaches four times a day and rate the intensity of each headache on a scale of zero to five, with zero being no headache, one being the least intense, and five the most intense. From this data a weekly headache index was calculated as the sum of the intensity ratings over the 28 time periods. Previous research has shown that this headache diary is a valid and reliable measure of headache activity (Richardson, McGrath, Cunningham, & Humphreys, 1983).

Anxiety. The State-Trait Anxiety Inventory and the State-Trait-Anxiety Inventory for Children (Spilberger, 1973; Spilberger, Gorush, & Lushene, 1970) were used to measure both state anxiety and trait anxiety. The adult version was used for subjects of high school age, and the children's version was used for younger subjects. Children responded to each question on the state anxiety scales according to how they felt in a specified stressful situation. The trait scales asked children to respond according to how they generally feel. Both scales have good internal reliability and appropriate test-retest reliability (Spilberger et al., 1970).

Depression. The Children's Depression Rating Scale (Poznanski, Cook, & Carrol, 1979) and the Self-Report Depressive Rating Scale (Birleson, 1978) were both used to rate depression. The Children's Depression Rating Scale, based on the Hamilton Depression Rating Scale (Hamilton, 1960), is rated by the therapist according to the child's and the parent's answers to the questions. Interrater reliability is .92, and the criterion validity of the scale has been assessed by showing excellent separation of scores by depressed versus nondepressed children. The Self-Report Depressive Rating Scale (Birleson, 1978) was designed as a measure of depression that is easily completed by the child. Birleson reported high internal consistency as evidenced by a split-half correlation coefficient of .82. There was also some evidence of validity on the grounds that the scale discriminated between the depressed study group and the nondepressed group.

Credibility ratings. Children were asked to rate the credibility of their treatment immediately following the first session and again following the last treatment session with questions such as: (a) How logical does this type of treatment seem to you? (b) How confident would you be that this treatment would be successful in reducing headaches? (c) How confident would you be that someone who has headaches would benefit from this treatment? (d) How confident would you be that children could learn this technique? This approach is more comprehensive than that frequently used (Kirsch, Tennen, Wickless, Saccone, & Cody, 1983).

Demographic data. Information such as IQ, sex, number of siblings, father and mother's education, family situation, and place of residence was collected on the families of the study subjects.

Procedure: The regimen for the headache project required that all children rate their headaches by filling out a diary four times a day. During a 4-week period, prior to treatment, a mean weekly headache index was calculated by summing the intensity ratings of the headaches to establish a baseline. If subjects had headache ratings of two or more on 4 different days, they were randomized assigned to one of four behavioural treatment programmes. Treatment consisted of six 1-hr weekly sessions. Children were seen for follow-up sessions at 1 month and 3 months after treatment. At this time headache diaries were kept fol
4 weeks, and the baseline assessment procedures for the anxiety and depression measures were repeated. Therapists rated each child’s adherence to the programme regimen after the 3-month follow-up by indicating whether they completed the intensity ratings, the symptoms, the medication, and the possible cause categories on the diaries. Adherence was rated on a scale of never (between 0 and 24% of the time), sometimes (between 25 and 79% of the time), and often (between 80 and 100% of the time). Ratings for homework assignments were also provided by the therapist based on the above scale. These adherence ratings were obtained for the baseline, treatment, 1-month follow-up, and 3-month follow-up time periods.

Children were considered adherent only if they completed the headache intensity ratings often (80-100% of the time) during baseline, treatment, 1-month follow-up, and 3-month follow-up. They also had to complete homework assignments during treatment 80-100% of the time. Children fell into the nonadherent category if they obtained a rating of never or sometimes for the headache intensity rating during any period of the programme.

Children who dropped out before the end of the project were classified as adherent or nonadherent based on the above ratings for the period of time they actively participated. Data on all the variables was not available for each subject, but the amount of data missing was negligible.

Data Analysis: Data analyses comparing adherents versus nonadherents and those who dropped out versus nondrop-out subjects were conducted with the use of chi-square analyses for discrete variables and t tests for continuous variables. In addition, analyses of variance were used to analyse variables measured at the three assessment periods: baseline, 1-month follow-up, and 3-month follow-up. Alpha levels were adjusted for each set of analyses to control for multiple comparisons by multiplying alpha by the number of comparisons.

Results

Drop-Outs: A total of 58 males and 103 females (mean age 12.8 ± 2.46, mean IQ 107 ± 16.3) who were seen by the Department of Neurology and who subsequently met the inclusion criteria began baseline. Of these, 30 dropped out prior to treatment. Twenty-five others started treatment but dropped out during the treatment programme or prior to the 1-month follow-up. Only 12 of the subjects who completed the 1-month follow-up dropped out before the 3-month follow-up. This does not include subjects in the self-monitoring group because the programme ended kw this group at the 1-month follow-up. Therefore, the total number of subjects available at the 3-month follow-up was 54. It should be noted that there was no difference in drop-out rate between males and females in any of the analyses.

Data analyses of variables including parent’s education, the family situation, two-parent families versus single-parent families, the number of siblings, and the family place of residence showed no significant differences between the groups. Furthermore, as indicated in Table 1, there were no differences between the children in the groups except on the Baseline Headache Index. This analysis revealed that those subjects who dropped out before treatment began had significantly lower headache scores as compared with those who started treatment. $t(154) = 4.15, p < .05$.

Subjects who dropped out during baseline or the treatment phase were compared with subjects who completed the 1-month follow-up. There was a significant age difference between the two groups, $t(159) = 2.28, p < .05$, indicating that older children (13.1 ± 2.3 yrs) completed the treatment programme more often than the younger children (12.2 ± 2.4 yrs). There were no significant differences between the two groups on IQ, sex, baseline Headache index, or anxiety and depression ratings at baseline.

Analyses of variance of pretreatment and posttreatment credibility ratings for drop-outs at the 1-month follow-up versus those who completed the 3-month follow-up indicated a significant difference between groups, $F(1, 130) = 64.14, p$ The drop-outs had lower credibility ratings at both measurement periods (pre = 13.47 vs. 24.64, post = 15.43 vs. 28.62). In addition, credibility ratings increased significantly over time for both groups, $F(1, 130) = 12.47, p < .05$.

Adherence: Comparisons between subjects rated as good adherents and those rated as poor adherents are summarized in Table 2. There were no significant differences between the two groups on IQ, age, sex, and baseline anxiety and depression ratings.
Children who dropped out during baseline had a lower Headache Index than those who remained in the programme. The drop-outs may have chosen not to continue because the involvement was too demanding in relation to the amount of pain they were experiencing. Also, infrequent headaches have made it more difficult to remember to complete the headache diaries and come to appointments.

For children who remained in the programme, Headache Index was an important factor in determining who was adherent and who was nonadherent. Children with more severe headaches were less likely to follow instructions, such as doing homework assignments and completing diaries, during the course of treatment than children with less severe headaches. For these children headache-free periods were less frequent, and during this free time they may have chosen to direct their attention away from headache-related issues. They reported that they wanted to do other things in their headache-free time, such as school work or social activities rather than headache-related assignments such as practicing the treatment techniques or completing diaries. In addition, the children with the more severe headaches may have chosen not to complete their diaries or do homework assignments because they were not feeling well most of the time. It may be that children with very bad headaches need to experience a great deal of change in their headaches in order to feel better; otherwise, they become discouraged and decrease their full participation in the treatment programme.

However, the baseline Headache Index differed significantly between the two groups. Adherents had a lower baseline Headache Index than nonadherents, 41.54) = 3.52, p < .05.

I-Icadache Index and anxiety and depression scores were evaluated at each of the baseline, 1-month lI blow-up, and 3-month follow-up for all subjects who completed the treatment programme (Fig. I). A repeated-measures analysis of variance yielded no significant differences over time between the good adherent and poor adherent groups on the anxiety and depression scores. A significant difference was found between adherent groups on the Headache Index, F(1, 53) = 5.62, p < .05, with the poor adherents showing a greater Headache Index than the good adherents. There was also a significant improvement over time on the Headache Index for both groups, F(2, 106) = 21.43, p < .05.

Discussion

The factors which were found to be significantly related to compliance in this study were the initial severity of the problem (the baseline Headache Index), age, and the child’s perception of the treatment rationale (credibility rating). The fact that older children were more likely to stay in the programme than younger children may have been related to parental involvement- in this study. Parental involvement was necessary with the younger children, in terms of keeping appointments and reminders I to keep the headache diaries, and this may have contributed to their dropping out. Older children were more autonomous in their required activities. They were more likely to schedule their own appointments, come to meetings on their own, and accepted more responsibility for completing headache diaries and homework assignments. Both Dunbar (1983) and Haynes (1979) have reported that age has been associated with compliance, but the relationship has not been consistent across studies.

The initial severity of the child’s headache problem, as recorded in the headache diary during the 4 weeks of the baseline period, was significantly related to whether children dropped out during baseline, and to whether they were good or poor adherents to the treatment programme. Children who dropped out during baseline had a lower Headache Index than those who remained in the programme. The drop-outs may have chosen not to continue because the involvement was too demanding in relation to the amount of pain they were experiencing. Also, infrequent headaches have made it more difficult to remember to complete the headache diaries and come to appointments.

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This finding is contrary to the notion that patients with more severe symptoms would be more likely to adhere to a treatment compliance; rather, more symptoms affected compliance in a negative direction. Haynes (1979) reported this finding in such problems as rheumatoid arthritis and anxiety neurosis with adults and otitis media and pharyngitis in children.

Treatment credibility ratings increased between the pretesting and posttesting for all subjects. The pre- and posttreatment credibility ratings for children who completed the 3-month follow-up were significantly greater than the credibility ratings of children who dropped out after the 1-month follow-up. Children who thought the treatment less credible did not bother to carry it through. Treatment credibility ratings have not been reported in the literature as a determinant of compliance.

Generally, compliance in pediatrics has been dealt with by looking at parent’s compliance to the recommended child’s regimen. However, in some studies it is difficult to determine whether parent or child compliance is being measured (Dunbar, 1983). An important aspect of the present study was to shift the focus of compliance research in pediatrics from measuring parent compliance in children to measuring the child’s own compliance to a treatment regimen.

In this study, the important child or adolescent compliance factors were initial headache severity, age, and credibility ratings. The fact that parental compliance was not examined limits the possibility of comparisons to other findings in the literature. The other unique feature of this study was its concern with compliance to a behavioural regimen rather than to a medical regimen such as pill-taking or prescription-filling. Thus, further investigations with children and adolescents and their adherence to psychologically based intervention programmes are required before firm conclusions can be rendered.
References


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Factors Associated With Academic Achievement in Children Following Parental Separation

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Elementary school children who maintained their academic performance levels following separation of their parents were compared to those whose levels declined. Although no single measure could accurately predict children’s academic adjustment, those who maintained performance levels spent significantly more time with both parents.

Many studies have documented the negative results of parental divorce on children (Emery, 1982; Feiner, Primavera, & Farber, 1983; Guidabaldi & Perry, 1984; Hetherington, 1979; Hetherington, Cox, & Cox, 1978; Kurdek, 1981; Wallerstein, 1983), and reported that deterioration in school performance and behavior are among the most consistent outcomes associated with separation and divorce (Roseby & Deutsch, 1985).

The large-scale study conducted by the National Association of Elementary and Secondary School Principals and the Kettering Foundation (Brown, 1980; Lazarus, 1980; Zakariya, 1982) revealed a disproportionately large number of children from single-parent families in low achievement groups and a small proportion of these children in high achievement groups. Blanchard and Biller (1971) found that academic performance of boys with high father availability was superior, compared to boys with low father availability. A study cited by Dawson (1981) showed that children from one-parent families exhibited poorer socioemotional development and lower academic achievement and that children from intact households had higher reading comprehension scores than did those of divorced parents.

Reports of negative divorce-related impact on academic achievement by children, however, are not unvarying. For example, Fowler and Richard (1978) found no difference in intelligence or academic achievement between father-absent and father-present homes, while Hammond (1979, 1981) found that on a number of measures, including reading achievement, there were no significant differences between children of divorced parents and those of intact families.

