

Early Behavioral Intervention for Autism

What Does Research Tell Us?

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Autism. For most of the half-century that label has been in use, many have understood it as a life sentence for the individuals to whom it has been applied. Most were expected to have serious and permanent deficits in communication, play, relating to others, and learning. A very small proportion of people with autism (less than 5%) might be expected to achieve independent functioning as adults, but even within this tiny group many retain at least some autistic characteristics. Historically, most people with autism have required extensive treatment and supports throughout their lives (Rapin, 1991; Rimland, 1994; Rutter, 1970; Rutter & Schopler, 1987; Szatmari et al., 1989). Today the mainstream position is that autism is a “severely incapacitating lifelong developmental disability.” It is considered treatable; indeed, a wide variety of treatments, therapies, and techniques are claimed to help (or even cure) people with autism, and new ones are invented regularly (Autism Society of America, 1995).

Until recently, however, none of those treatments has offered any solid, realistic basis for changing the view that autism is a permanent disability. Several studies have now shown that one treatment approach—early, intensive instruction using the methods of Applied Behavior Analysis—can result in dramatic improvements for children with autism: successful integration in regular schools for many, *completely normal functioning* for some (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Fenske, Zalsenski, Krantz, McClannahan, 1985; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Lovaas, 1987; Maurice, 1993; McEachin, Smith, & Lovaas, 1993; Perry, Cohen, & DeCarlo, 1995; Sheinkopf & Siegel, in press). In fact, there is abundant scientific evidence that Applied Behavior Analysis methods (also called *behavioral intervention* or *behavioral treatment*) can produce comprehensive and lasting improvements in many important skill areas for most people with autism,

regardless of their age. No other treatment for autism offers comparable evidence of effectiveness (Lovaas & Smith, 1989; Schreibman, 1988; Schreibman, Charlop, & Milstein, 1993; Smith, 1993; see also Chapters 2 and 4 in this manual).

Despite the evidence, families with young autistic children are often told incorrectly that all treatments are equally effective or, even more inaccurately, that behavioral intervention is ineffective or harmful. They are likely to be encouraged to try whatever fad treatment is currently in vogue, or to mix and match among the many options on the market. Families who are fortunate or diligent enough to discover the one approach with scientifically proven effectiveness often express the need for a single, fairly concise summary of research on early behavioral intervention for autism. This chapter attempts to address that need. Its purposes are to (a) provide a brief overview of Applied Behavior Analysis principles and methods as they apply to teaching young children with autism; (b) review studies of early behavioral intervention for autism that have been published in the peer-reviewed professional literature; and (c) summarize what research tells us about early behavioral intervention for autism, as well as questions that remain to be answered by further research.

THE INTERVENTION OF CHOICE: APPLIED BEHAVIOR ANALYSIS

Applied Behavior Analysis employs methods based on scientific principles of behavior to build socially useful repertoires and reduce problematic ones (Cooper, Heron, & Heward, 1989). The behavior analytic view is that autism is a syndrome of behavioral deficits and excesses that have a neurological basis, but are

nonetheless amenable to change in response to specific, carefully programmed, constructive interactions with the environment. Extensive research has shown that children with autism do not learn readily from typical environments, but many can learn a great deal given appropriate instruction (e.g., Harris & Handleman, 1994; Koegel & Koegel, 1995; Lovaas & Smith, 1989; Schreibman, 1988; Schreibman et al., 1993).

Behavior analytic treatment for autism focuses on teaching small, measurable units of behavior systematically. Every skill the child with autism does not demonstrate—from relatively simple responses like looking at others, to complex acts like spontaneous communication and social interaction—is broken down into small steps. Each step is taught (often in one-to-one teaching situations, to begin with) by presenting a specific cue or instruction. Sometimes a prompt is added (such as gentle physical guidance) to get the child started. (A word of caution: Prompts of all kinds should be used sparingly and faded quickly to avoid making the child dependent on them.) Appropriate responses are followed by consequences that have been found to function effectively as reinforcers—that is, when those consequences have consistently followed the child's response, it has been shown that the response was likely to occur again. A high-priority goal is to make learning fun for the child. Another is to teach the child how to discriminate among many different stimuli: his name from other spoken words; colors, shapes, letters, numbers, and the like from one another; appropriate from inappropriate behavior. Problematic responses (such as tantrums, stereotypies, self-injury, withdrawal) are explicitly not reinforced, which often requires systematic analyses to determine exactly what events function as reinforcers for those responses. Preferably, the child is guided to engage in appropriate responses that are incompatible with the problem responses.

Teaching trials are repeated many times, initially in rapid succession, until the child performs a response readily, without adult-delivered prompts. The child's responses are recorded and evaluated according to specific, objective definitions and criteria. Those data are graphed to provide pictures of the child's progress, enabling the teacher or parent to adjust the teaching procedures whenever the data show that the child is not making the desired gains. The timing and pacing of teaching sessions, practice opportunities, and consequence delivery are determined precisely for each child and each skill. In this way, instruction can be highly personalized and tailored to each child's learning style and pace.

To maximize the child's success, emerging skills are also practiced and reinforced in many less struc-

tured situations. With some children, certain skills can be taught entirely in relatively unstructured situations from the outset. Such "incidental" or "naturalistic" practice opportunities have to be arranged carefully, however, to ensure that they occur frequently, and that consequences are provided consistently. Ideally, there is a gradual progression from one-to-one to small group to large group instruction. Simple responses are built systematically into complex and fluid combinations of typical, age-appropriate responses. The overall emphasis is on teaching the child how to learn from the normal environment, and how to act on that environment in ways that will consistently produce positive outcomes for the child, her family, and others (Harris & Handleman, 1994; Koegel & Koegel, 1995; Lovaas et al., 1981; Lovaas & Smith, 1989; Schreibman et al., 1993; and Chapters 6 and 7 in this book).

