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# Home-Based Behavioral Treatment of Young Children with Autism

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This study evaluated the impact of intensive behavioral treatment on the development of young autistic children. The treatment reported in this study was home based and was implemented by parents of autistic children with the assistance of community-based clinicians. Although treatment was unable to be observed directly, parents reported that therapy was based on methods developed by Lovaas et al. (1981). Treatment differed from that described in previous reports of intensive behavior therapy for this population in that it was implemented outside an academic setting and for a shorter period. In addition, children received fewer hours per week of therapy than in previous reports. Children in the experimental treatment group were pairwise matched to children in a control group (who received conventional school-based and brief one-on-one interventions) on the basis of pretreatment chronological and mental age, diagnosis (autism vs. PDD), and length of treatment. The groups did not differ on pretreatment IQ. Children receiving the experimental treatment had significantly higher posttreatment IQ scores. Smaller, but still statistically significant effects on symptom severity were also found, though experimental subjects still met diagnostic criteria for autism or PDD.

**KEY WORDS:** Behavioral treatment; autism; early intervention.

## INTRODUCTION

Recent advances in the early identification of autism have presented new opportunities for early intervention. Available treatments vary greatly in terms of context (e.g., school vs. home), intensity, and theoretical underpinning. Many autistic children receive a mixture of treatment modalities. Parents and professionals face difficult choices when having to decide upon the most appropriate combination of treatments for individual children. Research on a variety of treatment programs is needed to aid in such decision-making processes. The aim of this paper is to examine the effectiveness of home-based behavioral treatment on the development of young children with autism. Recent reports have suggested that intensive behavioral therapy can yield significant results in terms of autistic children's cognitive development and behavioral presentation (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993). In particular, one variant of behavioral therapy has been developed and reported by Lovaas and colleagues (Lovaas, 1987; McEachin et al., 1993). Lovaas's work has generated considerable controversy over the applicability of intensive behavior therapy for very young children with autism. Thus, it is important that the field continues to examine the effectiveness of these programs when implemented in a variety of settings.

Because the reports of Lovaas and colleagues are at the center of much of the current debate on early intervention services for autistic children, it may be useful to briefly review this line of research. Lovaas has based his treatment program on an operant conditioning model and therapeutic sessions

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are structured as a series of discrete trials. Parents are heavily involved with treatment implementation. For the children followed by Lovaas (1987) and McEachin et al. (1993), treatment was intensive, with children exposed to up to 40 hours of therapy per week for at least 2 years (Lovaas, 1987). Both Lovaas's original report and the subsequent follow-up report by McEachin et al. indicated that children exposed to this intensive therapy made gains on both measures of intellectual functioning and in behavior. In fact, both reports concluded that a subset of the treated children achieved normal functioning. This conclusion was based in part on the children scoring in the normal range on intelligence tests (Lovaas, 1987) as well as on a measure of adaptive functioning (McEachin et al., 1993). This conclusion also appeared to be based upon reports that some children were able to function in normal (i.e., regular education) classrooms.

This claim of normal functioning, in addition to issues of sampling and assignment of children to groups, have been the focus of considerable controversy (e.g., Kazdin, 1993; Mundy, 1993; Schopler, Short, & Mesibov, 1989). The comments and critiques of Lovaas and colleagues underscore the need for continued research on the effects of intensive behavior therapy on young children with autism. Further research may help to clarify the magnitude of therapeutic effects, and help to understand for whom therapy is most effective. An additional consideration in evaluating the efforts of Lovaas and colleagues is that the treatment upon which they reported took place under the careful supervision of university-based researchers. In the past, research has shown that university-based interventions often are efficacious (Casey & Berman, 1985; Weisz, Weiss, Han, Granger, & Morton, 1995). However, questions remain as to whether the same treatment approaches can be transported to community-based settings where they will have wider availability (Weisz, Weiss, & Donenberg, 1992). The present research examines the effectiveness of intensive behavior therapy when implemented in the community, without the close support or monitoring of a university center. The general aim of this study is to examine the effects of such intervention on the intellectual functioning and symptom presentation of young children diagnosed with autism or pervasive developmental disorder (PDD).