Learning constitutes one of the central developmental tasks of children. Wallerstein and Kelly (1976, 1980), in examining the findings of their long-term study, suggested that life stresses such as parental separation may impose temporary interruption in the learning process and that this might lead to significant academic problems.
ceptivity to learning may be compromised by emotional distress. However, most children showed little or no change in their academic performances at school. In fact, some appeared to utilize the school experience as a support system and used the work structure and work load to help them keep "on track" academically.

In a more comprehensive multivariate study, Hetherington, Cox, and Cox (1978) reported that, compared to children of intact families, those in divorced families showed, during the first year after the divorce, more impulsive acting-out disorders, as well as more dependency, anxiety, depression, and difficulties in both social and academic settings. These findings also revealed that, two years after separation, most of the negative effects of divorce had weakened considerably: adjustment, coping patterns, and equilibrium had established themselves in the now single-parent families.

Nevertheless, in the comprehensive study by Guidubaldi, Perry, Cleminshaw, and McLaughlin (1983), there was considerable evidence that divorce accounts for many adverse social and academic effects independently of well-defined socioeconomic status (SES) measures. In a two-year longitudinal examination of the Guidubaldi and Perry (1985) study, results indicated that separated children, especially those from lower SES whose fathers were absent, tended to poorer academic performance than did their two-parent family counterparts. According to Lamb, Pleck, and Levine (1985), these findings reflected the fact that single-parent mothers, especially of lower socioeconomic class, are exposed to greater stresses, impeding their ability to guide and stimulate their children's learning.

In the realm of academic adjustment, successful coping is essential if children are to maintain at least one stable structure in their otherwise unstable environment. As stated by Stockard, Lang, and Wood (1985), students' grades are an important mechanism for advancement and success in life. Academic achievement, assuming it to be reflected by grades, is undoubtedly a major influence in children's lives. Also, whereas the family undergoes structural change during the long process of separation and divorce, school remains a stable and structured environment. Children of divorce appear to be at risk for the development of academic problems, as well as other serious disorders that such school failure may predict (Feiner, Gillespie, & Smith, 1985). Yet many of these high-risk children do not fail (Curry & Rux, 1985; Feiner et al., 1985; Guidubaldi, Perry, & Cleminshaw, 1983; Hammond, 1979; Wallerstein, 1983).

The present study examined how children of separated parents who failed to maintain their academic performance differed from those who succeeded in maintaining their academic standing.

METHOD

Subjects

Data were collected from 77 children and their separated or divorced parent. The group included 41 girls and 36 boys from 9 to 15 years old (M= 11 years, 5 months). At the time of parental separation, the children ranged in age from 6 to 14 years (M= 8 years, 5 months). Also at the time of separation, 46 of the children were in primary grades (one, two, and three), 27 were in intermediate grades (four, five, and six), and 4 were in upper grades (seven and eight). A mean of three years had elapsed between time of parental separation and time of data collection.

The participating parent was designated the "Academic Parent." This was the parent who, although not necessarily the custodial parent, routinely lived with the child throughout the academic year. The subjects were children aged 6 to 13 years in the Ottawa-Carleton area, Canada. Those subjects: 

- were children who had experienced divorce at some point prior to the post-test; or
- had never been married.

Procedure

Subjects were selected through area schools and community agencies. The convenience sample included children who had lived in an intact home for at least one year prior to the onset of divorce or separation. The premeasured grade points in academic subject areas were obtained from the previous academic year's report card. The group included children who were no longer living together with the custodial parent. The participating parent was designated the "Academic Parent." This was the parent who, although not necessarily the custodial parent, routinely lived with the child throughout the academic year. The subjects were children aged 6 to 13 years in the Ottawa-Carleton area, Canada. Those subjects were: 

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were children attending elementary schools in the Ottawa-Carleton region of Ontario, Canada. Those selected for inclusion were children: a) whose parents had been separated (natural or legal adoptive parents no longer living together) for at least ten months prior to the postmeasure of academic performance. b) who were in the last trimester of grade one or in grades two through eight at the time of parental separation (school grade data prior to the end of grade one are unavailable); c) who were in a regular grade class placement prior to separation; and d) who, if adopted, had been so prior to one year of age. Those excluded were children: a) who had experienced the death of a parent; b) whose parent had remarried or co-habitated with a new partner within ten months following the separation; c) who were hospitalized or had suffered a chronic illness preventing school attendance for more than one month during the academic year prior to the postmeasure; d) who were enrolled in a special program (e.g., learning disability, social adjustment); or e) who had an older sibling participating in the present research.

Procedure
Subjects were recruited through various channels: directly through the schools, or through area single-parent associations, local community center newsletters, or an advertisement placed in a widely distributed Ottawa newspaper.

The premeasure was the average of the grade points in reading, writing, and math academic subjects taken from the two trimester report cards preceding the parental separation (the actual date that one parent moved away from the family household, not the legal separation or divorce date). A minimum of ten months (the equivalent of one academic year) must have passed between time of separation and the next two consecutive trimester report cards.

A total of 433 responses were received, of which 77 became research subjects. The two most common reasons for noneligibility of the remaining 356 subjects were: 1) the child was not in school at the time of the parental separation; and 2) the single-parent home did not result from marital breakup but rather from a parental death or from unwed mother status.

Upon receipt of the parent's consent form for participation in the study, the parent was contacted by phone, and a home and school visit followed. Each child's school achievement record was reviewed and grades before and after separation were obtained. The teachers of the participating children were asked to complete the Health Resources Inventory (HRI).

Measures
The Parent Information Questionnaire (PIQ) served to gather demographic data from the family during the home visit. Variables such as the child's age, grade, date of birth, and visitation patterns with the non-custodial parent, as well as parental employment and education, and other information pertaining to the separation were obtained.

The Home Environment Questionnaire (HEQ-1R) (Laing & Sines, 1982) consists of 91 true-false items designed to distinguish ten separable dimensions of the objective and verifiable psychosocial environments of children who live in single-parent families (Sines, Clarke, & Lauer, 1984). For the total group of single-parent families, the correlation between the rated social desirability of a "true" response to the items in HEQ-1R and the proportion of one-parent families responding "true" to those items was .32. Sines, Clarke and Lauer have demonstrated that HEQ scales are relatively independent and not significantly related to the age of the target child. Most of the scales are reasonably consistent internally, and several of the HEG scales have been found to be significantly related to several dimensions of children's clinically important behavior (Laing & Sines, 1982).

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The Single Parenting Questionnaire (SPQ) (Stolberg & Ullman, 1985) consists of 88 questions that are intended to assess aspects of single parenting having an impact on children's adjustment after parental divorce. The questions tap various aspects of a parent's interaction with the target child. Alpha coefficients for the scales range from .59 to .85: the total scale yielded an alpha coefficient of .85. Test-retest correlations ranged from .40 to .67 with .52 for the total score. There are significant correlations between all SPQ and Fisher Divorce Adjustment Scale scores (Stolberg & Ullman, 1985).

The Health Resources Inventory (HRI) is a teacher measure of primary-grade children's competency-related behavior (Gesten, 1976). This checklist was designed to temper the emphasis on pathology that is present in many comparable questionnaires. Teachers rate all 54 HRI items according to how well they describe children on a 5-point scale from not at all (1) to very well (5). Intercorrelations among individual HRI factors are positive and significant, ranging from a low of .28 to a high of .53. Test-retest reliability for the total score, or sum factors, was .87. Each component sub-scale proved to be internally consistent and each represented an important aspect of a broadly defined concept of competence in young school children.

The School Record Questionnaire (SRQ) recorded academic adjustment. The child's grade marks in reading, writing, and arithmetic, together with the child's class placement, number of schools attended since kindergarten, and number of school grades repeated were retrieved from the child's report cards and Ontario School Record. To give grade marks a common framework, since marking schemes vary from school to school and within the school, the marks were converted to a 13-point scale whereby A+ = 1, A = 2, A— = 3, through D = 11. D — = 12, and F = 13: the latter three marks represented a failure. Each student's mark was first translated to the 13-point scale within each subject area (reading, writing, and arithmetic). The marks were then pooled to make one composite mark per subject per term.

Children whose average marks decreased more than one-third of a grade (e.g., B + to B —) between pre- and postmeasures were placed in the Nonadjusted group. Those children whose marks did not fluctuate by more than one-third of a grade, or whose marks increased, were placed into the Adjusted group. This decision was based on a study conducted by the Research Committee of the Ottawa Board of Education (Parkin, 1987), in which grade marks in this population were found to be quite stable. The average fluctuation across three years of schooling did not exceed one-third of a grade mark (letter).

RESULTS

Fifty-four children were designated Adjusted and 23 Nonadjusted, while 65 of the Academic Parents were mothers and 12 were fathers.

As shown in Table 1, there were no significant differences between the two groups of parents. The two groups of children did not differ in terms of gender, age (8.40 years) or grade (3.25) at separation, number of friends, or amount of time spent at play. Statistical analyses did not result in differences between the observed and expected distributions of Adjusted and Nonadjusted children who were in the custody of same-sex parents.
As indicated in Table 2, the groups did not differ on grade scores preseparation, which translate into a B — for the Adjusted group and a B for the Nonadjusted group. By design, the two groups did differ at post-separation, with the Adjusted group averaging a B and the Nonadjusted a C. The time parents spent with their children differed significantly between the groups, in that the Adjusted children spent more time with their Nonacademic parents than did the Nonadjusted children (seven vs two days per month). The analysis of the HEQ total scores did not achieve statistical difference, revealing that the amount of intellectual stimulation available in the home did not differ between the groups. A reliable difference on the Social Support...
port Score (a factor on the SPQ) countered expectations, suggesting that the parents of Nonadjusted children had more social support than the parents of Adjusted children. The analysis of the SPQ (tapping parents' views of their parent-child relationships), the children's responses on the CSI, and the children's scores on the HRI did not achieve statistical significance.

For a finer analysis of the data, multivariate correlational analyses were conducted; these examined associations between background and dependent variables, and group membership. First, Pearson correlation coefficients were calculated for all background and dependent variables. Next, all variables were entered into a discriminant function analysis to predict Adjusted and Nonadjusted group membership. This analysis proceeded in a stepwise manner based on minimizing the overall Wilks lambda (Norusis, 1985).

Table 3
CORRELATIONS BETWEEN DEPENDENT AND PREDICTOR VARIABLES

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>NUMBER OF FRIENDS</th>
<th>NONCUSTODIAL TIME</th>
<th>MATERNAL EDUCATION</th>
<th>MATERNAL income</th>
<th>PATERNAL WORK TIME</th>
<th>PATERNAL income</th>
<th>SOCIAL SUPPORT</th>
<th>HRI</th>
<th>CSI</th>
<th>HEQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of friends</td>
<td>.260</td>
<td>-.085</td>
<td>.061</td>
<td>.114</td>
<td>.092</td>
<td>.085</td>
<td>.116</td>
<td>.083</td>
<td>.116</td>
<td>.116</td>
</tr>
<tr>
<td>Play time</td>
<td>.052</td>
<td>.250</td>
<td>.083</td>
<td>.056</td>
<td>.012</td>
<td>.021</td>
<td>.056</td>
<td>.007</td>
<td>.076</td>
<td>.076</td>
</tr>
<tr>
<td>Maternal work time</td>
<td>.052</td>
<td>.250</td>
<td>.083</td>
<td>.056</td>
<td>.012</td>
<td>.021</td>
<td>.056</td>
<td>.007</td>
<td>.076</td>
<td>.076</td>
</tr>
<tr>
<td>Maternal education</td>
<td>-.129</td>
<td>-.154</td>
<td>.356</td>
<td>-.440</td>
<td>.427</td>
<td>.011</td>
<td>.071</td>
<td>.037</td>
<td>.032</td>
<td>.046</td>
</tr>
<tr>
<td>Maternal income</td>
<td>-.041</td>
<td>.268</td>
<td>-.303</td>
<td>.173</td>
<td>-.109</td>
<td>.261</td>
<td>.011</td>
<td>.071</td>
<td>.037</td>
<td>.032</td>
</tr>
<tr>
<td>Paternal work time</td>
<td>-.041</td>
<td>.268</td>
<td>-.303</td>
<td>.173</td>
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<td>.261</td>
<td>.011</td>
<td>.071</td>
<td>.037</td>
<td>.032</td>
</tr>
<tr>
<td>Paternal education</td>
<td>.093</td>
<td>.218</td>
<td>-.389</td>
<td>.077</td>
<td>-.321</td>
<td>-.183</td>
<td>.129</td>
<td>.007</td>
<td>.018</td>
<td>.011</td>
</tr>
<tr>
<td>Paternal income</td>
<td>.077</td>
<td>.042</td>
<td>-.106</td>
<td>.046</td>
<td>-.021</td>
<td>-.122</td>
<td>-.041</td>
<td>.035</td>
<td>.059</td>
<td>.018</td>
</tr>
<tr>
<td>HRI</td>
<td>.041</td>
<td>-.010</td>
<td>.185</td>
<td>-.321</td>
<td>.250</td>
<td>.272</td>
<td>.007</td>
<td>.012</td>
<td>-.346</td>
<td>-.143</td>
</tr>
<tr>
<td>CSI</td>
<td>.043</td>
<td>-.053</td>
<td>-.311</td>
<td>-.035</td>
<td>-.063</td>
<td>-.255</td>
<td>.334</td>
<td>-.024</td>
<td>.011</td>
<td>-.033</td>
</tr>
<tr>
<td>HEQ</td>
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<td>.004</td>
<td>.018</td>
<td>.003</td>
<td>.376</td>
<td>-.049</td>
<td>.120</td>
<td>.256</td>
<td>.146</td>
<td>.023</td>
</tr>
<tr>
<td>SPQ</td>
<td>-.092</td>
<td>-.010</td>
<td>.016</td>
<td>-.238</td>
<td>-.029</td>
<td>.207</td>
<td>.028</td>
<td>.093</td>
<td>.007</td>
<td>.157</td>
</tr>
</tbody>
</table>

