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Effectiveness of a Home Program Intervention for Young Children with Autism

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This project evaluated the effectiveness of a TEACCH-based home program intervention for young children with autism. Parents were taught how to work with their preschool autistic child in the home setting, focusing on cognitive, academic, and prevocational skills essential to later school success. To evaluate the efficacy of the program, two matched groups of children were compared, a treatment group and a no-treatment control group, each consisting of 11 subjects. The treatment group was provided with approximately 4 months of home programming and was tested before and after the intervention with the Psychoeducational Profile-Revised (PEP-R). The control group did not receive the treatment but was tested at the same 4-month interval. The groups were matched on age, pretest PEP-R scores, severity of autism, and time to follow-up. Results demonstrated that children in the treatment group improved significantly more than those in the control group on the PEP-R subtests of imitation, fine motor, gross motor, and nonverbal conceptual skills, as well as in overall PEP-R scores. Progress in the treatment group was three to four times greater than that in the control group on all outcome tests. This suggests that the home program intervention was effective in enhancing development in young children with autism.

KEY WORDS: Home program intervention; autism.

INTRODUCTION

Autism is a developmental disability present from very early in life. While the severity of the disorder can vary, all autistic individuals experience difficulties in the areas of social relatedness, communication, and range of behaviors and interests (American Psychiatric Association, 1994). There is no cure for the disorder, which is a lifelong disability. Many programs that help children with autism better handle their deficits exist, however (Campbell, Schopler, Cueva, & Hallin, 1996). In the past three decades, major advances have been made in the education and treatment of autistic individuals and their families (e.g., Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Fenske, Zalenski, Krantz, & McClannahan, 1985; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Helmsley et al., 1978; Hoyson, Jamieson, & Strain, 1984; Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Prizant & Wetherby, 1988; Rogers & Lewis, 1989). Several features common to all effective treatment programs, regardless of model or philosophy, have been identified: (a) the use of structured behavioral and educational approaches, (b) training parents to implement the program at home, and (c) enrollment in the treatment program prior to age 5 (Moroz, 1989; Simeonsson, Olley, & Rosenthal, 1987).

In 1966, a treatment program for individuals with autism was established at the University of North Carolina (Schopler & Reichler, 1971). This program was focused on the Treatment and Education of Autistic and related Communication handicapped CHildren and has come to be known by its acronym, Division TEACCH. In the 1960s, there were a number of ways in which this program was

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highly novel. At the time, the predominant model of psychopathology was the psychodynamic model, which dictated that autism was caused by parental failure to provide adequate emotional support and nurturance (Bettelheim, 1967); one form of treatment consistent with this etiological notion was removal of autistic children from their homes. In contrast, the founders of Division TEACCH believed that autism had an organic basis, as yet unknown. The guiding philosophy of the TEACCH model, then and now, was that parents not only were not to blame for causing their child's autism but in fact were a necessary and integral part of the treatment team. Parent–professional collaboration has always been seen as an element essential to treatment outcome and generalization (Davis & Marcus, 1980; Schopler, 1987; Schopler, Mesibov, Shigley, & Bashford, 1984). Rather than blaming parents as causative agents, the TEACCH approach identified them as critical instruments of change for their child.

A cornerstone of the TEACCH intervention model is home programming, in which parents are taught to serve as their child's "co-therapist," implementing treatment in the home setting. A number of benefits of home programs, or "extended diagnostic services," as they are called at TEACCH, have been suggested (Schopler, 1987; Schopler et al., 1984). First, they provide an economical method of increasing the number of hours a child receives treatment. Although previous studies consistently found that provision of early, intensive treatment results in the best outcomes, it is beyond the means of most families to enroll their child in both day treatment programs and numerous private therapy hours. Home programming provides additional hours of intervention at low cost. Second, even should a parent be able to afford extensive outside services for their child, the length of time in which therapists are typically involved is limited; it is impossible for any therapist or agency to provide services for a child across his or her lifetime. Parents, however, can be involved for many years and can serve as liaisons to new classrooms, placements, or agencies, providing the continuity of services and techniques that is needed. Thus, parent education and empowerment are critical to provision of appropriate lifetime services. Third, many parents of newly diagnosed autistic children feel depressed, highly stressed, and ineffective (Bristol, 1985, 1988; Gray & Holden, 1992). Several studies have demonstrated that after a home program intervention, however, parents report increased feelings of competence and success (Schopler, 1987) and decreased feelings of depression and stress (Bristol, 1985, 1988; Bristol, Gallagher, & Holt, 1993; Short, 1984).