The effective and ethical use of Applied Behavior Analysis methods requires special training, which interested parents should seek. Like any treatment procedures, these can be misused, inadvertently or intentionally. It is particularly important to have competent, well-trained behavior analysts guiding and supervising behavioral treatment for autistic children for several reasons. Research has shown that stereotypic, disruptive, and destructive responses are often provoked by specific (but not always obvious) events, and maintained by sensory stimulation, attention from others, the termination of events like requests or demands, or combinations of these (Green & Cuvo, 1993; Lovaas & Smith, 1989; Repp & Singh, 1990; Taylor & Carr, 1992, 1994). Individuals who mean well but are unaware of this research and its implications, and unskilled in the necessary assessment and behavior-change procedures, may interact with the child in ways that actually make problem behavior worse (Eikeseth & Lovaas, 1992; Meinhold & Mulick, 1990; Taylor & Carr, 1992, 1994; Vyse & Mulick, 1988). For example, providing an autistic child with attention, sensory stimulation, or the opportunity to escape from demands following instances of self-injury may very well increase the rate of occurrence of self-injury (e.g., Lovaas & Simmons, 1969; Mason & Iwata, 1990; and see Chapter 6).

Additionally, procedures that are intended to reduce inappropriate responses, such as time out from positive reinforcement, are easy to misuse and abuse. Unless they are administered carefully, with supervision and monitoring by well-trained professionals, such procedures can jeopardize the child's fundamental rights and worsen rather than improve behavior (e.g., Green, 1990; Repp & Singh, 1990). One of the keys to producing lasting treatment gains in children with autism is consistency. Caregivers who do not know the events that can trigger or maintain prob-

lem behavior are often inconsistent in their interactions with autistic children. They may unintentionally provide a child with mixed messages, impeding rather than fostering the development of adaptive skills, and strengthening rather than decreasing problematic responses. Further, if behavior-change procedures are not carried out consistently across settings, people, and time, any gains the child makes are likely to be lost. Happily, research shows that many parents learn to be consistent, effective behavior-change agents for their children, and can play a vital role in their treatment (Koegel & Koegel, 1995; Lovaas, 1987; McEachin et al., 1993; Schreibman, 1988).

The discipline of Applied Behavior Analysis is based on more than 50 years of scientific research and evolves continually as new evidence emerges. Ideally, behavioral intervention for autistic children should be guided by ongoing, competent professional analysis of previous and current research findings in behavior analysis, as well as related areas (Green, 1990; VanHouten et al., 1988).

EARLY BEHAVIORAL INTERVENTION: RESEARCH FINDINGS

Applied Behavior Analysis techniques have proven effective for improving a wide range of skills in children and adults with autism. So far, however, only a few studies have evaluated the effectiveness of many behavioral techniques combined into a comprehensive, intensive program for preschool-age children with autism. Those that have been published in peer-reviewed research journals are described in the following sections. Research on home-based early intervention is presented first, followed by research on school- or center-based early intervention.

The studies included here evaluated the effects of comprehensive behavioral programming on the overall functioning of children with autism or pervasive developmental disorder (PDD). That is, the investigators measured effects on children's intellectual functioning, language, social interaction, adaptive (or self-care) skills, play, and maladaptive behavior. Some investigators used global measures that encompassed several of those skill domains (e.g., standardized, objective intelligence [IQ] tests, developmental scales, adaptive behavior scales, or enrollment in schools for typically developing children); others used several specific measures.

Studies showing that behavioral intervention can produce large improvements in specific and important areas like peer interactions and classroom behavior

(e.g., Strain, Hoyson, & Jamieson, 1985), imitation (e.g., Young, Krantz, McClannahan, & Poulson, 1994), self-care (e.g., Pierce & Schreibman, 1994), and various language skills (e.g., Taylor & Harris, 1995) were not included in this chapter simply because there are too many of them. Also, reports about program effectiveness that have appeared in sources other than peer-reviewed research journals (e.g., Strain & Cordisco, 1994, and others in Harris & Handleman, 1994) were not included.

Home-based Behavioral Intervention

The UCLA Young Autism Project

The most thorough studies of home-based behavioral intervention for young children with autism have been conducted by Ivar Lovaas and colleagues at the University of California–Los Angeles (UCLA). The first was reported by Lovaas in 1987. An intensive-treatment experimental group of 19 children with autism reportedly received 40 hours a week of one-to-one behavioral treatment from trained therapists (mostly UCLA students). A comparable group of children received fewer than 10 hours a week of one-to-one behavioral treatment with UCLA-trained therapists (the minimal-treatment control group). A second control group of 21 comparable children was treated in programs other than the UCLA project. All children received a diagnosis of autism from qualified professionals not associated with the study, and started treatment before the age of 4 years. The three groups of children had similar measured developmental levels, language and play skills, and rates of stereotypic behavior when treatment began. All participated in treatment for at least 2 years.

The children in the intensive-treatment group received one-to-one teaching at home, at school, and in the community (when appropriate). Instruction focused on increasing language, attending, imitation, social behavior, appropriate independent play, cooperative peer play, and self-care skills, as well as decreasing aggressive, stereotypic, and ritualistic behavior and tantrums. After the first 2 years, it was determined that children who were able to benefit from regular school placement received behavioral treatment for 10 hours or fewer each week while they completed regular kindergarten, and minimal consultation from trained therapists while they completed first grade. Children who did not gain enough skills to function successfully in regular classrooms continued to receive 40-hour-a-week treatment for up to 6 years. Children in the minimal-treatment control group received a variety of other interventions in addition to 10 hours a week of behavioral

intervention; the second control group also received various other interventions (but not intensive behavioral treatment).

All children were reevaluated between the ages of 6 and 7 years by examiners who did not know which group they were in. Their educational placements were also verified. These follow-up measures revealed striking differences between the experimental group and both control groups. Of the 19 children in the intensive-treatment group, nine (47%) successfully completed regular first grade and obtained average or above-average scores on IQ tests (94–120; 100 is average). This was an average gain of 37 IQ points over the course of treatment, and a gain of 31 points more than the minimal-treatment group, on average. Eight children (42%) successfully completed first grade in classes for language-delayed or learning-disabled children, and had IQ scores that were, on average, in the mild range of mental retardation. They had made substantial improvements in most other areas (communication, adaptive behavior) but not enough to enable them to participate fully in regular classrooms. The remaining two children were placed in classes for autistic/mentally retarded children and had IQ scores in the profoundly mentally retarded range. In contrast, only one child from the two control groups completed regular first grade successfully and achieved an IQ score in the average range. Eighteen (45%) were in classes for children with language and learning disabilities, and 21 (53%) were in classes for autistic/mentally retarded children. Their IQ scores remained unchanged from the beginning of treatment, which is consistent with other follow-up studies of children with autism who have received typical educational services (Freeman et al., 1991; Rutter, 1970; Schreibman, 1988; also see Chapter 4).