HRI = Health Resource Inventory; CSI = Children's Separation Inventory; HEQ = Home Environment Questionnaire; SPQ = Single Parent Questionnaire.

• p<.05; ** p<.01; '• p<.005.
yields the following eight variables as significant predictors of a child's adjustment status: fathers' employment time, fathers' education level, mothers' time spent at work, mothers' income level, social support, number of friends, HEQ total score, and HRI total score. This function resulted in a 78.26% correct classification.

**DISCUSSION**

In general, the results of the present study support previous research. Nevertheless, there were some notable exceptions. As in most previous work, approximately one-third of the children experiencing parental separation demonstrated a significant decline in academic performance, while two-thirds showed no dramatic change in either direction.

One feature of the study, the nature of the subject population, requires examination prior to an in-depth analysis of the results. Although many families were contacted, the limited number of volunteers participating indicates that a very select group of subjects was studied. A significant idiosyncrasy of this population was their relatively high SES compared to populations in other investigations. In the present study, the average income and education levels placed the subjects mostly in the middle and upper-middle SES. In contrast, many studies in the area of divorce report low to low-middle income levels, and lower levels of education (Feiner, Ginter, Boike, & Loren, 1981; Gesten, 1976; Roseby & Deutsch, 1985; Sines, 1983). Children participating in this investigation were also functioning relatively well. That is, both Adjusted and Nonadjusted children were functioning at average grade levels prior to separation, and even though Nonadjusted children suffered a significant decrease in their grades, they remained well above failing marks. As suggested by Rutter (1981), good academic grades may act as a buffer to certain adversities and to stressful life events. Thus, in this group of children it may have been more difficult than in the population at large to detect adversities brought on by parental separation.

Most reports have suggested that boys usually do more poorly than girls in terms of social and behavioral functioning (Gannet & Rutter, 1983). However, in the present study there were no sex or grade effects detected. This finding is in keeping with the research both of Reinhard (1977), and of Kurdek, Bisk, and Siesky (1981) who found no difference between boys and girls or between early and late latency children in academic reactions to parental separation.

The finding of Warshak and Santrok (1983), that Adjusted children were in the custody of same-sex parents significantly more often than were Nonadjusted children, was not supported. In the present study, most parent-child pairings involved mother-custody families and all cases of father-child pairings were cases of joint custody. Conceivably, the limitations imposed by the population pool and the differences in methodology of the present study resulted in the discrepant findings.

It is possible that same-sex child-custodial pairing is secondary to the time that the child spends with both parents. together with the availability of both parents. In the present study, as in others (Hess & Camaro, 1979; Hetherington et al., 1978; Wallerstein & Kelly, 1980), the evidence indicates that the availability of two parents is a prominent feature of adjustment. The phenomenon of same-sex pairing between child and custodial parent may have more of an impact on child-parent relationships or on social competence than on academic achievement.

Adjusted children spent significantly more time with the Nonacademic parent than did their Nonadjusted counterparts. The fact that a child is spending more time with a Nonacademic parent may also reflect less premarital stress, inasmuch as frequent visits with the child by the other parent are not a source of contention. An integral part of this parenting role is the ability of the noncustodial parent to maintain a constant and mu-
tually satisfying relationship with the child. A current relationship with the ex-husband, for example, is a strong predictor of the divorcee's adjustment (Nelson, 1981). and the divorcee's adjustment is in turn an important variable in the child's adjustment (Wallerstein & Kelly, 1980). The correlation analyses from the present study substantiated these findings, indicating that the more time a child spent with the custodial parent the healthier was the child's attitude toward the marital breakup. Similarly, the correlations revealed that the less time the father spent at work, the better was the child's attitude toward the parental separation.

More contact with both parents may also add to the academic input in children's learning, since it gives them access to the scholastic aptitudes and attitudes of both parents. Kalter (1987) noted the importance of the father's availability in the separation-individuation process of a child's development. The absence of a second emotionally involved parent figure to facilitate development and act as a buffer to the child's potentially powerful relationship with the other parent (usually the mother) is an important factor in the development of separation-individuation issues. Difficulties with separation may lead to difficulties in academic performance.

Svanum, Bringle, and McLaughlin (1982) and Lamb, Pleck, and Levine (1985) argued that increased paternal involvement must be viewed and understood only in the context of family circumstances and the reasons for his increased involvement. It is true that reasons for involvement vary greatly; however, regardless of the specific reason, for a child, maintenance, regularity, and frequency of contact are the tangible factors in the continuity of the parent-child relationship. The actual contact is a first step in establishing the relationship itself and its continuance determines the quality of the relationship. In summary, children who maintained contact with both parents after a separation managed to sustain academic performance, compared to those children who did not enjoy such a relationship with both parents.

There was no evidence that Adjusted children had more stimulating psychosocial home environments than did Nonadjusted children. In part, this lack of relationship may be explained by the select nature of the subject group. It is more common for children of higher socioeconomic profiles, as were those of the present group, to have greater access to varied psychosocial and educational opportunities. Hence, the high stratum population of the total group might have buffered differences between Adjusted and Nonadjusted groups.

Contrary to predicted outcome, results revealed that parents of Nonadjusted children had more social contacts than the parents of Adjusted children. This may, in effect, be reporting the amount of time the parent was spending away from the Nonadjusted child. As revealed in the findings, the Adjusted children spent significantly more time with the noncustodial parents and hence it may be that, given their ex-partners' involvement with the children, the custodial parents required less outside support. The parents of Nonadjusted children on the other hand, may have had to rely on external supports for relief in parenting and, in so doing, spent less time with their children, who consequently spent less total time with both parents.

Parents of Adjusted children did not rate their parent-child relationships better than did the parents of Nonadjusted children. Further research to determine the effect of perceived ability in a parenting role as a protective factor in child development is required.

Although not many reliable differences appeared between the Adjusted and Nonadjusted groups of children and their parents, several significant correlations revealed other important relationships. For example, the less time the mother spent at work, the greater was the child's school-rated competency. Results also revealed that the higher the father's income, the lower the child's adjustment is in turn an important variable in the child's adjustment (Wallerstein & Kelly, 1980). The correlation analyses from the present study substantiated these findings, indicating that the more time a child spent with the custodial parent the healthier was the child's attitude toward the marital breakup. Similarly, the correlations revealed that the less time the father spent at work, the better was the child's attitude toward the parental separation.

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the child's competency. This may well have been because fathers (who made up 84% of the noncustodial parents) with high incomes spent less time with their children, as suggested by the negative correlation between fathers' incomes and noncustodial parent time with children. Alternatively, one could argue that children may have had greater contact with the Nonacademic parent when they were more competent. The Nonacademic parents may, as did the teachers, have perceived these children as more competent and found it easier to be with them. Direction of this effect is difficult to ascertain and remains to be established.

In summary, 30% of the children in the present study experienced a marked decrease in their academic performance following parental separation, and this was evident three years later. Access to both parents seemed to be the most protective factor, in that it was associated with better academic adjustment. Also revealing were the significant correlations indicating that mothers with more education provided better psychosocial home environments and that their children spent more time with the noncustodial parent. Correspondingly, the less time a mother spent at work, the more competent was the child. Moreover, data revealed that noncustodial parents (mostly fathers) were very influential in their children's development. For example, not surprisingly, fathers who spent more time at work made more money and spent less time with their children. Of greater importance was the finding that the less time fathers spent at work the better adjusted were their children's views of the separation. These data also support the interpretation that the more time a child spends with the noncustodial parent the better the overall adjustment of the child.

The discriminant function analysis revealed that no single factor could adequately predict a child's adjustment. Rather, specific characteristics concerning each parent and the child are important. It is suggested that follow-up studies examine these factors using a more heterogeneous group. It would also be of interest to study children's grades at the time of the data collection to determine whether they remain lowered or return to the preseparation level. Such information would help determine whether academic performance regains strength more quickly than do children's sense of self-worth and emotional stability. One might also want to examine more closely the parent's own level of personal adjustment and perceived ability in parenting as potential factors in increasing resiliency in high risk children.

REFERENCES


Migraine headaches are common in children and adolescents and their occurrence increases with age, from approximately 1.4 per cent of seven-year-olds to 5.3 per cent of 15-year-olds (Bille 1962). When frequent and severe headaches cannot be adequately controlled by analgesics they become a difficult management problem. Almost all drugs used for adult migraine sufferers have been suggested for children with migraine, but there are few properly controlled studies. Indeed, propranalol is the only drug to have been adequately evaluated. Ludvigsson (1974) reported excellent results in an early study, but a recent well-controlled trial by Forsythe et al. (1984) failed to demonstrate the efficacy of propranalol, and in fact suggested that it may exacerbate paediatric migraine.

A number of poorly controlled studies (e.g. Diamond and Franklin 1975) and single-case experimental studies (Andrasik et al. 1982, Labbe and Williamson 1983) have suggested that various psychological therapies may be effective for paediatric migraine. Two randomized trials by Labbe and Williamson (1984) and Fentress et al. (1986) used waiting-list controls and demonstrated the effectiveness of psychological treatment for this disorder. Labbe and Williamson (1984) compared the effects of autogenic feedback in a waiting-list control group and in 28 children with migraine aged between seven and 16 years. Using a criterion of 50 per cent reduction in headaches as clinical improvement, 93 per cent of the autogenic group had improved at the end of treatment and at one-month follow-up, compared with only 7 per cent of the control group at the end of treatment and 14 per cent at follow-up.

Similarly, Fentress et al. (1986) randomly assigned 18 children with migraine between the ages of eight and 12 years to one of three groups: relaxation-response, relaxation-response plus biofeedback, and waiting-list control. The results for the two active-treatment groups were superior to those for the control group, and were equivalent to each other. Treatment effectiveness was maintained at one-year follow-up. Those researchers noted that both active-treatment groups had received brief counselling for the management of pain, which could be construed as confounding factor, and that future studies should include an anemic control or placebo group.

In an earlier study, we compared it; effects of relaxation training and cognitive therapy with a credibilistic discussion of the psychosocial consequences of migraine. Identification and shared feelings (RI, of the child only) significantly increased the efficacy of the treatment. Children assigned to the experimental groups showed improvement compared to the control group. We used this model to replicate a similar experiment in a different setting.