Several studies have been carried out to examine the effectiveness of the TEACCH model. Schopler and colleagues used an ABAB design to demonstrate the improvement in learning and behavior that followed the provision of structure in classroom teaching situations (Schopler, Brehm, Kinsbourne, & Reichler, 1971). Marcus, Lansing, Andrews, and Schopler (1978) demonstrated a significant increase in both child compliance and parent teaching skill after implementation of a home program. Similarly, Short (1984) found that parents significantly improved in structured methods of teaching their children and significantly increased their child's appropriate behavior after being enrolled in a home program. Finally, Schopler, Mesibov, and Baker (1982) administered satisfaction questionnaires to parents and therapists and found that both rated home programs very positively. This study also documented an 8% institutionalization rate for individuals receiving TEACCH interventions, which was much lower than rates cited for other treatment programs (39–74%). This suggests that TEACCH services helped autistic children function more independently in the community as adults.[3]

While these studies suggest that the TEACCH model is an effective intervention for individuals with autism, a number of issues remain to be explored. First, many of these studies were carried out without a control group, making it difficult to examine how much of the change that occurred in child behavior was due to developmental maturation alone. Some gains will likely be made without home programming services, especially if the child is simultaneously enrolled (as most children are) in a day treatment program. Thus, no-treatment control groups are essential. Second, no previous studies have examined child variables that may predict outcome, such as age, intellectual and communicative functioning, and severity of autism. At present, we do not know who benefits most from this type of treatment service.

[3]A potential problem with this conclusion, however, is that the deinstitutionalization movement reduced hospitalization rates around the world at approximately the same time that the TEACCH program was first being implemented, making it difficult to identify the sources of the lowered institutionalization rates.

Third, other studies have not examined the potential effects of using different teaching techniques in the home and school settings. In Utah, where the present study was conducted, most programs for children with autism do not use TEACCH methods, but rely more heavily on discrete trial training techniques. The home program intervention employed in this study did not, however, use discrete trial methods. Since consistency is a primary principle of working with children with autism, it is possible that using different teaching techniques at school and home may cause confusion. This could result in poorer outcomes for children receiving both day treatment and home services, relative to children receiving only day treatment, who were instructed with one consistent set of teaching techniques. Finally, previous studies have not examined the impact of home programs on participants' cognitive functioning but have concentrated on changes in child behavior and compliance. The present study examined these four issues.

METHOD

Subjects

Twenty-two children diagnosed with autism were recruited from the Salt Lake City area. Group assignment was not random. The first 11 subjects to respond to the study announcement were assigned to the treatment group and the latter 11 were assigned to the control group. Participating children were 2 to 6 years in age. All came from two-parent families. All were Caucasian American, with the exception of 1 child in the treatment group, who was Hispanic American. Each group consisted of 9 boys and 2 girls.

All subjects were simultaneously receiving services from local day treatment programs. In the treatment group, 6 children were enrolled in special preschools for children with autism, while the other 5 attended non-categorical public special education programs. In the control group, 9 children attended programs specifically for children with autism and the other 2 attended noncategorical programs. The groups were matched on age, severity of autism, initial PEP-R score, and time interval between pre- and posttesting. No significant differences emerged in any of these characteristics between the two groups (Table I).

Measures

The Psychoeducational Profile-Revised (PEP-R; Schopler, Reichler, Bashford, Lansing, & Marcus, 1990) is a developmental test designed for assessing both the typical strengths and the characteristic weaknesses of children with autism. The test measures functioning in seven developmental domains: imitation, perception, fine and gross motor skills, eye-hand coordination, and nonverbal and verbal conceptual ability. The mental age required to perform items ranges from 1 to 72 months. The low floor of the test allows success on some items for even the youngest, lowest functioning, or most handicapped children. The high ceiling permits the test to be given to normal IQ, high-functioning children with autism up to 6 years of age. The child receives either a pass, emerge, or fail on each test item. An emerge score indicates a skill that a child is beginning to acquire, but needs help or direction in completing. Emerging skills are used as a basis for designing the subsequent intervention. The number of passes received is summed and converted to a developmental score that indicates a functioning level in months.