The nine children in the original (Lovaas, 1987) intensive-treatment group who had achieved normal functioning by the end of first grade, participated in a long-term follow-up study (McEachin et al., 1993). These children were reevaluated when they were 13 years old, on average. They were compared with children from the minimal-treatment control group from the 1987 study. Examiners who were not familiar with the children's histories administered intelligence tests, adaptive behavior scales, and a personality inventory to those from the intensive-treatment group, as well as age-matched children whose development had always been typical. Similar evaluations were conducted with children from the control groups. Educational placements were also evaluated. Results indicated that the effects of the intensive behavioral treatment persisted: Eight of the nine formerly autistic children continued to succeed in regular classrooms. One was in a special education class, but an-

other child from the original experimental group who had not completed regular first grade successfully had later moved into regular classes and was enrolled in junior college at the time of the follow-up study. Thus the proportion of intensively treated children who attained normal functioning in school remained 47% (9 of 19). Similarly, IQ score gains these children had shown at the end of first grade were maintained, and scores remained on average 30 points higher than those of the control group. Scores on adaptive behavior and personality measures were also significantly higher than those of the control group, whose school placements (all in special education classes) had also remained unchanged. In fact, "blind" examiners could not distinguish the formerly autistic children who received early intensive behavioral intervention from typically developing children of the same age on measures of cognitive, academic, social, or adaptive skills.

The groundbreaking research by Lovaas and his colleagues raises several intriguing possibilities. First, it suggests that intensive teaching that requires young children with autism to engage actively with their physical and social environments and provides them with consistent, differential consequences can result in completely normal functioning for many. Contrary to what some critics have said, behavioral intervention does not necessarily result in children who merely "act normal" in rote fashion. If that were the case, the children who achieved the best outcomes would not have demonstrated sufficiently flexible behavior to be judged normal by teachers and examiners who did not know their histories. Indeed, there is no solid evidence that behavioral intervention makes autism worse or makes children robot-like—but these misconceptions persist. Second, the studies suggest that intensive behavioral intervention produces substantially better outcomes than other available treatments for young children with autism. Children in the control groups, who received a variety of other interventions, generally did not fare nearly as well as children in the intensive behavioral treatment group over the same period of time. Third, the studies suggest that young children with autism must be involved in behavioral intervention for a large number of hours every week over an extended period of time to have the best chance for optimal outcomes. Normal functioning was achieved only by children who received intensive behavioral treatment for 40 hours a week, 50 weeks a year, for at least 2 years. Those who received behavioral treatment for only 10 hours a week or not at all, with one exception, did not show much improvement.

As with most studies, those reported by Lovaas and his colleagues do not by themselves provide con-

1987
results

1993

Lovaas

clusive answers to all questions about early intervention for autism. They raise several important issues; some have been addressed by other published studies discussed in this chapter, some are the focus of ongoing research, and still others remain to be answered in future studies. Among the more burning questions are these: Exactly how did the majority of children in the intensive treatment group differ from the 47% "best-outcome" minority before treatment, and in their responsiveness to particular components of treatment? This leads to a broader question: Which children are likely to respond best to intensive behavioral intervention? Are there characteristics (e.g., degree of developmental delay or disorder, level and course of language development, learning style, etc.) that can be assessed before treatment begins, or early in treatment, to determine if a child is going to be more or less responsive? For example, other research has shown that the development of useful language by the age of five is associated with more positive outcomes for children with autism. Also, despite its limitations, IQ score is a relatively good predictor of later academic and overall adjustment (Rapin, 1991; Rutter & Schopler, 1987; Schreibman, 1988). Consistent with those findings, most of the best-outcome children from the 1987 study learned to imitate adult speech by the end of 3 months of intensive treatment, although many had little or no useful vocal speech when they entered treatment (ASA, 1994). The best-outcome children also had somewhat higher IQ scores before treatment than those in the intensive-treatment group who did not achieve normal functioning (Lovaas & Smith, 1988). Otherwise, the reports published by Lovaas and colleagues provided little information about individual children that might have revealed exactly how those who responded dramatically to intensive behavioral intervention differed from those who did not.

Other questions have to do with the nature of the intervention. Many different individuals served as therapists in the Lovaas (1987) study, most of them college students and parents. It is very likely that the manner and skill with which they delivered the intervention varied, which may account in part for the variability with which the children apparently responded. The published articles reported only general information about how the therapists were trained and what they did, and no direct measures of how well or how consistently the therapists performed over the course of treatment, exactly how much treatment was provided by parents vs. other therapists, and so on. Of course, authors usually have to omit some details from published research reports because of space limitations imposed by journals. Accordingly, Lovaas and his coauthors referred readers of their journal articles to *The ME Book* (Lovaas et al., 1981) for details about

treatment procedures. That begs the question of how well therapists actually carried out the procedures as intended, however. In addition, since *The ME Book* was published a number of years ago, it does not include the many new teaching techniques and refinements that have resulted from research conducted in the meantime by the UCLA Young Autism Project as well as many other behavior analysts.

Answers to these and other questions are very important not only to other researchers, but also to families, advocates, service providers, policymakers, and others concerned with providing effective treatment to young children with autism at a time when resources are becoming ever more scarce. More careful, rigorous studies like those conducted by Lovaas and his colleagues will be needed to obtain credible, reliable answers (see Chapters 2 and 4).

The studies reported by Lovaas and his colleagues suggest that early, intensive, home-based behavioral intervention provides the best opportunity for a sizable proportion of children with autism to have normal lives. Those studies would have relatively limited value, however, if they could not be repeated (replicated) by other, independent practitioners, families, and researchers (Foxy, 1993). Fortunately there have been several efforts to replicate them, at least in part, and others are in progress at this writing.

The May Institute Study

In a study conducted in Massachusetts, 14 youngsters with autism (average age: 43 months) received 15–25 hours per week of intensive behavioral teaching from trained teachers and parents in their homes (Anderson et al., 1987). Their overall mental age (MA), adaptive behavior, and language development were measured with standardized tests administered by professionals not directly associated with the project. Parents and teachers also recorded data every day on each child's progress toward instructional goals as well as levels of maladaptive behavior. Additionally, project staff used a standardized measure (the Uniform Performance Assessment System, or UPAS) to assess each child's progression through normal developmental sequences in several skill domains. These measures were taken before treatment and after one year of treatment. For seven children who completed a second year of treatment, assessments were repeated at the end of the second year.