## METHOD

### *Subjects*

Children in this study were drawn from a larger longitudinal study on young autistic children. A serendipitous observation from the larger study was that, at follow-up visits, parents of a subset of children reported that their children had received treatment based explicitly on the methods outlined by Lovaas and colleagues (Lovaas et al., 1981). The 11 children included in this study were identified as having had treatment implemented after their previous clinic visit. The authors of the present paper had no role in selecting children for treatment. Thus, were there to be systematic bias in the "assignment" of children to treatment, it would seem most likely for such bias to arise from socioeconomic, social support, or other factors. However, a review of background data on parent employment did not reveal any significant differences among groups as to fathers categorizable as "professional/executive" versus "managers/small businessmen" versus "physical laborer/blue collar." The actual assessment of children occurred prior to this study's conception and implementation. All interviews occurred after the children's follow-up assessment. Thus, collection of cognitive and behavioral data was prospective and essentially blind to treatment group membership.

A control group of 11 children was formed by individually matching children within 6 months on the following variables: pretreatment chronological age (CA), mental age (MA), and the interval between pre- and posttreatment assessments. Subjects were also matched on diagnosis (i.e., autistic disorder vs. PDDNOS). As a result of this matching procedure, groups did not differ in posttreatment CA. A match on sex was accomplished for all but one pair of subjects. Outcome measures were not made available during the matching procedure. Matching was accomplished by reverse serial selection of any case matching an index case, with controls drawn from a database of approximately 1,000 children surveyed from most recent cases, backward.

Due to disruptive behavior, it was not possible to administer a pretreatment standardized cognitive measure to two children, one in each group. These two children formed a matched pair and, along with one additional matched pair with missing posttreatment IQ data, were not included in the analyses of

group differences on IQ. Ten matched pairs of children had diagnoses of autism, with the remaining pair having diagnoses of PDD-NOS. Procedures for diagnosis and cognitive assessment are discussed in greater detail below. Pre- and posttreatment characteristics of individuals in the experimental and control groups are summarized in Tables I and II, respectively.

**Table I.** Sample Characteristics on Pre- and Posttreatment Variables: Experimental Group

| | Pretreatment | | | | Posttreatment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Subject | CA[a] | IQ[b] | Test[c] | Symptom count | CA[a] | IQ[b] | Test[c] | Symptom count | Tx hours[d] |
| 1[e] | 29 | — | — | 9 | 67 | 91 | WPPSI | 3 | 27 |
| 2 | 23 | 22 | Bayley | 9 | 48 | 102 | M-P | 5 | 28 |
| 3 | 26 | 27 | Bayley | 9 | 46 | 65 | M-P | 8 | 25 |
| 4 | 34 | 47 | Cattell | 8 | 65 | 69 | WPPSI | 9 | 12 |
| 5 | 38 | 61 | M-P | 8 | 58 | 76 | M-P | 11 | 33 |
| 6 | 35 | 63 | M-P | 11 | 56 | 80 | Cattell | 9 | 43 |
| 7 | 31 | 68 | M-P | 9 | 48 | 96 | M-P | 9 | 23 |
| 8[e] | 31 | 71 | M-P | 10 | 47 | — | — | 8 | 30 |
| 9 | 44 | 86 | M-P | 9 | 57 | 98 | M-P | 11 | 19 |
| 10 | 34 | 94 | M-P | 4 | 46 | 117 | M-P | 0 | 31 |
| 11 | 47 | 97 | M-P | 10 | 60 | 103 | WPSSI | 9 | 28 |
| | 33.8 | 62.8 | | 8.7 | 54.4 | 89.7 | | 7.5 | 27.02 |
| | 6.2 | 27.4 | | 1.8 | 7.8 | 17.7 | | 3.4 | 7.90 |

[a]All ages in months.
[b]IQ a ratio of MA and CA (multiplied by 100).
[c]M-P = Merrill-Palmer; WPSSI = Wechsler Preschool and Primary Scale of Intelligence; School = unspecified school report.
[d]Total intervention hours per week across modalities.
[e]Excluded from IQ analyses and reported mean IQ.