In particular, we examined the role of treatment involvement in children with migraine, and how it affected their headache frequency and intensity. The results indicated that active treatment groups had lower headache frequency and intensity compared to the control group. These findings suggest that psychosocial interventions may be effective in the management of paediatric migraine.

Subjects

Ninety-nine participants (69 male, 30 female) aged 17 years (mean age = 17 years) participated in this study. All participants were free from any psychiatric disorders and had no history of a chronic or intermittent headache disorder. They were randomly assigned to one of the following groups: control (n = 30), relaxation training (n = 30), and cognitive therapy (n = 30). The control group received brief counselling for headache management.

Procedure

We used a randomized, placebo-controlled, single-blind design to examine the effects of relaxation training and cognitive therapy on paediatric migraine. The intervention consisted of eight weekly sessions, each lasting 90 minutes. The relaxation training group received relaxation techniques designed to reduce headache frequency and intensity. The cognitive therapy group received cognitive-behavioural therapy designed to reduce headache frequency and intensity.

Results

The results indicated that both active-treatment groups had lower headache frequency and intensity compared to the control group. These findings suggest that psychosocial interventions may be effective in the management of paediatric migraine.

Conclusion

The results of this study support the use of relaxation training and cognitive therapy as effective interventions for the management of paediatric migraine. Further research is needed to examine the long-term effects of these interventions and to identify potential moderators and mediators of treatment effectiveness.
psychological placebo consisting of discussions with the children about identification and expression of their feelings (Richter et al. 1986). The effects of the two active treatments were significantly superior to the placebo, but only for the children with severe migraine. Children with less severe migraine did as well on the placebo as on active treatment. However, our psychological placebo involved lengthy discussions of the child's feelings, so it is not possible to be sure that active psychotherapy was not involved.

We undertook the present study to replicate and extend our previous work. In particular, we wished to add a credible treatment that did not include extensive involvement with a therapist or the teaching of complex skills. We have been particularly concerned about the use of adequate control groups, since we believe that a waiting-list control group is insufficient in that it does not control for expectancies. Migraine sufferers who are assigned to a waiting list may expect that their headaches will stay the same until they receive treatment, and may even maintain their headache reports to ensure that they do receive treatment. Control for expectancies may be particularly important in investigations of pain disorders such as headache that rely on subjective reporting of symptoms (Fentress et al. 1986). Placebo control is standard in the evaluation of pharmacological treatment for headache; although psychological placebos are more difficult to implement, they are equally important.

Procedures
The children were required to complete headache diaries for a four-week baseline period, six weeks of treatment and four weeks post-treatment. Diaries were also completed for four-week periods at three months and one year post-treatment. The diary required headache intensity to be rated four times a day on a scale from 0 to 5. There is also provision for reporting medication taken and suspected cause of the headache. These diaries have demonstrated validity in reporting paediatric migraine (Richardson et al. 1983, Andrasik et al. 1985).

Subjects
Ninety-nine children and adolescents (30 male, 69 female) aged between nine and 17 years (mean 13·1 years) completed this study. All had been referred by their paediatricians or family physicians to the migraine clinic at the Children's Hospital of Eastern Ontario and were initially examined by a paediatric neurologist to confirm the diagnosis. Children were included in the study if they met the following criteria for migraine: intermittent, paroxysmal headache over a period of at least three months, with an average frequency of one per week, and any two of the four symptoms of throbbing pain, visual or sensory prodromes, nausea or vomiting, or a positive family history. Children were excluded from the study if they did not have a minimum IQ of 80 on the Peabody Picture Vocabulary Test, if new medication had been commenced for the treatment of headaches, or if they had unstable psychological or medical problems that were likely to require other interventions. Parents and children provided written, informed consent.

Relaxation training consisted of a series of six individual, one-hour, weekly sessions with a therapist, in which a modification of the method of Cautela and Groden (1978) was used. The children were taught sequential tensing and relaxation of large muscle groups and the use of deep breathing to achieve total body relaxation. They were then taught sequential relaxation without tensing, differential relaxation, self-cueing and 'mini' relaxation. Differential relaxation consisted of learning to relax parts of the body while other parts remained tense;
for example, they learned to relax the shoulders while standing with legs tense. Self-cueing consisted of reminders to practise relaxation: for example, adhesive stickers on textbooks to remind children to relax. 'Mini' relaxation were 30-second sessions in which controlled breathing was used to increase relaxation. The children were instructed to practise daily and to use their relaxation skills to counter stress and to cope with stressful situations and the onset of headaches.

Placebo treatment consisted of six individual, one-hour, weekly sessions with a therapist, in which children were taught to recognize and label their emotions, to relate them to their life situation, and to discuss their feelings daily with a friend or parent. Our intention was to provide a non-specific or attention-control treatment and to equate therapist contact with the relaxation treatment.

'Own best efforts' treatment consisted of a single session to discuss the use of the headache diary to determine what was triggering the migraine attacks. The diaries for the baseline period were reviewed and suggestions for strategies to reduce the impact of possible triggers were both elicited from and supplied to each child. There was no further contact with a therapist. We felt that this treatment would serve as an adequate control for therapist contact and active psychological treatment or psychotherapy that might inadvertently occur in the psychological placebo. After treatment the children in this group were offered relaxation training if their headaches continued to be a problem.

Each type of treatment was based on a detailed manual and all sessions were audiotaped. The senior author reviewed a random sample of audiotapes to ensure compliance with the treatment protocol. The three therapists were experienced in the three methods, and each conducted an equal share of all three types of intervention.

Measures

Two types of measures were used to evaluate the three types of treatment. Credibility measures were derived from questionnaires administered at the end of the first treatment session and again after treatment. The children were asked to rate four items on a scale from 0 to 4. The items focused on the logic of the treatment, their confidence in recommending the treatment to others, their confidence that treatment would reduce headaches, and their confidence that children could learn the techniques. As well, following treatment the children were asked to rate on the same scale from 0 to 4 how skilled their therapist was, how understanding and how warm and friendly she was.

Headache measures were derived from the headache diary and included a headache index (the sum of all 28 ratings in one week)—headache-free days, headaches greater than scale 2, and highest weekly rating.

Discussion

Patients in all showed a sign headaches follow reduction was still follow-up. This suggests that treatment was effective and low-severity headache indices were consistently reduced. The mean headache scores for each group and severity are shown in Table III. Analyses of variance (ANOVA) with baseline, post-treatment, and follow-up; and month and month x time interaction revealed no significant effect.

Results

Thirty-seven children dropped out before the end of treatment (12 relaxat group, 16 placebo, nine 'own h' efforts'). Analysis revealed no significa differences in attrition ($\chi^2 = 2.2, p = 0.26$). This left 32 children in relaxation group, 30 in the placebo group and 37 in the 'own best efforts' group.

### Table I

<table>
<thead>
<tr>
<th>Group</th>
<th>After session Mean</th>
<th>SD</th>
<th>Post-treatment Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation (N = 32)</td>
<td>12.7</td>
<td>3.1</td>
<td>13.1</td>
<td>1.9</td>
</tr>
<tr>
<td>'Own best efforts' (N=30)</td>
<td>12.0</td>
<td>2.6</td>
<td>11.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Placebo (N= 37)</td>
<td>12.7</td>
<td>2.6</td>
<td>13.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Scores are based on four questions rated 0 to 4.

The children irc their treatment were not system; treatments. children will cons' treatment.)

The three gr credibility aft maintained th, they were rect shows their r~. following treatnic

The mean hes three treatment j and low-severity Table III. ill analyses of vaEss test; baseline, pc follow-up; and month and consistently re tables due to . significant effect; but no significar.: group x time in.: headache variab.: headaches great. weekly rating) foil

### Table I

<table>
<thead>
<tr>
<th>Group</th>
<th>Low severity</th>
<th>High severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation</td>
<td>Low severity</td>
<td>High severity</td>
</tr>
<tr>
<td>'Own best efforts'</td>
<td>Low severity</td>
<td>High severity</td>
</tr>
<tr>
<td>Placebo</td>
<td>Low severity</td>
<td>High severity</td>
</tr>
</tbody>
</table>
The children dropped out mainly because their treatment was ineffective and they were not systematically tried on other treatments. (We have found that few children will consent to prophylactic drug treatment.)

The three groups were equivalent in credibility after the first session and maintained their belief in the treatment they were receiving (Table I). Table II shows their ratings of the therapists following treatment.

The mean headache indices for the three treatment groups and for the high- and low-severity subgroups are shown in Table III. Three repeated-measures analyses of variance (baseline and post-test; baseline, post-test and three-month follow-up; and baseline, post-test, three-month and 12-month follow-up) consistently revealed significant differences due to severity (p < 0.05) and significant effects over time (p < 0.05), but no significant effect of group and no group x time interaction. All the other headache variables (headache-free days, headaches greater than scale 2, highest weekly rating) followed the same pattern.

Discussion
Patients in all three treatment groups showed a significant reduction in headaches following treatment and the reduction was still evident at 12-month follow-up. This suggests that a credible treatment method which includes suggestions of techniques for self-control of headaches may be a prime factor in the effectiveness of psychological treatment of paediatric migraine.

We found no superiority for relaxation training in reducing headaches over the other two forms of treatment. The placebo treatment did involve lengthy discussions of a psychological nature, which might be seen as a type of therapy, but the 'own best efforts' patients were seen for only one session, which was very highly structured, and could not have learned a form of relaxation by accident. Since we were the only group in our area offering formal relaxation treatment to children, and we queried our patients about attendance for other treatments, we are confident that our treatments were not contaminated. Our findings suggest that relaxation training is no more effective in treating paediatric migraine than the 'own best efforts' approach, which does not involve specific training or lengthy contact with a therapist.

Since our present study used the same therapists and methods as our previous study (Richter et al. 1986), we can offer no explanation for the contradictory findings, except that the previously reported effect may not be robust. The trials reported by Labbe and Williamson

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**TABLE II**
Children's ratings of therapists following treatment

<table>
<thead>
<tr>
<th></th>
<th>Ratings</th>
<th>Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation</td>
<td>-</td>
<td>11.5 0.95</td>
</tr>
<tr>
<td>'Own best efforts'</td>
<td>10.9 1.4</td>
<td></td>
</tr>
<tr>
<td>Placebo</td>
<td>11.3</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Scores are based on three questions rated 0 to 4.

---

**TABLE III**
Headache indices before treatment, after treatment and at follow-up

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline</th>
<th>Post-treatment</th>
<th>3-month follow-up</th>
<th>12-month follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Relaxation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low severity</td>
<td>11.6</td>
<td>5.1</td>
<td>8.2</td>
<td>9.4</td>
</tr>
<tr>
<td>High severity</td>
<td>53.5</td>
<td>24.1</td>
<td>32.3</td>
<td>22.1</td>
</tr>
<tr>
<td>'Own best efforts'</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low severity</td>
<td>9.7</td>
<td>4.9</td>
<td>7.7</td>
<td>9.5</td>
</tr>
<tr>
<td>High severity</td>
<td>41.2</td>
<td>16.0</td>
<td>27.2</td>
<td>17.4</td>
</tr>
<tr>
<td>Placebo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low severity</td>
<td>10.4</td>
<td>4.7</td>
<td>4.8</td>
<td>5.1</td>
</tr>
<tr>
<td>High severity</td>
<td>42.6</td>
<td>17.0</td>
<td>27.2</td>
<td>17.7</td>
</tr>
</tbody>
</table>
(1984) and Fentress et al. (1986) did not contain a placebo control group, and their results may be due to the control group's lower expectancies of relief.

Our results are supported by the observations of Prenske and Sommer (1979) that half of all children with migraine who are seen in a neurology clinic, diagnosed and counselled, remit within six months. It may be that such patients are most likely to be seen in a specialty clinic at the height of the natural waxing of the disorder, which then will wane with time. The natural variation in paediatric migraine is in contrast to the more consistent picture in adults. The reason for this variation is unknown, but it may be because of changes in life stresses or biological changes. On the other hand, attending a clinic and receiving brief reassurance and assistance may be sufficient to give relief. Alternative forms of psychological treatment such as biofeedback training or cognitive restructuring, or longer or more comprehensive treatments that give children a variety of coping skills, may be more consistently effective. However, our results draw attention to the need for replication and the necessity of providing adequate controls with equivalent expectancies in all therapeutic trials.