After one year of treatment, MA and social-age scores increased to some degree (ranging from 2 to 23 months) for 12 of 13 children tested. Nine of the eleven children with whom language tests were repeated after one year of treatment made gains of 3–18 months. Similar improvements were revealed by the UPAS, but

gains in communication skills were smaller than gains in other skill areas (e.g., social and self-help). Children who received a second year of intensive behavioral treatment continued to improve in most areas at about the same rates as they had in the first year. Improvements were significant as measured by statistical tests comparing average group scores on standardized tests completed before treatment with those readministered after one year of treatment. For eight of the thirteen children, rates of learning in the first year of treatment were also found to be accelerated relative to normal development; this was true for all children who continued in treatment for another year. All children progressed on their individual instructional objectives, mastering 20 objectives in the first year, on average. None, however, were integrated full time in regular classrooms at the time the study ended, although 31% were integrated at least 2 hours a week (Anderson et al., 1987).

As Anderson and his coauthors were careful to point out, their study differed from the study by Lovaas (1987) in a number of ways. Any of several characteristics of the children and the treatment might account for the less favorable outcomes obtained by Anderson and colleagues. The children were nearly a year older, on average, and there was a larger difference (by an average of 6 months) between their chronological ages and measured mental ages when treatment started. They participated in treatment about half as many hours per week as the children in the Lovaas (1987) intensive treatment group (an average of 20 hours per week vs. 40 hours or more per week), over a shorter total duration (1–2 years vs. 2–6 years). No physically aversive procedures were used by Anderson et al. (1987), whereas reprimands and thigh slaps were provided as consequences for aggression, noncompliance, and other maladaptive responses by some children in the Lovaas (1987) study. Additionally, there was no control group of comparable children who received another type of intervention, or no particular intervention, for direct comparison with behavioral intervention.

On the other hand, Anderson et al. (1987) obtained detailed data on all children before they began treatment (baseline) and throughout the course of treatment. Baseline data showed that none of the children were making appreciable progress in the preschool programs in which they were participating. For each child, appropriate responding increased and maladaptive behavior decreased when and only when behavioral intervention began. That is, behavioral intervention was compared directly with no particular intervention (i.e., typical education) for each child, and replicated across children and behaviors. Such

within-subject comparisons and replications, or single-subject experiments, can provide powerful evidence of treatment effectiveness (Barlow & Hersen, 1984; Kazdin, 1982; also see Chapter 2). In addition they can document specific changes in behavior that may be too small to be detected by broad measures like standardized tests, but are nonetheless very meaningful and important to the individual child and those around her. Finally, unlike Lovaas (1987), Anderson and colleagues evaluated the skills of the parent therapists, providing some evidence that the treatment procedures were carried out with relative consistency and skill across all participating children.

The Murdoch Early Intervention Program

Another evaluation of intensive, home-based behavioral intervention for autism was conducted by behavior analysts at Murdoch University in Western Australia (Birnbauer & Leach, 1993). Nine young children with autism or PDD (average age: 39 months) received an average of 18.72 hours per week of one-to-one instruction from trained parents and volunteers (college students, other family members, friends) supervised by individuals with advanced training in Applied Behavior Analysis. A control group of five similar children did not receive behavioral treatment. Standardized assessments of intellectual functioning (IQ), language development, and adaptive behavior were administered to all children before and at the end of a 2-year treatment period by examiners who were not associated with the program. Direct observations, parent interviews, and a personality inventory were used to evaluate the severity of each child's autistic behavior before and after treatment. Additionally, samples of each child's play, instruction-following, imitation skills, and maladaptive behavior were videotaped before, during, and at the end of the treatment period, and scored by "blind" independent raters. For children in the treatment group, performance data and details about individual programs were recorded during every teaching session. Finally, parents completed a stress index twice a year.

At the end of the 2-year treatment period, four of the nine children in the treatment group had made substantial gains as measured by IQ, language, and adaptive behavior tests. They achieved IQ scores of at least 80 (89–103), whereas before treatment the independent examiners had judged them untestable. Language and adaptive behavior test scores also improved considerably, but not as much as IQ, so that measured performances in those areas were still below chronological-age levels. The communication, play, instruction-following, social, self-help, and tantrum behavior

of these four children had also improved considerably as measured by direct observational assessments and the personality inventory. Stereotypic response levels were essentially the same as before treatment, however. Four of the other five children in the treatment group made moderate improvements, while one made only minimal gains. In contrast, one of five children in the control group made substantial improvements in adaptive behavior and language, but not in intellectual functioning, over the 2-year period. That child had the most advanced skills and least severe autistic characteristics of all the children when the study began. One other child in the control group made moderate improvements, but three made few or minimal gains on any measures.

Scores on the stress index were high for parents of children in both groups when treatment started. By the end of 2 years, scores for parents of children in the behavioral treatment group had improved (i.e., their reported stress levels had decreased) by an overall average of 12.8 points, in comparison to an overall improvement of 1.8 points for parents of children in the control group.

The Birnbrauer and Leach (1993) study had many features in common with the Lovaas (1987) study. Children in the treatment group were slightly older and had slightly lower adaptive behavior and intelligence scores before treatment than those in the Lovaas study, but they were otherwise very similar. Outcomes were similar as well, in that just under half of the children in both studies made substantial improvements in 2 years of treatment; however, the best-outcome children in this study were not shown to achieve completely normal functioning as did those in the UCLA studies, although they seemed to be moving in that direction at the end of 2 years. The major difference between the studies was that the Australian children received considerably fewer hours a week of treatment than those in the UCLA intensive-treatment group were said to receive, and less than the 30 hours the investigators sought.

The quality of treatment delivered in the two studies may have differed as well. Like Anderson et al. (1987) but unlike Lovaas (1987), Birnbrauer and Leach used no physically aversive consequences in treatment. Additionally, their volunteer therapists received most of their training on the job, while the college student therapists in Lovaas' study reportedly had prior and ongoing academic as well as practical training in behavioral principles and procedures. It is impossible to determine how treatment differed in the two studies, however, because neither measured the competencies of therapists or the extent to which they adhered to treatment protocols (see Birnbrauer & Leach, 1993, p. 72).