**Table II.** Sample Characteristics on Pre- and Posttreatment Variables: Control Group

| | Pretreatment | | | | Posttreatment | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Subject | CA[a] | IQ[b] | Test[c] | Symptom count | CA[a] | IQ[b] | Test[c] | Symptom count | Tx hours[d] |
| 1[e] | 32 | — | — | 10 | 63 | 13 | School | 10 | 4 |
| 2 | 31 | 35 | Bayley | 9 | 43 | 35 | Bayley | 9 | 9 |
| 3 | 31 | 35 | Bayley | 9 | 44 | 30 | Bayley | 11 | 10 |
| 4 | 36 | 56 | M-P | 8 | 65 | 49 | M-P | 11 | 5 |
| 5[e] | 31 | 58 | Bayley | 6 | 46 | 91 | Bayley | 0 | 16 |
| 6 | 39 | 59 | M-P | 9 | 54 | 72 | M-P | 11 | 6 |
| 7 | 30 | 60 | Bayley | 9 | 47 | 74 | Bayley | 8 | 12 |
| 8 | 37 | 62 | M-P | 9 | 55 | 76 | M-P | 10 | 15 |
| 9 | 47 | 64 | M-P | 9 | 61 | 49 | M-P | 9 | 15 |
| 10 | 42 | 90 | M-P | 11 | 58 | 91 | WPSSI | 12 | 21 |
| 11 | 32 | 94 | M-P | 2 | 52 | 102 | WPSSI | 4 | 10 |
| | 35.3 | 61.7 | | 8.3 | 53.5 | 64.3 | | 8.6 | 11.13 |
| | 5.5 | 20.2 | | 2.4 | 7.8 | 25.0 | | 3.6 | 5.26 |

[a]All ages in months.
[b]IQ, a ratio of MA and CA (multiplied by 100).
[c]M-P = Merrill-Palmer; WPSSI = Wechsler Preschool and Primary Scale of Intelligence; School = unspecified school report.
[d]Total intervention hours per week across modalities.
[e]Excluded from IQ analyses and reported mean IQ.

*Treatments Received*

Information on treatments received for both groups was gathered via phone interviews with one parent of each child. For the experimental group, pilot interviews indicated that parents kept written records of information such as hours of treatment per week and the number of therapy aides to whom children were exposed. Parents of both groups were asked to recall past school-based interventions, as well as nonexperimental, one-on-one interventions such as individual speech therapy. The treatment characteristics for both groups are presented in Table III. (Individual data for total intervention hours received per week are included in Tables I and II.) The mean interval between pre- and posttreatment assessments was 20.36 months for the experimental group and 18.09 months for the control group. According to parental report, the children in the experimental group were distinguished by their receiving one-on-one behavioral treatment based on methods developed by Lovaas et al. (1981). Parents of these children relied heavily upon one of three behavior therapists in the San Francisco Bay area for guidance in treatment implementation. These therapists were reported to have undergone prior training specific to Lovaas's treatment protocol, although no direct support from Lovaas's group was reported during the course of treatment. The authors of this paper were not involved in treatment implementation.