The Childhood Autism Rating Scale (CARS) is a widely used instrument developed to distinguish children with autism from those with other developmental disabilities or normal functioning (Schopler,

Table I. Characteristics of the Sample[a]

	Treatment group (n = 11)			Control group (n = 11)		
	M	*SD*	Range	*M*	*SD*	Range
Age (months)	53.3	12.3	31.0–69.0	53.5	10.9	32.0–65.0
CARS score	40.9	5.7	32.5–49.5	38.0	4.0	32.0–46.5
Pretest PEP score (months)	21.4	6.0	16.5–36.0	24.2	7.6	15.5–37.0
Time to follow-up (weeks)	16.5	1.6	14.0–18.7	16.5	2.0	13.6–19.0
Gender (M:F)	9:2			9:2		

[a]No significant group differences.

Reichler, & Renner, 1988). It contains 15 scales that measure behavior relevant to autism, including relating to others, communication, sensory functioning, emotional reactions, and resistance to change. Each scale can be rated from 1 (*normal for age*) to 4 (*highly abnormal for age and characteristic of severe autism*). These scores combine to form a composite score that ranges from 15 to 60. Scores of 30 or above are considered indicative of autism. The CARS has been shown to have high reliability and validity (Schopler et al., 1988).

Procedure

Subjects in the treatment group received TEACCH-based home program services from trained graduate students in the University of Utah's Department of Psychology. The mean number of treatment sessions was 10 (range 8–12). Before the first session and after the last session, the graduate student therapists administered a PEP-R. The control group received no home program but, like the children in the treatment group, regularly attended their day treatment program. They were tested at the same 4-month interval as the treatment group, using the PEP-R. Testing of controls was performed by the authors.

The Home Program Intervention

The treatment program used in this study was preceded by a thorough assessment. Children were given a battery of cognitive and developmental tests to assess their current levels of functioning in a number of areas relevant to the subsequent treatment program. Areas of particular interest in the assessment were communication patterns, imitation skills, preacademic and prevocational abilities, and visual-spatial strengths. Work habits, attention, motivation, and interests were also carefully evaluated. Parents observed the assessment and were given extensive feedback about their child's strengths and weaknesses. Together, the therapist and parents then designed a treatment plan for the child to be implemented in the home setting.

The typical home program lasted 10 weeks. Families met weekly with two therapists in the clinic for approximately an hour. One therapist worked directly with the autistic child, demonstrating tasks and modeling teaching skills to the parent. The parent watched behind a one-way mirror with the other therapist, who explained the techniques in detail and provided emotional and other support. Specific activities and methods were then written down in a formal program that was sent home with parents for implementation. During the following week, parents were encouraged to spend half an hour per day working with their child in the home, using the same materials and techniques as in the clinic session. Upon their return to the clinic a week later, they demonstrated to the therapists what they had been doing at home, while therapists provided suggestions for fine-tuning and modifying activities as needed.

An explicit goal of this time-limited therapy was to teach parents the principles underlying work with any autistic child. Typical weaknesses for children with autism are communication, imitation, abstract reasoning, and executive function skills, while strengths tend to be visual processing and memory (Green, Fein, Joy, & Waterhouse, 1995; Lincoln, Allen, & Kilman, 1995). Thus, autistic individuals have difficulty with abstract, language-based, conceptual tasks that require sequencing and organization. Typical methods of teaching, such as verbal explanation, demonstration, and modelling, may not be successful, due to the social, communicative, and imitative limitations of autism. Conversely, tasks that are visual in nature and rely more on eye-hand integration, spatial, or motor capacities are more understandable and enjoyable for children with autism. It is possible to capitalize on these strengths while remediating weaknesses. Thus, if tasks, even those falling in the verbal or conceptual realm, are structured for the child so that what is expected and how to complete it are apparent from visual characteristics, teaching and learning go much more smoothly (Schopler, Mesibov, & Hearsey, 1995). These basic principles of structured teaching were explicitly taught to parents during the course of the home intervention.

Development of home programs did not follow a specific time-line, packaged protocol, or manual. Treatment objectives were individualized for each participating child and were chosen based on the pattern of emerging skills evident on the PEP-R, specific developmental needs of the child, and parental concerns. Because of the wide variability in child functioning, each child's program was slightly different. Most interventions did, however, contain the following common ingredients: structured teaching, capitalization on visual strengths to teach more difficult skills, such as language and imitation, a schedule to

help the child anticipate future events, a communication system of some type (gestures, pictures, signs, or words), and preacademic-prevocational activities that helped prepare the child for entry into the public school system (e.g., colors, numbers, shapes, drawing, writing, assembly, and packaging tasks). Therapists went to the child's home to directly observe parental teaching methods and the home teaching environment on at least one occasion during the course of treatment. In addition, therapists visited the child's day treatment program at least once to encourage generalization of the skills outside the home and clinic settings.