The UC—San Francisco Study

Recently the effects of intensive, home-based behavioral intervention on young children with autism were evaluated by researchers at the Pervasive Developmental Disorders (PDD) Clinic, Langley Porter Psychiatric Institute, University of California at San Francisco (Sheinkopf and Siegel, in press). This clinic was conducting a long-term study of young autistic children who had received initial diagnostic evaluations at the clinic. On follow-up evaluations, the researchers happened to notice that a number of children were reported to have received intensive, home-based behavioral intervention. They designated 11 of those children to constitute a treatment group. Each was paired with a child from the larger study who did not receive behavioral intervention. Pairs of children were matched for chronological age (which averaged just under 3 years), mental age (MA; just under 2 years, on average), diagnosis (10 pairs, autism; 1 pair, PDD), and the interval between their initial and follow-up evaluations. Each child's intellectual ability (mental age and/or IQ) was estimated with standardized tests on initial and follow-up evaluations at the clinic. Additionally, the severity of their autistic symptoms was rated on a scale from zero (symptom not present) to three (severe), and a diagnosis was established by consensus of at least three clinic staff.

The researchers were not involved in deciding which children received behavioral treatment or in providing treatment. They were "blind" to group membership when they compared the measures of the children's status before and after treatment. This effectively ruled out the possibility of biased selection of children for the behavioral treatment group, a criticism that some have made about the Lovaas (1987) study (e.g., see Schopler, Short, & Mesibov, 1989; Lovaas et al., 1989).

Information about interventions in which children participated was obtained through phone interviews with parents. From these reports it appeared that children in the treatment group received an average of just under 20 hours a week of one-to-one, in-home instruction with behavioral methods (range: 9.43–38.75 hours per week) for periods ranging from 7 to 24 months. Trainers were mostly paraprofessionals (college students, relatives, friends) recruited by parents, who reportedly were assisted in training and supervision by one of three master's-degreed "behavior therapists" working in the San Francisco area. Children in the treatment group also attended school an average of a little more than 6 hours per week. None of the children in the control group received intensive behavioral intervention, according to parental reports,

reduced parental stress

but they attended school an average of 10.7 hours per week. All children in both groups were placed in special education classes initially.

Statistical comparisons of averaged test results indicated that, as a group, the children who received intensive behavioral treatment had significantly higher MA and IQ estimates after treatment than matched children in the control group (recall that these scores were very similar for both groups initially). Examination of individual IQ test data reveals some interesting patterns. All 10 children in the behavioral treatment group for whom follow-up data were available improved on IQ measures, most of them by substantial amounts. In the control group, six children improved by small to moderate amounts, four had lower scores, and one stayed the same. After treatment, six of the ten children in the behavioral treatment group achieved IQ scores of at least 90. However, three of them had scores near 90 before treatment began; all three of those children had higher scores after treatment (about 95, 100, and 115). Three of the eleven control group children had IQ estimates of 90 or above after the treatment interval, but two of those had scored around 90 before treatment. When the IQ data for matched pairs of children are compared, it appears that for seven pairs the child receiving behavioral treatment improved more than his matched partner over the same time period. Within those pairs, the IQ scores of three control group children decreased from initial assessments, while two remained the same and two increased slightly. For two other pairs, treatment and control group children made roughly equivalent IQ gains. In one case the control group child's IQ increased more than that of the matched child receiving behavioral intervention, and for one pair no follow-up data were available for the treatment group child.

The authors reported that the number of autistic symptoms did not differ significantly for the two groups of children either before or after treatment, but the symptoms of the children in the treatment group were rated as significantly less severe after treatment (Sheinkopf & Siegel, in press).

Results of this study add to the evidence that intensive behavioral intervention increases the intellectual functioning (as measured by standardized, objective tests) of many young autistic children. Behavioral intervention also appears to be more effective than other interventions in that regard, or at least the typical interventions that are available to autistic preschoolers. In this study, the "blind" assignment of children to groups and evaluations by professionals who were not associated with treatment, together with the matching procedures employed, lend credence to these conclusions. Unfortunately no measures of adaptive behavior, language, social skills, or

educational performance were obtained, so there is no basis for judging whether any children attained normal or near-normal functioning in those important domains, nor for evaluating how specific characteristics of the children (e.g., language skills, learning styles) were related to outcomes.

More important, the only information about the nature of the behavioral treatment provided to children in the Sheinkopf and Siegel study was obtained indirectly through parental reports. These included general information, such as how long treatment was provided and by how many therapists, but nothing specific about the training or competencies of the therapists or precisely what they did. No information was provided about the level of involvement of the master's-level behavior therapists in training and supervising those working directly with the children, nor how much of the direct intervention was provided by parents vs. paraprofessionals. The studies summarized earlier all had at least one doctoral-level psychologist or behavior analyst providing overall supervision for treatment implementation and evaluation; that did not appear to be the case here. Further, there is not enough information in the report to determine whether the amount of behavioral treatment (in number of hours per week and total number of weeks) related to individual outcomes, although the authors did report that the IQs of children who received an average of about 30 hours a week of behavioral treatment generally improved more than the IQs of those who received about 20 hours a week. (Readers should note, however, that this author reviewed a prepublication version of the Sheinkopf and Siegel report, cited here with the investigators' permission. More details may be included in the version that is revised for publication.)

The Maurice Children

The effectiveness of early intensive behavioral intervention for two siblings with autism was documented in a book written by their mother (Maurice, 1993), as well as a case study published in a professional journal (Perry et al., 1995). The two children were each diagnosed with autism at about the age of 2 years by independent professionals who did not know about each other's evaluations. Intensive treatment was provided by master's-degreed behavior analysts and the children's mother, along with a speech-language pathologist. Formal, one-to-one teaching sessions were conducted for 10–35 hours per week, but incidental and informal instruction provided by the parents outside of those sessions meant that the children participated in intervention during most of their waking moments. The first child, a girl, made rapid progress within the first year of treatment, at

Key finding

which point her younger brother was diagnosed and started an intensive behavioral program. He too responded well to behavioral intervention. Intensive treatment continued for both children for about 2 years, and was reduced gradually as they began to attend regular preschools. By the ages of 39 and 53 months respectively, they no longer met criteria for the diagnosis of autism, and behavioral treatment was discontinued.