We were unable to directly observe therapy and as such to account for treatment fidelity. However, it is possible to characterize the experimental treatment procedures in terms of Lovaas's protocol as reported by parents. Parents received a detailed manual of treatment methods, including general principles of learning and operant conditioning, as well as a hierarchically organized curriculum. Therapy sessions were modeled on a discrete trial (prompt–response–reinforcing stimulus) format. These discrete trials served as the basic unit of therapy. Punishment was reportedly limited to mild verbal aversives. Specific guidelines were provided on prompting, generalization, and maintenance. The section of the manual dealing with generalization emphasized enhancing ecological validity of therapy sessions, and encouraged the natural reoccurrence of "trials" in the child's home environment (i.e., outside of therapy sessions). Forms were provided with which parents and therapists could keep detailed records of sessions and, within sessions, the child's responses to individual trials. The treatment curriculum comprised numerous sessions focusing on a variety of skills.

These activities were organized both hierarchically and by domain. Thus, children began with sessions focusing on receptive language skills (these sessions appeared to also focus on enhancing child compliance with adult directives), moved on to nonverbal imitation, nonverbal problem solving, and expressive language skills (e.g., such as object naming). Later activities addressed verbal expression, preacademic classroom skills (e.g., learning numbers and counting, completing worksheets), and, finally, play and social skills. A variety of paraprofessionals, as well as parents, acted as therapists with supervision from behaviorally-trained clinicians in the community.

Both groups received school based services, although the control group spent more time per week in school than did children in the experimental group, $t(20) = 2.21, p = .04$. All children were placed

**Table III.** Treatment Characteristics for the Experimental and Control Grups

| | Groups | | | |
|---|---|---|---|---|
| | Experimental | | Control | |
| Variables | *M* | *SD* | *M* | *SD* |
| Pre-post interval (months) | 20.36 | 8.20 | 18.09 | 6.25 |
| Length of experimental therapy (months) | 15.73 | 5.87 | — | |
| Nonexperimental Interventions (hours/week) | | | | |
| School[a] | 6.41 | 3.72 | 10.70 | 5.26 |
| Other one-on-one therapy | 1.16 | 1.49 | 0.44 | 0.42 |
| Experimental therapy (hours/week) | 19.45 | 8.20 | — | |
| Total Intevention (hours/week) | 27.02 | 7.90 | 11.13 | 5.26 |

[a] $p = .04$.

in special education classrooms at the time of treatment implementation. A subset of children in the experimental group were reported to have been subsequently placed in a regular education classroom. Of the five children in the experimental group who were subsequently placed in regular education classrooms, two required the presence of a full-time aide. One-on-one services separate from the experimental treatment were provided to children in both groups. Examples of such interventions included occupational therapy and speech and language therapy. Groups did not differ in the number of hours per week of such services. However, due to the nature of the experimental therapy, the experimental group received a greater number of total hours in intervention (across modalities) than did the control group. In fact, on average, children in the experimental group received over twice the number of weekly hours of intervention than did children in the control group.

### *Measures*

Diagnostic and developmental data were gathered during semistructured clinical assessments at pre- and posttreatment clinic visits. All children were administered one of several standardized cognitive assessments from which ratio IQ scores were generated. Tests were chosen for their developmental appropriateness for each child (i.e., the highest level assessment for which a basal score could be generated). Cognitive measures included the Merrill-Palmer Scale of Mental Tests (Stutsman, 1948), the Bayley Scales of Infant Development (Bayley, 1969), the Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Wechsler, 1967), and the Cattell Infant Intelligence Scale (Cattell, 1940). These tests were used in similar proportion across the groups at the pretreatment assessment (see Tables I and II for information on which children received which tests). One child received unspecified testing through his school (only a mental age estimate was noted in this child's file) and this child was part of a matched pair excluded from the IQ analyses.

DSM-III-R (American Psychiatric Association, 1987) diagnoses were based upon both developmental information derived from parent interviews and from standardized behavioral observations (Siegel, 1991). Diagnostic decisions were made by consensus of at least two clinic staff, including a child psychologist (B.S.) and a child psychiatrist, both of whom have extensive experience in the area of autism. In addition, at follow-up each DSM-III-R symptom was rated on a 4-point severity scale: 0 (*symptom not present*), 1 (*mild/questionably present*), 2 (*moderate*), 3 (*severe*). Only symptoms with ratings of 2 or 3 counted toward diagnosis.