As parents became more fluent with the principles of structured teaching, they were given increasing responsibility for directing the home program. Therapists began to take a secondary role in the selection, design, and fine-tuning of tasks, while parents correspondingly took a more central role. Toward the end of the treatment program, clinic sessions were held every 2 or 3 weeks, rather than weekly, to increasingly fade the role of the therapist and give parents more freedom and responsibility in implementing their child's treatment. Studies have shown that parents are very enthusiastic about this treatment model (Schopler, 1987).

RESULTS

To examine group changes in cognitive functioning secondary to the home intervention, pre- and posttreatment PEP-R scores were entered into a repeated measures multivariate analysis of variance, with time as the within-subjects repeated factor and group as the between-subjects factor.

As can be seen in Table II, there were significant group by time interaction effects, with children in the treatment group demonstrating significantly more improvement than those in the control group on the Imitation subtest, $F(1, 20) = 4.99, p < .05$, the Fine Motor subtest, $F(1, 20) = 7.93, p < .01$, the Gross Motor subtest, $F(1, 20) = 4.24, p < .05$, and the Cognitive Performance subtest, $F(1, 20) = 9.37, p < .01$, as well as on the total posttest PEP-R score, $F(1, 20) = 4.57, p < .05$. Group differences were shy of statistical significance on the Perception, $F(1, 20) = 3.89, p = .06$, and Cognitive Verbal subtests, $F(1, 20) = 2.60, p = .12$, but performance of the treatment group still exceeded that of the control group by two to three times. These results suggest that the home programming intervention was highly effective in improving the cognitive and developmental skills of children in the treatment program.

Pretest PEP-R scores were subtracted from posttest PEP-R scores, yielding a developmental change score, in months. Correlations were conducted to examine which independent variables best predicted improvement. In the treatment group, pretreatment PEP-R scores were significantly positively correlated with total change scores ($r = .92, p < .001$), indicating that subjects with higher initial abilities demonstrated more improvement. In addition, treatment group pretest scores on the Cognitive Verbal subtest of the PEP-R were significantly related to total change scores ($r = .85, p < .001$), while CARS scores were significantly negatively correlated with change scores ($r = -.62, p < .05$). This indicates that mild

Table II. Group Differences in PEP-R Scores (in Months)

	Treatment group (n = 11)				Control group (n = 11)			
	Pretest		Posttest		Pretest		Posttest	
Scale	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Imitation[b]	17.9	12.9	27.0	15.8	20.0	11.6	22.9	13.9
Perception[a]	26.3	14.2	43.9	19.1	33.5	19.9	39.8	19.9
Fine motor[c]	28.8	7.7	38.7	14.6	30.6	8.9	32.9	9.6
Gross motor[b]	29.8	9.0	38.5	12.6	31.8	17.2	31.5	13.3
Eye-hand integration	27.1	7.5	34.4	12.0	32.6	11.9	36.2	13.3
Cognitive performance[c]	15.6	6.4	26.2	12.5	20.5	7.7	22.4	10.9
Cognitive verbal[a]	14.9	8.7	19.3	12.3	19.1	9.7	19.4	12.9
Total PEP-R score[b]	21.4	6.0	28.7	11.5	24.2	7.6	26.9	10.4

[a]Group × Treatment interaction effect, $p < .15$.
[b]Group × Treatment interaction effect, $p < .05$.
[c]Group × Treatment interaction effect, $p < .01$.

autism and good language skills predicted better progress in this home intervention. Age was not correlated with change scores. No significant correlations between the independent and dependent variables were evident in the control group.

DISCUSSION

Evaluating home treatment programs is important for several reasons. Such therapies require a large time commitment by parents. Additionally, programs can be expensive, imposing a financial burden on families. Implementing treatment at home may strain an already stressed family system. Further, most children receiving home interventions are enrolled in regular educational programs during the day. It is necessary to evaluate whether home programs confer any additional benefits above and beyond the improvement the child is already making in his or her school-based program. Finally, in the current complex climate of third-party payment, it is important to document the benefits and necessity of any intervention.