Both children successfully completed regular kindergarten, and have gone on to do very well in typical classrooms where teachers who do not know their histories evaluate them as academically advanced and socially well-adjusted. Three of the professionals who diagnosed the children evaluated their progress (on a standardized test of adaptive behavior as well as their impressions from direct observations) at intervals of 6–9 months until behavioral treatment was discontinued. At that point these professionals, who were not involved in providing treatment to the children, reported that both were fully recovered from autism (Perry et al., 1995).

While they were not formal experiments, the case studies of these two children include several features that make them credible: documentation of little or no progress before treatment (baseline); objective measurement of treatment effects repeated over extended periods of time; intensive behavioral treatment introduced systematically across many behaviors, producing relatively rapid and dramatic improvements each time; and verification of diagnoses, pretreatment (baseline) measures, and outcomes by several independent observers (Kazdin, 1982).

School- or Center-based Behavioral Intervention

The effectiveness of educational programs using the methods of Applied Behavior Analysis with preschool and school-age children with autism has been documented in countless articles published in scientific journals like the *Journal of Applied Behavior Analysis*, *Research in Developmental Disabilities*, *Journal of Autism and Developmental Disorders*, *Behavior Modification*, and others. Many have been reviewed and compiled in books. Several respected preschool programs were described in considerable detail in a recent book edited by Harris and Handleman (1994). Only a couple of programs, however, have documented broad effects of comprehensive, intensive behavioral programming provided in a school or center in reports published in peer-reviewed research journals.

The first study of this kind was conducted by staff of the Princeton Child Development Institute (PCDI),

a private nonprofit program that provides educational and other services to children with autism and their families on a thoroughgoing Applied Behavior Analysis model. Outcomes for nine children who enrolled at PCDI before the age of 60 months (Group 1) were compared with outcomes for nine comparable children who enrolled after the age of 60 months (Group 2). All were diagnosed by agencies outside PCDI, and were enrolled in the program for 24 months or more. Behavioral intervention was delivered primarily in the PCDI school program for about 27.5 hours per week, 11 months a year, by a number of teachers and therapists trained in Applied Behavior Analysis. Most children lived with their families, and their parents were trained to implement behavioral procedures at home. One child in Group 1 and four children in Group 2 lived in PCDI-run community group homes, where professional staff also provided behavioral intervention.

Treatment outcomes were defined as positive (the child lived at home and was enrolled full-time in a regular school) or not (the child remained in treatment). It is important to note that children began to make transitions from PCDI to regular school programs only when objective, direct observational data showed that they had language, social, self-care and leisure skills, and control of problem behaviors that were sufficient for them to benefit from placement in regular classrooms (McClannahan & Krantz, 1994). Transitions were accomplished gradually while the children's progress was measured by PCDI staff, and were completed when data showed that skills had generalized to the regular school setting. Results of the study showed that six of nine children who enrolled at PCDI before the age of 60 months (i.e., 67%) achieved positive outcomes, compared to just one of the nine children who enrolled after the age of 60 months (Fenske et al., 1985).

This study had a number of limitations: It did not employ an experimental research design; there were no direct measures of specific outcomes (e.g., language development, maladaptive behavior, self-help skills, social skills, intellectual functioning); and the published report did not include any detailed information about the intervention, or measures of treatment integrity. Nor was any information about individual children included in the report. However, PCDI researchers have a long and distinguished record of scientific research on behavioral teaching procedures for children and youth with autism, staff training, parent training, and program evaluation (e.g., Krantz, Zalski, Hall, Fenske, & McClannahan, 1981; McClannahan & Krantz, 1993; McClannahan, Krantz, & McGee, 1982). The study by Fenske et al. (1985) provides important evidence about the relation between age of entry into a high-quality, school-based behavioral program and outcomes for children with autism.

recovery

the children of 1994
studies

Another study was conducted by researchers at the Douglass Developmental Center, Rutgers University (Harris et al., 1991). This center provides preschool education using methods of Applied Behavior Analysis for children with autism in a segregated classroom as well as a classroom in which children with autism are integrated with typically developing peers (Handleman & Harris, 1994). The study evaluated changes in intellectual functioning and language development in children with autism over the course of about a year's participation in the center's program, in comparison with their same-age, typically developing peers. Diagnoses of autism were made by outside agencies and confirmed by a clinical psychologist at the center. Typically developing children were drawn from the center's integrated preschool and day care center.

A standardized IQ test (the Stanford-Binet IV) was administered to nine preschoolers with autism when they were 50 months old, on average, and to nine typically developing preschoolers (average age: 45 months). The same test was given again 10–11 months later (posttest). On the first test administration (pretest), the average IQ score for the children with autism was 67.5; the average for the typical youngsters was 114.11. On posttesting, the children with autism achieved an average IQ score of 86.33 (an average gain of 18.78 points), while the average for the typical children did not change significantly. Scores of seven of the nine children with autism improved by at least 10 points.

A different group of 16 preschoolers with autism and a sample of 12 typically developing peers were pre- and posttested on the Preschool Language Scale at intervals of 9–10 months. Scores for both groups increased by about eight points, which was statistically significant, but scores of the children with autism were well below those of their typical peers on both pre- and posttests.

As the authors noted, the children with autism were relatively advanced when this study began. Their average IQ score was nearly 70, their average age was more than 4 years, and their autistic characteristics were rated mild to moderate. Nonetheless, the gains they made in intellectual functioning over a period of just under one year were substantially greater than the negligible changes that have been documented in other research with 4-year-olds with autism, and exceeded those of their normal peers. It is not known whether the improvements maintained because no long-term data were reported. Unfortunately the study included no measures of other important skills like social interaction, play, self-help skills, and maladaptive behavior, which do not necessarily improve with increases in IQ scores, so the impact of behavioral intervention on the children's overall functioning can-

not be determined. In addition, no specific information was provided about the nature or intensity of the intervention, and there were no comparisons involving preschoolers with autism who received no treatment or some other type of intervention. Thus it is not clear whether the improved intellectual functioning demonstrated by seven of nine children with autism was the direct result of their participation in a behavioral preschool program, but it seems likely given the other research reviewed above and in Chapter 4.