## RESULTS

Groups were compared on measures of cognitive ability and symptom presentation. A paired $t$ test of the difference between the experimental and control groups on pretreatment IQ was not significant, $t(8) = 0.29$, $p = .78$. At follow-up, a paired $t$ test revealed significant group differences, $t(8) = 3.36$, $p = .01$. These tests excluded two matched pairs with missing IQ data (these pairs were included in the comparison of groups on diagnostic presentation). The mean difference in IQ was roughly 25 points (89.7 for the experimental group, 64.3 for the control group). The difference in IQ scores between the experimental and control groups can be seen on both a group and subject-by-subject basis in Tables I and II. After treatment, all children in the experimental group had IQ estimates above 65 (one had missing data). By contrast, only 6 of the 11 children in the control group had IQ above 65 at follow-up. It should be noted that for a large proportion of children in both groups, IQ estimates were derived from results of the Merrill-Palmer Scales, which more heavily weights nonverbal ability and does not produce separate estimates of verbal and nonverbal intelligence. Children in both groups uniformly achieved higher levels on nonverbal than verbal test items.

Confounding the effects of the experimental treatment was the large between-group difference in the number of hours spent in treatment. While it was impossible to control for such between-group differences in treatment intensity, it was possible to examine the effects of variation in treatment hours on outcome within the experimental group. By calculating pre- and posttreatment IQ difference scores, it was possible to examine the relation between this difference score and intensity of treatment. In the experimental group, this IQ difference score did not correlate significantly with either the variation in the number of hours per week spent in experimental therapy, $r = -.17$, or with the variation in the number

of total hours of intervention per week, $r = -.03$. These results are illustrated in Figure 1, where the experimental group was split at the median of total treatment hours per week (i.e., all treatment hours combined). As is evident in Figure 1, those children receiving ≥28 hours ($M = 32.1$) of intervention per week entered and completed the study with slightly higher IQs than did children receiving ≤27 hours ($M = 21.0$) of intervention per week. However, both subgroups showed comparable gains in IQ from pre- to posttreatment assessments.

Behavioral data in this study were limited to measures of symptom presentation. Two measures are reported here: (a) number of positive DSM-III-R symptoms as a percentage of the number of age-appropriate "scorable" symptoms and (b) a measure of symptom severity. A simple sum total of positive symptoms was replaced with a percentage score so as not to underestimate the symptom presentation of children in the sample. (Given that a number of the children in this study were quite young and had fairly low IQ estimates, particularly at pretreatment, a number of DSM-III-R symptoms were judged as unable to be assessed, such as aspects of atypical language use for preverbal children.) The percentage of symptoms rated positive was similar for the two groups at the initial assessment, 54.6 and 51.7% for the experimental and control groups, respectively. At the posttreatment assessment, the experimental group was rated positive on 46.6% of symptoms (an 8% decrease), as compared to the 54.0% rated positive for the control group (a 2.3% increase). Although in the expected direction, a paired $t$ test of this difference did not reach statistical significance, $t(10) = 0.94, p = 37$. The groups were next compared on the 4-point scale of symptom severity, with individual subject scores being a sum of the severity ratings across symptoms at posttreatment assessment. A Wilcoxon Rank Sum Test revealed that children in the experimental group received significantly lower posttreatment severity ratings than did children in the control group, $Z = -2.04$, $p = .014$. The mean posttreatment severity ratings were 18.64 ($SD = 6.96$) for the experimental group and 24.64 ($SD = 7.95$) for the control group. Despite this attenuation in symptom severity, children in the experimental group were no more likely than controls to be reclassified as nonautistic or non-PDD. One child in the experimental group was reclassified from PDD to developmental language disorder at follow-up. Three other children in the experimental group were reclassified from autistic to PDD at follow-up, compared to two such children in the control group.