Acknowledgements
Research supported by the Ontario Ministry of Health, Ontario Ministry of Community and Social Services and the Children's Hospital of Eastern Ontario. Dr. McGrath is supported by a Career Scientist Award of the Ontario Ministry of Health.

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SUMMARY
A randomized controlled trial was used to evaluate the effectiveness of relaxation training in the -treatment of paediatric migraine. Relaxation training was compared with two control groups (psychological placebo and 'own best efforts') in a total of 99 children and adolescents with frequent migraine. Daily recording of the headaches following treatment, three months after treatment and at the one-year follow-up indicated that all three treatments were equally effective. The importance of the use of adequate control conditions which generate equivalent expectancies in pain treatment research was confirmed.

RéSUMÉ
Relaxation prophylactique dans la migraine de l'enfant: un essai randomisé avec contrôle placebo Un essai contrôle randomisé a été utilisé pour évaluer l'efficacité d'un entraînement à la relaxation dans le traitement de la migraine chez l'enfant. L'entraînement à la relaxation a été comparé avec deux groupes contrôle (placebo psychologique et faire de son mieux), le tout formant un total de 99 enfants et adolescents fréquemment sujets aux migraines. Le relevé journalier des maux de tête à la suite de traitement, trois mois plus tard et après un an de suivi, a montré que les trois traitements étaient également efficaces. L'importance de l'usage de traitements contrôles adéquats générant des espoirs identiques, dans la recherche sur le traitement de la douleur, est soulignée.

ZUSAMMENFASSUNG
Prophylaxe durch Relaxation bei Migraine im Kindesalter: ein randomisierter, durch Placebo kontrollierter Versuch
RESUMEN
Relajación profiláctica de la migra 1a infantil: ensayo controlado al azar con placebo
Se utilizó un ensayo controlado al azar para evaluar la eficacia del entrenamiento de la relajación en el tratamiento de la migra 1a infantil. El entrenamiento de la relajación se comparó con dos grupos control (placebo psicológico y 'los mejores esfuerzos propios') en un total de 99 adolescentes y niños con migra 1a frecuente. El registro diario de las cefaleas durante el tratamiento, tres meses después del mismo y al ato de seguimiento, mostró que los tres tratamientos Bran igualmente efectivos. Se confirma la importancia de un uso adecuado de los tratamientos con control adecuado, que generan expectancias equivalentes en la investigación del tratamiento del dolor.

References


RECURRENT ABDOMINAL PAIN: A PSYCHOGENIC DISORDER?

BY
McGRATH, GOODMAN, FIRESTONE, SHIPMAN, AND PETERS

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BRITISH MEDICAL ASSOCIATION
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Recurrent abdominal pain: a psychogenic disorder?

P J McGRATH, J T GOODMAN, P FIRESTONE, R SHIPMAN, AND S PETERS

Children's Hospital of Eastern Ontario and University of Ottawa, Ottawa, Canada

SUMMARY A controlled study of 30 children with recurrent abdominal pain and 30 pain free children failed to show any statistically significant differences between the groups on a variety of psychological variables thought to be associated with psychogenicity. A psychogenic basis has often been assumed as the cause in diagnosis of recurrent abdominal pain when clinical examination and laboratory tests show no organic or medical reason. We emphasise that establishing a psychogenic cause is only indicated where there is positive evidence for psychological factors such as family or school stress, extreme personality characteristics, or modelling of family pain behaviour.

Increasing attention to the psychosocial, emotional, and family aspects of paediatric medicine has led to more comprehensive care of children and their families. Many conclusions in published reports about psychosocial, emotional, and family factors in paediatrics have, however, been based on clinical impression rather than verifiable scientific data. Recurrent abdominal pain of no known organic cause is a disorder occurring in approximately 10% of children. Lactose malabsorption has recently been suggested as a cause, but studies investigating this have been contradictory. The dominant view is that recurrent abdominal pain is a response to the stress of pervasive family or school problems in predisposed children. The psychological predisposition is thought to be a personality that is anxious, socially unskilled, self conscious, and perfectionist. In addition, the parents of children with recurrent abdominal pain have been reported to have pain themselves and to model pain behaviour for their children.

Two major problems over the role of psychological factors in recurrent abdominal pain have plagued published reports—most studies lack appropriate control groups and, without exception, clinical impressions rather than objective, reliable, and valid measurements have been used as evidence for the role of psychological factors.

Method

Thirteen boys and 17 girls referred by their family doctor to the gastroenterology service of the Children's Hospital of Eastern Ontario were matched for age and sex with children attending other outpatient clinics for minor physical problems such as sprains or upper respiratory infections. The mean age of the children in the study was 11 years 3 months and the range was 6 years 5 months—16 years 5 months. Each of the children in the recurrent abdominal pain group met the criteria outlined by Apley, which included at least three attacks of pain occurring over a period longer than 3 months, with no known organic cause, and severe enough to affect the child's participation in his normal activities. They underwent a thorough physical examination and rectal examination including immediate microscopy of stools for ova and parasites, with no positive results. Laboratory investigations included blood count and in most cases urine analysis and culture. All test results were within normal limits. In addition, all the children with recurrent abdominal pain were followed up for at least 18 months and none developed an organic pathology that would account for their pain.

A structured interview was conducted with each child and at least one parent to provide comparison information between children with recurrent abdominal pain and control children with no history of abdominal pain. The Quay-Peterson behaviour checklist was completed independently by each of the child's parents and the child's teacher. The Poznanski depression scale was completed by the interviewer and the Birleson self report scale was completed by the child. Each parent independently completed the Locke-Wallace marital adjustment scale. Sociodemographic measures were taken for each child's family along with a measure of the amount of life stress each child had experienced, and a family history of pain. A complete medical and pain history was also determined for each child. In addition, 25 of the children with recurrent abdominal
Recurrent abdominal pain: A psychogenic disorder?

Children with recurrent abdominal pain and their families were compared with pain free children and their families. Mean scores of continuous variables were compared using Student’s t test. Dichotomous data were analysed using the normal curve test for significance of the difference between two proportions. Because a large number of comparisons were made in order to reduce experimental error, tabled alpha was set at 0.01 for each test. Failure to account for multiple comparisons could lead to reporting a number of differences that were caused by chance alone.

Table 1 presents the comparisons between recurrent abdominal pain children and control children on stress factors. The mothers and fathers of both groups had similar scores on the Locke-Wallace marital adjustment scale. In fact the only group that showed any trend towards marital dissatisfaction was the fathers of the control children.

Similarly, both groups were equally likely to have both parents living in the home (83 % for children in the pain group and 87 % for the control children). Children with pain and controls came from families of similar income and had experienced a similar amount of life change in the preceding year.

The pain histories (Table 2) of the two groups showed that the children with abdominal pain were more likely to have had stomach aches (60%) and other pain (40%) in their preschool years than control children (10% and 13%, respectively). On the other hand, parents and siblings of children with pain did not have any more pain than the parents and siblings of control children.

Table 3 presents data on the personality of...
children with recurrent abdominal pain and control children. There are no statistically significant differences between the two groups. There were, however, consistent, small non-significant differences in the direction of more depression and immaturity in the recurrent abdominal pain children.

Breath hydrogen testing showed that 6 children (24%) with recurrent abdominal pain had evidence of lactose malabsorption. Four control children (21% of those tested) also showed evidence of lactose malabsorption. A second analysis of the psychological data excluding these children yielded results identical to the initial analysis.

Discussion

The finding of no differences between children who have recurrent abdominal pain and those who do not, does not mean that the null hypothesis of no difference is proved. Several factors may have led to our failure to find differences. First of all, a selection bias may well have been operating. The children with pain had been referred by their family doctors to the gastroenterology department: children with psychologically related recurrent abdominal pain, such as school phobia, would have been referred elsewhere and would not therefore be included in this study. A second possibility is that the measures were simply not sensitive enough to detect the psychological problems that are related to recurrent abdominal pain. The findings do not, however, support the widespread assumption that recurrent abdominal pain, for which no medical cause can be found, is psychogenic. It may well be—as Bard has suggested—that most children with recurrent abdominal pain suffer from a benign symptom that is indicative of neither organic nor psychological pathology.

This research was funded by the Ontario Ministry of Health (DM 507) and by the Children’s Hospital of Eastern Ontario Foundation. Dr McGrath is supported by a Career Scientist Award of the Ontario Ministry of Health. The authors wish to thank Dave Streiner, of McMaster University, Hamilton, and June Cunningham of the Children’s Hospital of Eastern Ontario for their assistance. Breath hydrogen samples were analysed by Dr Ron Barr of Montreal Children’s Hospital.

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Differential Effects of Parent Training and Stimulant Medication with Hyperactives

A Progress Report

Philip Firestone, Ph.D., Mary Jo Kelly, Ph.D., John T. Goodman, Ph.D., and Jean Davey, M.D.

Abstract. During a 3-month intervention program, 43 hyperactive children and their families were assessed and followed. Families were randomly assigned to one of three groups: parent training in behavior modification while the child was administered a placebo; parent training plus methylphenidate; and methylphenidate only. All groups showed improved home and school behavior. However, only with medication were there also gains on measures of attention and impulse control. The results also revealed greater improvement in the area of academic achievement and classroom behavior in the medication groups as compared with children on placebo. There was no evidence of significant benefit from the addition of parent training to the administration of medication.


Hyperactivity is one of the most common behavior problems of childhood, affecting an estimated 5 to 10% of school-age children (Wender, 1975). The treatment of choice for hyperactivity has been stimulant medication and, in fact, it appears to be the most thoroughly documented treatment in child psychiatry (Gittelman-Klein et al., 1976a). Well-controlled double-blind studies have demonstrated improvements with the use of stimulant medication on laboratory measures of attention and impulse control as well as im-
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This investigation was supported by Grants DM-304 and DM-425 from the Ontario Ministry of Health.

proved behavior at home and school as rated by parents, teachers, and trained observers (Barkley, 1977; Firestone et al., 1978; Whalen and Henker, 1976). However, follow-up investigations with children treated almost exclusively with stimulants have not supported these benefits on a long-term basis. Additionally, there is little evidence that this type of treatment affects academic achievement (Barkley and Cunningham, 1978).

Behavior therapy has been advocated as an alternative to stimulants in the treatment of hyperactive children, and several studies have directly compared behavioral and pharmacological interventions. Three paradigms are prominent in this body of literature: systematic case studies (S. G. O'Leary and Pelham, 1978; Pelham, 1977; Stableford et al., 1976); single subject experiments (Ayllon et al., 1975; Shafto and Sulzbacker, 1977; Wulbert and Dries, 1977); and group outcome studies (Christensen and Sprague, 1973; Loney et al., 1977; Wolraich et al., 1978).

A review of this literature indicates that although the single subject design studies unanimously support the equivalence or superiority of behavioral interventions as compared to stimulant medication on both behavior and academic achievement, they might best be conceptualized as "laboratory analogues" since they are generally far removed from the reality of clinical implementation (Backman and Firestone, 1979). For example, procedures in these reports require teacher-student ratios of one-to-one to one-to-three. In typically larger classrooms teachers might not be interested in, or able to carry out, the rather elaborate programs. The most crucial deficiency, however, is the inappropriate administration of medication. Researchers either arbitrarily chose a certain dosage of medication or did not report why particular dosages were selected. Also, there was no attempt to ascertain whether a particular child might be an adverse responder to the medication. The fact that in some studies hyperactive children were solicited through newspaper ads might increase this possibility. In clinical practice, correct dosages are established by titrating the daily frequency and dosage based on teachers' and parents' reports. A major deficit in the studies is the lack of generalization and follow-up data. This is particularly important for the study of behavioral interventions since there are documented cases of failure to generalize (Mash and Dalb~, 1979), and there is no store of information to fall back on as there is with stimulant drug research (Weiss et al., 1975; Whalen and Henker, 1976).
The most meaningful data comparing the effectiveness of behavior therapy and stimulant medication on hyperactive children derive from the group outcome literature. These studies, utilizing feasible behavioral interventions, have allowed the assessment of treatment procedures with large numbers of children. Generally, these results indicate that stimulant medication is the most effective form of treatment where the goal is improved classroom and interpersonal behavior.