SUMMARY AND IMPLICATIONS

The body of research on early behavioral intervention for autism is quite small, and many important questions remain to be answered. Taken together, however, the studies just reviewed provide reasonably strong evidence about a number of issues. Those are summarized next, along with their implications and questions that need to be addressed in future research.

Effectiveness

There is little doubt that early intervention based on the principles and practices of Applied Behavior Analysis can produce large, comprehensive, lasting, and meaningful improvements in many important domains for a large proportion of children with autism. For some, those improvements can amount to achievement of completely normal intellectual, social, academic, communicative, and adaptive functioning. In fact, a large majority of young children with autism benefit from early behavioral intervention. Most show substantial improvements in many adaptive, useful skill areas and reductions in problematic behaviors. Only a small proportion (about 10% of those studied so far) have been found to make few or no improvements despite intensive efforts (e.g., Anderson et al., 1987; Birnbrauer & Leach, 1993; Lovaas, 1987; McEachin et al., 1993; Sheinkopf & Siegel, in press).

The best documented positive effect is improved intellectual functioning as measured by standardized IQ tests or developmental scales. Virtually every study reviewed here found this effect. Again, the majority of children studied made at least some gains in IQ scores over the course of 1–6 years of behavioral treatment; slightly fewer than half made large gains (from levels indicative of moderate to severe mental retardation to levels in the normal range, in many cases), and a small percentage made few or no gains (Anderson et al., 1987; Birnbrauer & Leach,

1993; Harris et al., 1991; Lovaas, 1987; Sheinkopf & Siegel, in press). Improvements in language, social skills, play, self-help, and problematic behavior (e.g., tantrums, stereotypic and ritualistic responding, withdrawal, self-injury, aggression) were found to be somewhat less widespread and robust than IQ changes, although that may be a function of characteristics of the children or the treatment provided in different studies, or other variables (e.g., Anderson et al., 1987; Birnbrauer & Leach, 1993). Clearly, large and meaningful improvements in all domains were attained by some children who ultimately became indistinguishable from their peers on every dimension (Maurice, 1993; McEachin et al., 1993; Perry et al., 1995).

Successful integration in regular schools is another positive effect that is well supported by data. Many children with autism who received at least 2 years of intensive behavioral intervention starting at an early age went on to participate in classrooms for typical children of the same age, some with no or relatively little ongoing special support (Fenske et al., 1985; Harris et al., 1991; Maurice, 1993; Lovaas, 1987; McEachin et al., 1993; Perry et al., 1995; Sheinkopf & Siegel, in press). It is important to emphasize that the researchers represented in this chapter, for the most part, had extensive objective data showing that the skills of children with autism actually persisted or continued to improve when they were placed in regular classrooms, which happened only after there was clear evidence that the children had developed the skills necessary to succeed in those settings (see Chapter 16). This approach differs considerably from the "total inclusion" social movement that would have all children with autism (and other disabilities) placed immediately and permanently in regular classrooms regardless of their beginning or ongoing skill development, and without regard to objective evidence of effectiveness (e.g., Biklen, 1992; Stainback & Stainback, 1992).

There is strong evidence that behavioral intervention is more effective for young children with autism than no intervention, and more effective than typical early education services and assorted other therapies. This inference is based on the results of studies reviewed here that compared early behavioral intervention to no treatment or typical education (i.e., control groups or individual pretreatment baselines); a large body of research comparing the effectiveness of behavioral intervention to other procedures for changing specific behaviors of young children with autism (e.g., social skills, communication, and maladaptive responses); and the lack of strong scientific support for almost every other specific therapy for autism (Anderson et al., 1987; Birnbrauer & Leach, 1993; Harris et al., 1991; Lovaas, 1987; Maurice, 1993;

McEachin et al., 1993; Sheinkopf & Siegel, in press; also see Schreibman, 1988; Smith, 1993; and Chapters 2 and 4 in this book).

To this author's knowledge, however, no studies have directly compared comprehensive, intensive behavioral intervention with intervention based on another orientation (e.g., play therapy, sensory integration, a child-centered developmental model) provided to comparable children for a comparable amount of time. There are some hints that early educational efforts that are not explicitly behavior-analytic can produce some improvements in children with autism who participate in them for many hours a week over an extended time (e.g., Rogers & Lewis, 1989). In addition, some of the studies reviewed here found that an occasional control group child who participated in other interventions improved substantially (e.g., Birnbrauer & Leach, 1993; Lovaas, 1987; Sheinkopf & Siegel, in press). Few details about those children were reported, but some of them appeared to be relatively advanced prior to intervention (Birnbrauer & Leach, 1993; Sheinkopf & Siegel, in press). Further, the other interventions have not been well-specified nor evaluated in scientifically rigorous studies to date. The limited objective evidence available so far suggests that other interventions do not produce improvements as large as those that have been shown to result from behavioral intervention (Lovaas, 1987; Sheinkopf & Siegel, in press; also see Smith, 1993).

Age for Optimal Effectiveness

The optimal age to begin intensive behavioral intervention is before the age of 5. So far, the best outcomes have been reported for children who started treatment at age 2 or 3 (Birnbrauer & Leach, 1993; Lovaas, 1987; Maurice, 1993; McEachin et al., 1993; Perry et al., 1995; Sheinkopf & Siegel, in press). At present there seems to be no compelling reason to delay intervention as soon as autistic behavior is verified and the child has sufficient motor skills to carry out simple actions. It remains to be seen, however, whether very young children (i.e., 2 years or younger) will tolerate and benefit from teaching sessions that are as lengthy and structured as those commonly used with children ages 3 and older; that is, there may prove to be an interaction between the child's age or developmental level and treatment intensity, however, the latter is defined.

There may be an optimal period during which the young, developing brain is very modifiable. In some children with autism the repeated, active interaction with the physical and social environment

that is ensured by intensive behavioral intervention may modify their neural circuitry, correcting it before the neurobiological correlates of autistic behavior become relatively permanent (Lovaas & Smith, 1989; McEachin et al., 1993; Niemann, in press; Perry et al., 1995; Smith, 1993). At this point in time, of course, these are merely plausible speculations that remain to be investigated in scientific studies.