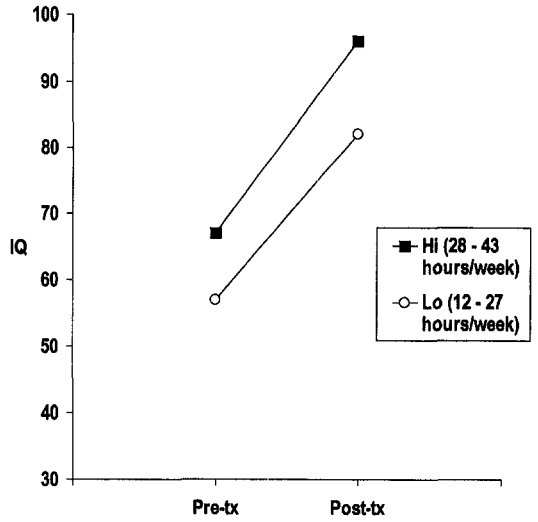


**Fig. 1.** IQ means, pre- and posttreatment, for experimental subjects grouped by total hours of intervention per week.

## DISCUSSION

Autistic children exposed to a course of intensive home-based behavioral therapy were compared at both pretreatment and follow-up assessments to a matched control group of children receiving standard school-based interventions. Children exposed to the intensive intervention were higher in IQ at the time of follow-up than were children in the "standard care" group (a difference of about 25 points). These posttreatment IQ differences, large in magnitude, did not appear to be the result of differences in age, diagnosis, or initial IQ, as children in the control group were matched on the basis of these and other variables. Despite the striking between-group differences in posttreatment IQ, the children receiving the intensive therapy were not notably different in diagnostic classification. Results suggest a modest group difference on an ad hoc measure of symptom severity.

The general implication for this study is that intensive home-based behavioral treatment can be implemented successfully in the field, without the direct support of an academic center. This finding, in and of itself, is important, as recent meta-analyses suggest that it is difficult to successfully implement univer-

sity-based treatment protocols in community settings (Weisz et al., 1992). Certain aspects of the treatment reported in this study may have enhanced its application in the field. First, it is a highly structured protocol, with activities clearly described and organized in a developmentally hierarchical format. Second, the goals of this therapy are behaviorally oriented, easily measurable, and explicitly integrated into the therapy itself. The treatment protocol also specifically addressed issues of maintenance and generalization of treatment effects.

One issue raised by these data concerns the failure to find more than modest effects on symptomatic behavior, despite the finding of large effects on cognitive functioning. At first glance our behavioral data appear inconsistent with those of Lovaas (1987) and McEachin et al. (1993), who reported improvements in children's adaptive behavior. However, two factors may help to explain our failure to find more convincing behavioral improvements. First, data bearing more directly on functional behavioral improvements, for instance in the domain of adaptive skills, were unavailable for the current study. Second, the follow-up intervals for this study, while wide in range, were generally shorter than in even Lovaas's first follow-up report. The finding by McEachin et al., that their treatment group was more advanced than controls on a scale of adaptive functioning, may have been related to the lengthy nature of the intervention and follow-up. It may be that mastery of daily living skills and basic rote social rules may be achieved without loss of the underlying autistic symptomatology. It is our clinical impression that subjects in the experimental group did make more gains in adaptive behavior, especially daily living skills, compared to controls. Our data suggest that IQ effects are robust in the face of variations in treatment implementation. Future research should ask a similar question of the behavioral gains reported in the university-based study by McEachin et al. In addition, future efforts should employ a multi-informant assessment of social, behavioral, and cognitive outcomes, as individuals who are able to function adequately in a "normal" environment (e.g., school or work) may still manifest autistic characteristics in more subtle but still handicapping ways (Mundy, 1993).