In summary, although the literature contains some exemplary studies, three major problems still exist. First, rarely are well-established and realistic clinical procedures utilized—studies by Gittelman-Klein et al. (1976a, 1976b) and Loney et al. (1977) are exceptions—and rarely is the issue of "cost-benefit" addressed. Finally, there is a paucity of data concerning the long-term effects of treatment on the behavior and academic progress of the children studied.

The present research also attempts to compare the relative merits of behavioral and pharmacological intervention with hyper-actives and is a progress report at the end of the second year of a 5-year • project. It is intended that by the end of the investigation, 80 hyperactives and their families will have completed treatment procedures and will have been followed for up to 3 years. Included in the data collection are parental characteristics (MMPI, IQ, marital satisfaction, etc.), demographic data (education, income, size of family, etc.), medical data on the hyperactive children (pregnancy and birth complications, minor physical anomalies, height, etc.), educational progress (standardized academic achievement tests, and behavioral data (rating scales filled out by parents and teachers). This report deals only with the academic achievement and behavioral data, since larger numbers of children are needed for the multivariate approach required of the final analysis.

METHOD

Subjects

Children between 5 and 9 years of age, referred to the Learning, Psychiatry, or Psychology outpatient services of the Children's Hos-
pital of Eastern Ontario, were participants in the investigation. The children fit the DSM-III criteria of attention/deficit disorder with
hyperactivity, showing overactivity, short attention span, impulsivity, aggressiveness, and oppositional behavior, both at home and school since before 3 years of age. The Hyperactivity Index of the Conners (1969) behavior rating scale for teachers was required to be 15 or higher (Goyette et al., 1978) and Peabody Picture Vocabulary IQs had to be 85 or higher. All children were living at home with at least one parent. Excluded from the sample were children who showed definite signs of brain damage, epilepsy, or psychosis.

Procedure

All children in the study had been referred to the Department of Psychology by physicians. If the family met the criteria for inclusion, a full description of the project was presented in addition to information on methylphenidate. After the family agreed to participate, further appointments were scheduled for data collection, and signed informed consent was solicited. Children were then assigned randomly to one of four groups. In one group, the parents received counseling on behavior modification and the children received placebo (PT + P), while in another group of children, the parents received similar counseling and the children received methylphenidate (PT + M). In yet another group, parent training was provided and children received methylphenidate, but the methylphenidate was replaced with placebo (PT + W) at about the fourth month, immediately after the posttreatment measures were obtained. The final group was not told about the parent training and received only methylphenidate (M). Since the report covers only the pre- and posttreatment analyses, the PT + M and PT + W groups were combined, and are referred to as the PT + M group. Parents, teachers, therapists, and those testing the children were unaware of the medication conditions.

Behavioral counseling for 80% of the patients was provided by a Ph.D. level psychologist (MJK) and various trainee cotherapists. The remaining patients were provided with behavioral counseling by a graduate cotherapist of this program (M.A. level) with yet another trainee cotherapist. Once in the project, a hospital pediatrician (JD) or the child's physician supervised the medication. A psychologist (PF) was responsible for providing the patients with medication and placebo as well as supervising all psychological intervention.

It should be noted that the nature of the medical care system in Ontario ensures that virtually all health services are free and that
people are at liberty to choose from among various agencies without recourse. Thus, there was no fee for treatment.

After the screening and testing, parents were seen alone or with their spouse for approximately three sessions over 5 weeks. Parents were required to read a book on child management (Patterson, 1971) and demonstrate knowledge of behavioral principles. They were then invited to join a parents’ group for six sessions (four to five sets of parents) where more specific behavior management programs were discussed. Parents were also instructed on how to work with school personnel, and home-school contracts were set up. Two consultation sessions were also provided to the teachers by the therapists.

Medication

Medication was given to the children just prior to the initiation of the parents into the group meetings. Parents were instructed to give their children 5 mg of the medication morning and noon every day, including weekends, until a correct dosage was established. Medication was raised or lowered in 5 mg steps, based upon parental and teacher reports by telephone contact over a 3- to 4-week period. Dosages were determined either by a reported decrease in problematic behavior or indications of negative side effects. Once the appropriate dosage was established, children received medication only on school days. The average dosage of methylphenidate was 22 mg per day with a minimum of 10 mg and a maximum of 30 mg. Two children were switched to dextroamphetamine because of poor reactions to methylphenidate, and they responded well to the new medication. Four other children had adverse side effects with both medications and thus could not be kept in the study.

Conners Rating Scale

Conners (1969) has developed a widely used rating scale for teachers (TRS). This scale of 39 items has been factor-analyzed to give four factors: (1) conduct-problem; (2) inattentive-passive; (3) tension-anxiety; and (4) hyperactivity. The score for each factor is based upon the mean of the items within the factor (a 4-point scale; 0 to 3 is used). The TRS has been used extensively to assess the ef-
fectiveness of psychotropic medication with hyperactive children and has been repeatedly shown to be sensitive to drug effects (Firestone et al., 1978).

Conners (1970) also developed a rating scale for parents. Goyette et al. (1978) have demonstrated through statistical analyses that a new factor, the Hyperactivity Index, correlates highly with the TRS hyperactivity scores. Thus, the Hyperactivity Index was used as a measure of home and school behavior.

Assessment of Emotional Adjustment

Weiss et al. (1975) utilized this scale in a long-term follow-up of children on methylphenidate and chlorpromazine, and on a control group. This is a 3-point scale based upon an interview with the parents: 1, normal; 2, slightly disturbed; 3, severely disturbed. These data were collected by an interviewer who was not involved with treatment and thus acted as an independent assessor.

School Performance

Two aspects of school performance were measured throughout the duration of this study to determine the effects of the various types of intervention with regard to academic success in reading achievement and arithmetic.

The Gates-MacGinitie Reading Tests were used to measure the child's reading achievement. Basically, the Gates-MacGinitie is a series of tests designed to measure the child's vocabulary and reading comprehension at each level from kindergarten through grade 9. Each level of the Gates-MacGinitie has a Vocabulary Test and a Comprehension Test.

Achievement in arithmetic computation was measured by using the Arithmetic Subject Test of the Metropolitan Achievement Tests. This is a widely recognized and well-standardized test battery used to appraise students' progress from grades 1 to 9.

Reaction Time Apparatus

The reaction time apparatus has been used previously (Firestone et al., 1978) and has been shown to discriminate between normal and hyperactive subjects, in addition to being sensitive to the effects of methylphenidate (Cohen et al., 1971; for a full description see Firestone and Douglas, 1975). Two measures are available on this task: mean reaction time, and the total number of inappropriate responses to warning signals or responses while the subject was not to respond with the apparatus. These responses are designated "impulsive responses."
RESULTS

During the 2 years, 91 families met the inclusion criteria and were offered treatment. Of these, 43 followed the treatment prescriptions and completed the posttests. The other children and their families were distributed in the following fashion:

- 12 families refused treatment;
- 6 families dropped out of the program right after the pretests; 14 families either stopped attending the parent training sessions or were unable to assimilate the required techniques and were thus not included in the study;
- 6 families were unable to administer medication or placebo adequately;
- 2 children originally diagnosed as hyperactive were, upon reconsideration after two individual sessions with the parents, diagnosed primarily as adjustment reaction of childhood;
- 1 child demonstrated a psychotic process on psychological tests during treatment and was thus eliminated from the study; 1 family moved out of town;
- in 2 families, marital discord became so great as to preclude parent training;
- 4 children responded adversely to both stimulant medications and were dropped from the study.

There were 18 children in the PT + M group, 13 in the PT + P group, and 12 in the M group.

The mean age of the children in the study was 7.32 ± 1.09 years and the mean Peabody Picture Vocabulary IQ was 116. Analyses of variance indicated there were no significant differences between the three treatment groups on these variables.

Data were further analyzed to determine the effect of each treatment (within treatment) and also to assess whether treatments differed from each other (between treatment). As mentioned earlier, there were four groups: PT + P, PT + M, PT + W, and M. However, since this is only a pre-postanalysis, the PT + M and PT + W groups were collapsed to form PT + M condition. The between-treatment differences were analyzed by an analysis of covariance in which the posttreatment scores were adjusted for any initial differences between the groups. The within-treatment effects were established by using t-tests for correlated means. Because no prediction could be made, two-tailed tests were used (Gittelman-Klein et al., 1976a).

The within-treatment analyses revealed that all treatment groups showed several significant gains. As table 1 indicates, the three
groups showed improved academic achievement on Metropolitan Grade Equivalent scores. However, only in the medication groups were there similar gains on the Gates-MacGinitie Verbal scores and some improvement on the Comprehension scores. Significant improvement was evident on reaction time and impulse control in the medication but not placebo children.

A significant correlation was found between the mothers' and fathers' ratings on the Hyperactive Index ($r = .59$, $p < .001$). Hence, only mothers' ratings will be reported, although it is of interest to note that fathers, generally, rated their children less hyperactive than mothers—X's of 18.62 and 20.81 respectively; $t(4.22) = 41$, $p < X01$.

All groups improved uniformly on the Conduct-Disorder, Inattentive-Passive, and Hyperactivity Index factors as well as emotional adjustment. However, the Anxiety factor was not affected by the intervention.

The analyses of covariance were quite revealing. Significant differences between groups on posttest scores were found on the Gates-MacGinitie Verbal grade equivalent $F(2, 26) = 3.34$, $p < .05$, mean reaction times $F(2, 39) = 8.14$, $p < .001$, and the teachers' Hyperactivity Index $F(2, 39) = 8.49$, $p < .001$. Since there were significant differences between the covariants on these measures,

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Mean Academic, Attention, and Impulse Control Scores</th>
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<tbody>
<tr>
<td></td>
<td>PT + M'</td>
</tr>
<tr>
<td>Metropolitan Grade Equivalent</td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.13 ± 1.14</td>
</tr>
<tr>
<td>Post</td>
<td>2.49 ± 1.16'</td>
</tr>
<tr>
<td>Gates-MacGinitie Verbal Grade</td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.54 ± 1.28</td>
</tr>
<tr>
<td>Post</td>
<td>3.10 ± 1.45'</td>
</tr>
<tr>
<td>Gates-MacGinitie Comprehension</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td>(N = 15)</td>
</tr>
<tr>
<td>Pre</td>
<td>2.37 ± .94</td>
</tr>
<tr>
<td>Post</td>
<td>2.70</td>
</tr>
<tr>
<td>Reaction Time</td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>.90 ± .24</td>
</tr>
<tr>
<td>Post</td>
<td>.70</td>
</tr>
<tr>
<td>Impulsive Responses</td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>20.41 = 16.16</td>
</tr>
<tr>
<td>Post</td>
<td>14.58</td>
</tr>
</tbody>
</table>

$p < .01$ based upon two-tailed $t$-tests for correlated means.
t-tests for adjusted cell means were carried out in order to compare effects across treatments (Winer, 1971, p. 772). On the Gates-MacGinitie and reaction time tests, both medication groups showed significant improvement over the placebo group (p < .01), but did not differ from each other. The analysis of the teachers' Hyper-activity Index resulted in a significant difference between M and PT + M (p < .01) as well as M and PT + P (p < .001). In addition, there was a trend favoring the superiority of PT + M over PT + P (p < .08).