The current study evaluated the effectiveness of a home teaching program for children with autism, modeled after the extended diagnostic services offered at Division TEACCH (Schopler et al., 1984). Children in the treatment group demonstrated significant improvement, relative to the control group, on four of the seven PEP-R subtests, as well as on the total PEP-R score. Furthermore, while group differences were short of statistical significance on three other subtests, scores of the treatment group still exceeded those of the control group by two to three times. In only 4 months, the treatment group made an average of 9.6 months of developmental gain, impressive considering that most subjects were diagnosed not only with autism but also with mental retardation, which would be expected to slow the rate of cognitive growth. Thus, this study provides clear evidence that implementation of a TEACCH-based home program is beneficial in improving the cognitive and developmental skills of young children with autism. It is important to clarify that these results do not demonstrate efficacy of other home-based treatment approaches for autism, such as Lovaas' discrete trial training method (Lovaas, 1981, 1987). This study evaluated only home programs based on the TEACCH philosophy.

This study differs from previous investigations in a number of ways. Most previous studies did not use a control group. Inclusion of a comparison sample in the present study helped clarify two issues. First, developmental maturation alone was not responsible for the changes in performance on the PEP-R seen in the children receiving home services. Since the treatment and control samples were matched on age and testing interval, changes in the treatment group must be due to other factors.

Second, this study provides no evidence that it is harmful to simultaneously use different types of treatments with the same child. Most children in the study attended local day treatment programs that used discrete trial methods. Such techniques differ substantially from the structured teaching techniques of TEACCH that we instructed parents to use at home. Despite this disparity of methods, we found that children who received the extra home therapy improved more than those who attended only their day programs, providing no evidence that simultaneous implementation of two treatment models was confusing to participants.

A few limitations of this study design are important to note. Children were not assigned randomly to the treatment and control groups, potentially limiting the generalizability of the results. It is possible that the first families to respond to the study announcement, who were assigned to the treatment group, were more eager for treatment and more likely to effect change than those who responded later to the study announcement and were assigned to the control group. Also, it is not ideal to have different testers, none of whom were blind to group assignment, administer the dependent measures to children in the treatment and control groups. If a systematic bias on the part of the examiners existed, this may have effected the study's results.

There are several areas in which future research could benefit this field of study. First, it is not yet clear how length of treatment is related to effectiveness. While the present study implemented treatment for 8 to 12 weeks, fewer sessions may be just as beneficial. Conversely, longer term treatment might impart more improvement than found in this investigation. This issue is important to clarify when resources are limited.

Another question unaddressed by the present study is the duration of improvement. This study focused on short-term follow-up. It is not yet known whether these improvements continue as children mature. Is there continued gain seen, for example, 6 months and a year after cessation of home program services? Although the intention of this treatment

model is to provide parents with lifelong tools to help their child, is this goal successfully attained? Do parents continue to implement the program and do children continue to make gains after formal involvement of professionals ends?

In addition, this study did not attempt to directly compare this TEACCH-based home program intervention with other treatment models. What is needed in future studies are head-to-head comparisons of different programs for treating autism, in which variables such as child age and functioning level, number of hours of intervention, and parent involvement are tightly controlled, while teaching methods are varied (e.g., structured teaching vs. discrete trial training).

This investigation focused on cognitive and developmental improvements in children receiving home services. A number of other outcome variables could be explored in future studies, including parent teaching skills, parent satisfaction, child adaptive behavior, child behavior problems, and teacher ratings of compliance and functioning.

Finally, future research should clarify which variables predict most successful utilization of home services. We found that mildly autistic children with higher initial cognitive and language skills benefited most from our intervention. The effect of other child variables, such as IQ, visual-spatial ability, and behavior problems, should also be explored. In addition, parent and family variables, such as motivation, stress and depression levels, socioeconomic status, and parent education may predict treatment outcome. Since home services are, at least in most areas of the country, a limited resource available to only a subset of families who desire them, determination of who benefits most from the treatment is critical.

The results of this study suggest that auxiliary home interventions increase developmental functioning in young autistic children, above and beyond gains due to school-based services. We hope these results will encourage teachers and other professionals to devise cost-efficient means of extending programming to the home. Eventually, this may lessen the substantial impact this disorder has on affected children, their families, and the community.

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