A second issue raised by comparing these results with previous reports by Lovaas is how to explain the strong cognitive gains made by children receiving treatment, despite the fact that they were exposed to fewer treatment hours than were children in Lovaas's previous studies. Of note in this study is that variation in treatment intensity did not relate to therapeutic response. Two possible explanations emerge. First, it is possible that Lovaas overestimated the minimum number of treatment hours per week needed for therapeutic effect. A second possibility is that the intense involvement of parents, and the implementation of treatment at home, helped *parents* generalize their skills to instructive interactions outside of formal treatment sessions. Such parent generalization would effectively and informally extend therapy outside of the formal treatment sessions themselves.

A third issue raised by these results concerns the most appropriate way to characterize the IQ effects. It is possible that the treatment, by including skills tapped by many tests of intelligence (e.g., language, categorization, imitation), effectively taught children skills relevant to later IQ tests. This explanation should not be viewed as trite nor as denigrating the treatment protocol as "teaching to the test." Rather, it appears that the treatment taught these children skills that they would have otherwise had a more difficult time learning, particularly in the group-based instructional settings attended by those in the control group. It is also likely that the intervention reinforced behaviors conducive to the test-taking situation, including increased attention to tasks and compliance with adults. There is nothing in our data to suggest one explanation over the other. Instead, it may be that the teaching of skills and behavioral controls are complementary aspects of treatment.

There are several significant limitations to this study that should be noted. First, although it is reasonable to conclude that the therapeutic protocol evaluated in this study was effective, we have no reason to conclude that it is more effective than anything other than standard, low intensity school-based interventions. There exist in the literature other examples of interventions that are effective in enhancing the development of children with autism (e.g., Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Koegel, Koegel, Hurley, & Frea, 1992; Stahmer & Schreibman, 1992). Yet, although independent replications of interventions are useful and necessary, more challenging questions await future research efforts. Specifically, future studies should compare proven therapies so as to develop a better understanding of when and for whom different interventions may be most useful. It may be possible to develop milestones during treatment that delineate

when a shift to more group-based and/or less intensive methods could become equally effective. For example, milestones in attention, receptive language, or imitation could be examined.

A second limitation, that of the confound between treatment intensity and type, was inherent in the experimental versus standard care comparison. Thus, unclear in this study are the relative contributions of treatment intensity and specific therapeutic techniques. In addressing this question, we chose to examine the within-group relation between treatment intensity and IQ change. Yet, as noted above, this relation was nonsignificant. Future research should use larger samples and should vary treatment intensity more systematically so as to disentangle the "active ingredients" of therapy.

A final set of limitations results from the retrospective nature of this study and relates to experimental control. First, we were unable to directly observe therapy sessions and thus were unable to account for treatment fidelity. Instead, we relied on parental reports to describe therapy. In addition to limiting our description of therapy, this factor prevented us from exploring process variables. Second, the IQ tests used in this study varied across individuals, with different tests weighted towards different types of skills. However, the proportions of children receiving various tests did not differ across groups. Thus, it is unlikely that this variation in tests received accounted for differences in posttreatment IQ estimates. Third, random assignment to treatment condition was not possible. In effect, parents chose the treatment condition. It follows that parents were not blind to treatment type. Thus, the fact that symptom severity estimates were based in part on parental interview (as well as behavior observation) possibly explains part of the difference in the groups' posttreatment symptom severity ratings. A more general issue is what factors influenced the choice of treatments for children and whether such factors may have had confounding effects on outcome. It is possible that several factors constrained the choice of parents, including the availability of social support, marital status, and financial resources. These factors represent possible confounds, although the similarity of the two groups in terms of paternal occupational status suggest that large differences were unlikely. Again, future research should explore this issue in more depth. One question that naturally arises, assuming that considerable social and financial resources are needed to implement treatment, is just what the conditions are under which families can implement such intensive therapy. Since we have speculated that parental efforts at getting the child to generalize skills gained in therapy to non-treatment hours may be itself an important component of the treatment, families who are able to participate extensively in their children's treatment may be among the best candidates. Clinicians should consider both the characteristics of the child and of the family when recommending a course of treatment for autism.