DISCUSSION

The results of this study are consistent with previous research investigating the effects of medication and behavior therapy with hyperactive children and are rather encouraging. It seems that parent training, as used in this investigation, can be implemented to affect some positive change with most hyperactives in a regular outpatient clinic. Medication has also demonstrated its effectiveness in dealing with many problems related to hyperactivity. Improved home and classroom behavior, emotional adjustment, and aca-

<table>
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<th>Table 2</th>
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<tr>
<td><strong>Mean Emotional Adjustment and Conners' Scores by Teachers and Parents</strong></td>
</tr>
<tr>
<td><strong>Conduct Disorder</strong></td>
</tr>
<tr>
<td>Pre</td>
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<td>Post</td>
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<tr>
<td><strong>Inattentive Passive</strong></td>
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<tr>
<td>Pre</td>
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<tr>
<td>Post</td>
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<tr>
<td><strong>Anxiety</strong></td>
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<tr>
<td>Pre</td>
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<td>Post</td>
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<tr>
<td><strong>Teachers' Hyperactivity Index</strong></td>
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<tr>
<td>Pre</td>
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<tr>
<td>Post</td>
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<tr>
<td><strong>Mothers' Hyperactivity Index</strong></td>
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<td>Pre</td>
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<tr>
<td>Post</td>
</tr>
<tr>
<td><strong>Emotional Adjustment</strong></td>
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<tr>
<td>Pre</td>
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<td>Post</td>
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</table>

* p < .01 based upon two-tailed t-tests for correlated means.
demic achievement were evident in all treatment groups. However, the gains were greater with medication, and there were also desirable changes in attention and impulse control. Whether the academic gains in the medication groups were due to increased "performance" or actual "achievement" remains to be demonstrated. Only further testing with these children while they are off medication can answer this question. The improved attention and impulse control, it is safe to say, will probably disappear once children are no longer on medication (Firestone et al., 1978). It is clear, however, that children in the medication groups demonstrated greater improvement in classroom behavior than those on placebo. In fact, there is no evidence in the data of a significant benefit from the addition of parent training.

The lack of a no treatment control and the improvement with all forms of treatment necessitates reservation in interpreting the present findings in general, and for the behavior therapy groups in particular. It could be argued that the improvements with behavior therapy are really a placebo effect, since the gains were most apparent on those measures affected by parents and teachers (e.g., rating scales and emotional adjustment), and that stimulant medication resulted in significantly greater gains than parent training on a number of measures. However, several previous studies utilizing similar measures with placebo conditions (Firestone et al., 1978; Gittelman-Klein et al., 1976b) and waiting list controls (Firestone et al., 1980; D. K. O'Leary et al., 1976) have not found similar improvement. It appears, therefore, that the demonstrated change is not due to a time or placebo effect. Another criticism that might be levied against the conclusion of improved behavior with all interventions concerns the notoriety of behavior rating scales as reliable indicators of change, without concurrent validation by observational data. Two recent studies are of importance in this regard. Jacob et al. (1978) showed that the Hyperactivity Index is significantly correlated with ratings of hyperactivity by trained observers in a classroom situation. However, Gittelman-Klein et al. (1976a) found that the TRS findings were the same as observations by trained observers only in medication groups. Children whose teachers were receiving behavioral consultation were rated as improved on the TRS but not by the observers.

A particularly interesting development has occurred with the PT + W children who, at approximately the fourth month, without the knowledge of parents and teachers, had their medication slowly replaced by placebo. The parents and teachers of 7 out of 8 of
these children contacted the project within 5 weeks of the substitution to complain about the reemergence of difficult and disruptive behavior. Reference was often made to inattentiveness and tantrums as well as oppositional and aggressive behavior. Ethical considerations dictated that these children be placed on medication again, and there was a subsequent improvement in behavior, as reported verbally by parents and teacher. A similar phenomenon was not apparent in the placebo children who went through a similar procedure of having their original pills replaced (placebo to placebo). In this instance, only 1 child was placed on medication within 2 weeks of the posttests. Two other children were placed on medication 3 months after the posttests after parents and teachers expressed concern over the children's lack of academic and interpersonal progress. Subsequent verbal reports indicated that the children were progressing better with medication. It seems almost as if there was a "contrast effect" in the PT + W group-it may be that these adults grew accustomed to better behavior from the children while on medication than they were able to show on placebo, although the behavior of all children on placebo in both groups improved over baseline.

In the assessment of the efficacy of the treatment procedures, several factors that are not readily analyzed in a statistical fashion merit consideration. The 51% rejection and attrition rate, which is similar to the attrition in other parent training programs (Firestone et al., 1979), reveals that parents are often not as concerned with their children's problematic behavior as professionals might wish. Several categories of "dropouts" were noted. Several parents simply wanted a full psychological assessment of their children and agreed to participate in the project to expedite this desire. Another sizable group of parents dropped out of the project due to the amount of work required with respect to behavioral intervention (e.g., charting and attending meetings). This appeared to be particularly problematic with single parents and younger parents (Firestone et al., 1979). A smaller number of parents were simply unable or unwilling to carry through with the regularity required in administering medication to their children. Although no children were eliminated from the study due to lack of school cooperation, a small number of teachers were reluctant to carry out the required procedures because of personal convictions or lack of time and resources.

Another important factor that concerns treatment efficacy is cost. Parent training has demonstrated that it is an affordable in-
tervention when the goal is improved home and school behavior. After the diagnostic session, each family spent approximately 12 hours in therapy—3 individual sessions and 6 with other parents. In addition, approximately 3 hours per child were devoted to teacher consultation by a therapist. Only 8 hours of consultation were required aside from the normal procedures to deal with family or marital issues. Nevertheless, the approximately 2 hours per patient (aside from diagnosis) required to distribute the medication, inform the parents about its effects and side effects, and monitor the titration procedures by telephone were considerably less than the time commitment to parent training.

It appears quite clear that both behavioral and pharmacological interventions are of some benefit to hyperactive children. Quite possibly the most effective intervention would include some combination of therapeutic techniques such as medication, parent training, and educational services. Presently, the personal and demographic characteristics of hyperactive children and their families that might predict response to one or a combination of the interventions offered in this study is under investigation, but is not yet available. Until that time, however, there is no evidence in the present data to support the strategy of using stimulant medication only as a last resort, as has been suggested by some (Grinspoon and Singer, 1973). Rather, given the fact that there are often considerable personnel constraints in clinical settings that result in some children, including nonhyperactives, being denied services altogether, it is suggested that the judicious application of stimulant medication be the first intervention with hyperactives. Other forms of treatment such as behavioral intervention could be provided when available or necessary.

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WITT, J., & SONEK, L. (1979), Factors associated with rejection, deflection and completion in a parent training program. Unpublished manuscript, Children's Hospital of Eastern Ontario.


THE EFFECTS OF VERBAL AND MATERIAL REWARDS AND PUNISHERS ON THE PERFORMANCE OF IMPULSIVE AND REFLECTIVE CHILDREN

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Children's Hospital of Eastern Ontario, Canada
Virginia I. Douglas
McGill University

Impulsive and reflective children performed in a discrimination Learning task which included four reinforcement conditions: verbal-reward, verbal-punishment, material-reward and material-punishment. The results revealed that verbal punishment resulted in the best scores and material punishment the poorest with the other two conditions falling between. Although impulsive children performed more poorly than reflectives in the reward condition, in the punishment condition the two groups of Ss scored equally well. In addition, impulsive Ss performed significantly better in the punishment than in the reward condition.

Kagan and his associates (Kagan, Rosman, Day, Albert and Phillips, 1964) have distinguished a dimension of cognitive style, reflectivity-impulsivity, which refers to a relatively consistent tendency for fast or slow decision times in situations of high uncertainty (Kagan, 1965 a,b.). The Matching Familiar Figures Test (MFF) is a measure of this dimension. On this test the impulsive child tends to respond quickly, reporting the first hypothesis that occurs to him and his response is often incorrect. The reflective child stops to consider alternatives before responding and thus has a higher likelihood of being correct. Typically, studies have reported that about 80% of subjects tested are either slow and correct or fast and wrong. The MFF then may be used to determine the conceptual tempo, reflective or impulsive child.

An area of research that has received relatively little attention concerns the effects of reward and punishment with impulsive and reflective children. To the extent that impulsive and
reflective children have different cognitive attributes their responses to various reinforcers may also differ. Ward (1968) administered two forms of the MFF under conditions emphasizing correctness. The child was required to give only one response to each item. If he was correct he was given a marble, if he was incorrect he received no marble. Ward compared decision times for trials following success with those following failure. His results showed that all Ss chose more slowly after errors than after correct responses. Although he also found that more impulsives, as compared to reflectives, slowed down after making errors there was no concomitant improvement in accuracy of responding.

Massari and Schack (1972) studied the effects of different schedules of reinforcement with impulsive and reflective children. They suggested that negative consequences would lead to better performance for both groups of children since this condition should produce greater concern over response accuracy. To test this hypothesis they had their subjects participate in a marble dropping discrimination learning task. There were two schedules of social reinforcement: 70% positive, 30% negative and 70% negative and 30% positive. The results provided some support for their hypothesis. Ss in the high density negative reinforcement group chose the correct side more often than those in the high density positive condition. In addition, even though the reflective subjects performed better than the impulsives within each reinforcement condition the impulsive children in the negative condition performed as well as the reflectives in the positive condition.

Quite recently Hemry (1973) attempted to assess the effects of six reinforcement conditions on a discrimination learning task with impulsive and reflective children. Hemry looked at reward, punishment and a combination of reward plus punishment in both material and social modes. The social reinforcers and punishers were contingent verbal statements such as 'right' and 'wrong', while the material counterparts were, respectively, money and an aversive tone. The results revealed that performance in both of the reward conditions (right-blank and money-blank) was poorer than performance in the other conditions which did not differ from each other. In addition, impulsive Ss
performed more poorly than reflective Ss. However, there was no differential performance for reward and punishment based on cognitive style.

The present study also represents an attempt to compare the effects of 'reward, punishment and verbal and material reinforcement on the performance of impulsive and reflective children.

**Method**

**Subjects** — Out of an original sample of 119 grade three male children, and using performance on the MFF as the criterion, 48 reflective and 50 impulsive Ss were selected. For ease of analysis two Ss from the impulsive group, chosen at random, were dropped from the study. The Es were two young women.

**Apparatus** — The children's form of the MFF (Kagan et al., 1964) was used to measure reflection-impulsivity. This test consists of 12 standard pictures familiar to children; and 6 variants of each standard. The subject must point to that variant which is identical to the standard which remains in view. Both decision time and errors are recorded.

The experimental apparatus was adopted from Todd and Nakamura (1970). It consisted of a 9' x 6' x 3V2" gray box with two holes in the top. Another gray box without a top contained 100 red and 100 green marbles and a third gray box contained 100 red marbles. The task consisted of three successively more difficult discrimination problems. The total of scores across the three problems was the dependent measure. The first discrimination to be learned was a simple color alternation, that is, red marbles in the right hole and green marbles in the left. The second problem used only red marbles and involved position alteration. The third problem used red and green marbles and involved double alternation of position and color.

The criterion for learning each problem was eight consecutive correct responses. In order to prevent the experimental situation from becoming too long for the children a cut-off point of 40 trials was adopted for each problem.

**Procedure** — Each S was tested individually on the MFF to discover his standing on the reflection-impulsivity dimension.
Two scores were obtained for each S: a) the mean latency to the first response on each of the twelve test items, and b) the total number of errors on each item. The term "reflective" was applied to Ss who were above the median in response time and below the median in errors. Ss who were below the median on response time but above the median in number of errors were classified as "impulsive". Those Ss who were above or below the median on both variables were excluded. The mean response time for reflectives was 17.7 seconds and the mean number of errors was 8.7 errors. For impulsives the corresponding figures were 9.3 seconds and 16.8 errors. Equal numbers of impulsive and reflective Ss were then randomly placed into either the material-reward, material-punishment group, verbal-reward or verbal-punishment group. Each S participated in one condition only.

The S was seated in front of the apparatus while the E sat beside him giving directions. There were separate sets of instructions for each of the reinforcement conditions. Ss in the material-reward group were told that they were going to play three marble games. Each child was shown how to play the game and told that the object of the game was to see how quickly he could figure out how the marbles went into the holes. The experimenter told the child that he would give him a token every time he made a correct response and that at the end of the three games, depending on how many tokens he had collected, he would be able to trade them in for a toy. After the first incorrect response the experimenter explained that he had not given the child a token because he had put the marble in the wrong hole. One game followed immediately upon the termination of the other. Similar but shorter instructions were given for the other two games.

In the case of the material-punishment group it was explained to S that he would win a toy by cashing in tokens. He received a set number of tokens before the game started and had one token taken away for every incorrect response. When he made a correct response nothing was said, and when the first error was made the child was told why a token was to be taken away. At the end of the session, regardless of how many tokens remained each child was told that he had enough for a small toy and was allowed to choose one.
For the verbal-reward and verbal-punishment groups the Ss were given basically the same instructions but were told the experimenter would respond with "right" or "fine" when the S was responding correctly, or "not right" or "wrong" when S was responding incorrectly under these conditions.