In sum, the significant effects of treatment on cognitive development suggest that intensive home-based behavioral therapy is an effective approach in the treatment of autism. Unique to this study was the finding of positive therapeutic effects when treatment was implemented in children's homes, outside the more controlled setting of an academic research center. Effects on IQ were largest in magnitude. Of smaller magnitude, but still statistically significant, were treatment effects on symptom severity. However, several confounds and limitations inherent in the design of this study limit broad conclusions about the efficacy of this particular behavioral program over other home- or school-based interventions. In other words, although this study suggests that home-based behavioral therapy is a *good* option for children with autism, it does not indicate whether or not such a treatment approach is *better* than other treatments of similar intensity and/or structure. In fact, this limitation mirrors a serious gap in the literature on treatments for young children with autism. There are few controlled trials of therapy for very young autistic children reported in peer-reviewed journals, and there are fewer (if any) controlled trials comparing various treatment approaches. Future research needs to not only compare treatment modalities but also examine the effects of treatment intensity and setting.

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## REFERENCES

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., Rev.). Washington DC: Author.

Bayley, N. (1969). *Bayley Scales of Infant Development: Manual.* Cleveland, OH: Psychological Corp.

Casey, R. J., & Berman, J. S. (1985). The outcome of psychotherapy with children. *Psychological Bulletin, 98,* 388-400.

Cattell, P. (1940). *The measurement of intelligence of infants and young children.* Lancaster, PA: Science.

Harris, S. L., Handleman, J. S., Gordon, R., Kristoff, B., & Fuentes, F. (1991). Changes in cognitive and language functioning of preschool children with autism. *Journal of Autism and Developmental Disorders, 21,* 281-290.

Kazdin, A. E. (1993). Replication and extension of behavioral treatment of autistic disorder. *American Journal on Mental Retardation, 97,* 377-379.

Koegel, L. K., Koegel, R. L., Hurley, C., & Frea, W. D. (1992). Improving social skills and disruptive behaviors in children with autism through self management. *Journal of Applied Behavioral Analysis, 25,* 341-353.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55,* 3-9.

Lovaas, O. I., Ackerman, A. B., Alexander, D., Firestone, P., Perkins, J., & Young, D. (1981). *Teaching developmentally disabled children: The me book.* Austin, TX: Pro-Ed.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation, 97,* 359-372.

Mundy, P. (1993). Normal functioning versus high-functioning status in children with autism. *American Journal on Mental Retardation, 97,* 381-384.

Schopler, E., Short, A., & Mesibov, G. (1989). Relation of behavioral treatment to "normal functioning": Comment on Lovaas. *Journal of Consulting and Clinical Psychology, 57,* 162-164.

Siegel, B. (1991). Diagnostic assessment of autistic disorder using a standardized play session. In C. Schaefer, K. Gitlin, & A. Sandgrund (Eds.), *Play diagnosis and assessment.* New York: Wiley.

Stahmer, A. C., & Schreibman, L. (1992). Teaching children with autism appropriate play in unsupervised environments using a self management training package. *Journal of Applied Behavior Analysis, 25,* 447-459.

Stutsman, R. (1948). *Merrill-Palmer Scale of Mental Tests.* Los Angeles: Western Psychological Services.

Wechsler, D. (1967). *Manual for the Wechsler Preschool and Primary Scale of Intelligence.* Cleveland, OH: Psychological Corp.

Weisz, J. R., Weiss, B., & Donenberg, G. R. (1992). The lab versus the clinic: Effects of child and adolescent psychotherapy. *American Psychologist, 47,* 1578-1585.

Weisz, J. R., Weiss, B., Han, S. S., Granger, D. A., & Morton, T. (1995). Effects of psychotherapy with children and adolescents revisited: A meta-analysis of treatment outcome studies. *Psychological Bulletin, 117,* 450-468.