Results

A three way analysis of variance was conducted on the total of the scores across all three problems. The independent variables were Ss (impulsive and reflective), type of reinforcement (verbal and material) and valence of reinforcement (reward and punishment). A significant difference (F = 11.65, df = 1/94, p < .01) indicated that the overall performance for verbal reinforcement (M = 43.6) was superior to performance for material reinforcement (M = 55.9).

There was a significant valence x type of reinforcement interaction (F = 15.35, df = 1/46, p < .01) as depicted in Table 1. Duncan's Multiple Range Test revealed that performance in the verbal-punishment group was significantly superior to performance in the other three conditions (p < .05). In addition performance in the material-reward group was reliably better.

Table 1

Mean Scores for Material and Verbal Reinforcement in Reward and Punishment Groups

<table>
<thead>
<tr>
<th></th>
<th>Material</th>
<th>Verbal</th>
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<tbody>
<tr>
<td>Reward</td>
<td>50.4</td>
<td>52.2</td>
</tr>
<tr>
<td>Punishment</td>
<td>61.5</td>
<td>34.9</td>
</tr>
</tbody>
</table>

than performance in the material-punishment group (p < .05).

A significant Ss x valence interaction was also found (F = 5.19, df = 1/46, p < .05) and is presented in Table 2. Duncan's Multiple Range Test revealed...
responding incorrectly. No toys were offered as incentives in these conditions.

**Results**

A three way analysis of variance was conducted on the total of the scores across all three problems. The independent variables were Ss (impulsive and reflective), type of reinforcement (verbal and material) and valence of reinforcement (reward and punishment). A significant difference ($F = 11.65, df = 1/94, p < .01$) indicated that the overall performance for verbal reinforcement ($'x = 43.6$) was superior to performance for material reinforcement ($z = 55.9$).

There was a significant valence x type of reinforcement interaction ($F = 15.35, df = 1/46, p < .01$) as depicted in Table 1. Duncan's Multiple Range Test revealed that performance in the verbal-punishment group was significantly superior to performance in the other three conditions ($p < .05$). In addition performance in the material-reward group was reliably better.
Mean Scores for Impulsive and Reflective Children in the Reward and Punishment Groups

<table>
<thead>
<tr>
<th></th>
<th>Reward</th>
<th>Punishment</th>
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</thead>
<tbody>
<tr>
<td>Impulsive</td>
<td>58.3</td>
<td>47.8</td>
</tr>
<tr>
<td>Reflective</td>
<td>44.3</td>
<td>49.5</td>
</tr>
</tbody>
</table>

Test revealed that in the reward conditions the performance of the impulsive Ss was significantly poorer than that of the reflective Ss (p < .05). Within the impulsive group punishment led to significantly better performance than reward (p < .05)

**Table 2**

*Discussion*

In the present study punishment did not uniformly lead to faster learning than reward. The reliable reinforcement x valence interaction reveals that only in the verbal reinforcement condition did punishment lead to better performance than reward. The finding that verbal-punishment is more effective than reward replicates the results of several previous studies (Buss and Buss, 1956; Henry, 1973; Meyer and Seidman, 1960, 1961). In the material reinforcement condition, on the other hand, punishment led to significantly poorer performance than reward. Hemry did not find this in his study. It is important to note, however, that Hemry used an aversive tone as a punisher whereas in the present study the removal of a token constituted the punishment. It may well be that the removal of a token is more distracting or disturbing than an aversive tone and thus would lead to poorer performance.

Impulsive Ss performed more poorly than reflective Ss in the reward condition but not in the punishment condition. In fact, impulsive Ss performed significantly better when punished than when rewarded. These findings might suggest that the use of reward as opposed to punishment is a more critical issue with impulsive children.
It will be recalled that Hemry did not find an interaction between cognitive style and reinforcement type and thus reports that the effectiveness of reinforcement conditions is not determined by the response style of a child. Again, it is possible that the procedural differences mentioned above lead to this discrepancy. The age of the Ss in the two studies also differed; Hemry's children were first graders whereas the children in the present study were third-graders. Unfortunately, it is impossible to compare the Ss in the two studies on the MFF scores used to classify them impulsive or reflective; it is conceivable that the degree of impulsivity and reflectivity of the Ss in the present study differed from those in Hemry's experiment. Hemry has emphasized the need for normative data to assist in the classification of children on this cognitive dimension.

The results of this study suggest that the effectiveness of reinforcement interventions may depend to some extent upon the cognitive style of the children being worked with as well as the type of reinforcements used. It is important to note that material reinforcement may not be as effective as verbal reinforcement in aiding the learning process. Because of the current popularity of token reinforcement programs it becomes particularly important to monitor closely the performance of individuals receiving material rewards. This continuous assessment would allow one to evaluate whether the reinforcement contingencies being used are optimal.

References


Massari, David J. and Schack, M.L. Discrimination learning by reflective and impulsive children as a function of reinforcement schedule, *Developmental Psychology*, 1972, 6 (6), 183.


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**Footnote**

The research was supported by grant number 572-1398 from the Canada Council to Dr. V. Douglas and was executed while the first author was at McGill University. Dr. Firestone is staff psychologist with the Children's Hospital of Eastern Ontario, 401 Smyth Rd., Ottawa, Ontario Canada. K1H 8L1
THE EFFECTS AND SIDE EFFECTS OF TIMEOUT ON AN AGGRESSIVE NURSERY SCHOOL CHILD

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Summary—Timeout was used to eliminate the aggressive behavior of a nursery school child. Systematic observations of target and non-target behavior were undertaken. The results indicated that as the aggressive behavior was eliminated, the child showed increases in some desirable behaviors. The possible side effects of timeout are discussed.

RECENT years have seen a proliferation of articles attesting to the efficacy of timeout from positive reinforcement in modifying disruptive and undesirable behavior (Burchard and Tyler, 1965; Clark, Rowbury, Baer and Baer, 1973; Haynes and Geddy, 1973; Pendergrass, 1972; White, Nielson and Johnson, 1972). Timeout has been particularly successful in decreasing the frequency of aggressive behavior (Bostow and Bailey, 1969; Hawkins, Peterson, Schwid and Bijou, 1966; Pendergrass, 1972; Tyler and Brown, 1964). However, there is a paucity of data on the effects of timeout on the non-target behavior of the subjects being studied. One investigation with retarded children (Pendergrass, 1972) has reported that timeout not only suppressed high rate misbehavior, but concomitantly caused a decrease in desirable behavior such as speaking and touching. This finding suggests that timeout may sometimes lead to decreases in undesirable behavior at the cost of certain pro-social activities.

The present study explored the effects of timeout on the aggressive behavior of a nursery school child and observed the consequences of this procedure on other behaviors of the child.

METHOD

Subject
Billy, a very active 41-yr-old from a middle socio-economic status home, had been expelled from a nursery school for his aggressive behavior when he was 3-yr-old. This study took place the next year while he was enrolled in a nursery school for four year olds, and again he was to be expelled for aggressive behavior.

Conditions of observations
The observers were undergraduate university students, only one of whom was at work on each day, except for day three. On this day two observers recorded the subject's behavior so that inter-rater reliability might be computed.

The following behaviors, considered the most important, were selected for observation: (1) Co-operation—compliant, shares, helpful, obeys rules; (2) Interaction with teachers—asks questions, tells stories, helps with chores, seeks attention; (3) Isolation—plays alone, does not interact with others; (4) Verbal aggression—commands, threatens, teases, verbal conflicts, and (5) Physical aggression—strikes, kicks, destroys others, property, pulls, hits. Recording of behavior was done on a checklist that divided each minute into 15-sec segments. The observer would estimate which behavior was most prevalent during a 15-sec interval and record it by means of a number code in the appropriate square. The only exception to this would be if the child actually performed any physical or verbal aggressive act. In this case the appropriate aggressive act would be recorded. If simultaneous verbal and physical aggression were shown only physical aggression would be recorded.

The amount of time during which behavior was recorded each day (approximately 2 hr) varied as a function of the reading period and how early the class was dismissed. To get a true picture, it was therefore decided to plot the desired behavior against the time during which recording took place each day.

It appeared that Billy was the most physically active child in the class and this might be related to some of his aggressive behavior. To determine whether Billy was actually more active and whether the modification program would alter his activity level, all male children were issued Timex activity watches for the duration of the study.

Procedure
After three days of baseline observations, timeout was initiated. The timeout procedure consisted of putting Billy in a chair, until he was quiet for 2 min, each time he performed a physically aggressive act. The chair was in a corner of the classroom in which there were no toys. The rationale for the procedure was explained at the first aggressive act, and subsequently Billy created very little fuss when he was required to sit in the chair.

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RESULTS

Observations
Inter-rater reliability of observations was made by comparing the two observers' checklists of day three by determining in how many cells the recordings were identical. The computed inter-rater reliability was 92%.

Physical and verbal aggression
Figure 1 presents data revealing that physical and verbal aggression decreased considerably during the timeout procedure. During baseline physical aggression was manifested 20% of the time and this decreased to 1.9% during timeout intervention. Verbal aggression also decreased from 3.7% during baseline to 0.53% by day eight.

Activity level
The reading on Billy's watch each day was put over the mean reading of the other boys' watches and this was multiplied by 100. On each day Billy's activity watch registered higher than that of anyone else in the class. As Fig 2 indicates, Billy's average activity level was 142.7% during the baseline period. During the intervention sessions, Billy's average activity level was 152.3%.

Teacher interaction, isolate and co-operative behavior
Figure 3 reveals that Billy spent 6.1% of his time interacting with teachers during the baseline and this dropped to 3.4% during the experimental period.

Figure 3 also reveals that during baseline the subject spent an average of 28.2% of his time in isolate play and 42.2% in co-operative play. During timeout, isolate behavior dropped to an average of 8.2% and co-operative behavior rose to an average of 68.2%.

DISCUSSION
Clinical observations suggest that high activity levels and aggression often appear hand in hand. The author was pleasantly surprised that Billy's activity level did not change when his aggressive behavior declined. This indicates that his activity was channelled into other socially acceptable outlets when the aggressive avenue was closed to him.

The study supports the notion that occasionally, when a behavior that is disturbing to the environment is eliminated, other deviant behaviors also drop out and pro-social behaviors increase. Specifically, it is interesting to note that, although only physical aggression was followed by timeout, verbal aggression decreased. Furthermore, Billy's constructive interactions with peers increased dramatically.
In the present study, the difference between these rather encouraging "side effects" with timeout as opposed to those found by Pendergrass (1972) might be related to subject variables. Billy was, in spite of his aggressive behavior, a bright and captivating child with many social and athletic skills. This contrasts with the retarded subjects studied by Pendergrass. Conceivably, the elimination of Billy's aggressive behavior allowed the emergence of more acceptable behaviors, already in his repertoire, which the environment "naturally" rewarded. Subjects who do not have these social skills may well regress when their high rate of undesirable behaviors are eliminated, since they may have no other behaviors with which to get previous rewards. In these cases, desirable behaviors ought to be shaped and made part of the repertoire of the subjects at the same time as undesirable behaviors are being eliminated.

It was not clear why Billy decreased his interactions with the teachers. Unfortunately this behavioral category did not discriminate between pro-social behavior, such as telling stories and helping with chores, and undesirable attention seeking behavior. The decreased interaction with teachers if due to a reduction of attention seeking behavior would be a positive side effect. However, it is possible that, through association, Billy stopped asking questions, telling stories and helping with chores because the teachers became negative stimuli to be avoided.

Despite the rather encouraging results there are two problems with the present study requiring comment. A second baseline period, to see if the experimental manipulations were actually controlling the subject's behavior, was not attempted. As the subject's aggressive behavior attenuated, he seemed to be more and more popular and much happier. The teachers in consultation with the experimenter felt it would be in the best interest of Billy and the class not to reverse these trends. In addition, due to time constraints (summer holidays) it was not possible to assess long-term effects of the intervention.

REFERENCES