3 The Nature of the Intervention

Behavioral intervention is a "package" treatment with many elements and dimensions. The studies reviewed in this chapter represent some of the first attempts to evaluate the whole package, applied in a comprehensive, intensive, and sustained way, with young children. Families, researchers, practitioners, service providers, policymakers, and others naturally have many questions about the nature of the treatment: What are the essential components? Exactly how is it done? Who can deliver the intervention effectively? What does *intensive* mean, in practical terms? How intensive does intervention have to be to have the desired effects? How long should it continue? Unfortunately, most studies published so far include very little specific information about how behavioral intervention was provided to the children studied, so many of the foregoing questions need to be addressed in future research. Some points that can be inferred from existing research, with varying degrees of confidence, are summarized next.

Components

Applied Behavior Analysis comprises many assessment and behavior-change procedures. They are all derived from scientifically established principles of behavior. Many procedures, singly and in certain combinations, have been validated repeatedly in scientific studies, but new techniques and combinations are constantly being developed and evaluated. The only published, comprehensive package of procedures and skill sequences for teaching young children with autism is *The ME Book* (Lovaas et al., 1981). As mentioned earlier, the version that is currently available does not incorporate techniques and strategies that have been developed since its publication. Most of the published research reports reviewed earlier did not describe specifically which of the many components of behavioral intervention were employed in the studies. That was partly out of necessity, not only because of space limitations in professional journals but be-

cause the very nature of Applied Behavior Analysis is that it is highly individualized. Behavior-change procedures and progressions are tailored to each child's current levels of functioning and projected future needs. It would be helpful nonetheless to know more about specific aspects of the intervention provided to participants in treatment evaluation studies like the ones reviewed here.

One component of behavioral intervention for young children with autism that has been addressed to some extent in the formal studies is the use of aversive consequences to reduce levels of inappropriate responding. Lovaas (1987) reported that sharp verbal reprimands and light thigh slaps appeared to be necessary to effect meaningful reductions in problem behavior for some children. Both the Anderson et al. (1987) and Birnbrauer and Leach (1993) studies opted not to employ aversive physical stimulation. In general their approach did not produce outcomes as impressive as those of Lovaas (1987), which may have been due to the exclusion of aversive treatment components or to any of several other differences. Children in both of those studies received fewer hours of treatment per week than reported in the Lovaas (1987) study; children in the Anderson et al. (1987) study were older; and therapists in the Birnbrauer and Leach (1993) study may have had less extensive training. On the other hand, physical aversives were not part of the intervention for the Maurice children, both of whom achieved normal functioning (Maurice, 1993; Perry et al., 1995). In short, it is not possible to draw any strong conclusions from the available evidence as to whether aversive components add to or detract from the effectiveness of early behavioral intervention.

Intensity

This may be one of the most important dimensions of behavioral intervention; surprisingly, it has not been well defined. Researchers have described intensity only in terms of the number of hours that children were reported to be receiving treatment. Those reports appear to have been largely anecdotal; no measures of actual time children were engaged in treatment, verified by independent observers, have been provided to date. Nor was information provided on other important dimensions of treatment intensity, such as proportions of time spent on discrete-trial drills vs. incidental teaching opportunities, or the amount and type of programming provided by parents vs. other therapists.

Much more specific, reliable information about treatment intensity is needed, for many reasons. For

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aversive

one, it is very difficult to draw comparisons across studies when we do not know how they differed on this important treatment variable. Then there is the question of cost-effectiveness, which is vitally important to families and advocates who are trying to procure funding for behavioral intervention, and to families, insurance companies, service providers, and policymakers who must make difficult decisions about resource allocation (time and labor, as well as money). Obviously the intensity of treatment must be well specified if valid and useful cost-effectiveness formulas are to be developed. Further, common sense as well as empirical facts about behavior suggest that it is not the number of hours allocated for intervention that is important, but rather what is *done* during that time. A very skilled therapist or parent could probably accomplish more with a child in 10 hours than a less-skilled individual could do given 30 hours with the same child. The crucial aspect of treatment intensity will probably prove to be something like rate of learning opportunities (e.g., number of programmed arrangements of specific antecedents, responses, and consequences presented for the child per minute).

A further qualification is that, to date, there is very little evidence from sound research about the relative effectiveness of behavioral intervention at different degrees of intensity. Lovaas (1987) reported that about 40 hours per week was considerably more effective than about 10 hours per week. Sheinkopf and Siegel (in press) inferred that about 30 hours a week produced greater IQ gains in children than an average of around 20 hours per week, but they determined treatment intensity from indirect, unverified reports and did not relate degrees of improvement to weekly or total hours of treatment specifically. The children who achieved positive outcomes in the study by Fenske et al. (1985) received at least 27.5 hours per week of intensive behavioral intervention as preschoolers in the Princeton Child Development Institute's programs, but no comparisons were made with children who spent less time per week in intervention. Studies in which children received an average of about 20–25 hours of treatment weekly (Anderson et al., 1987; Birnbrauer & Leach, 1993) found somewhat more modest effects than those reported to result from 40 hours per week (Lovaas, 1987). As noted above, however, those studies also differed from Lovaas' study in other ways. The research designs employed have not made it possible to separate the effects of treatment intensity clearly from the effects of other variables in any studies published to date.

Given these limitations, inferences about optimal treatment intensity should be made cautiously. The only conclusion supported by the data at this point in

time is that the best outcomes have been reported for children who participated in behavioral intervention for at least 30 hours per week.

Duration

Most of the questions and limitations just noted for treatment intensity also apply to treatment duration, or the total treatment period (months, years) that is likely to produce the best outcomes. Almost no comparative information is available from the published research. Not surprisingly, Anderson et al. (1987) found that youngsters who made good progress in 1 year of treatment made even more over a second year, but they did not compare the progress of children who had 2 years of treatment with that of children who terminated behavioral intervention after 1 year. Most of the best-outcome children in the initial Lovaas (1987) study achieved normal functioning after 2 years of intensive (40 hours per week, 50 weeks per year) behavioral intervention, but one child eventually did so after 6 years (McEachin et al., 1993). The retrospective study by Sheinkopf and Siegel (in press) included children who participated in behavioral intervention for periods ranging from 7 months to nearly 2 years. The data were not presented in such a way, however, that a relation between time in treatment and outcomes could be inferred. Further, it is likely that treatment effectiveness will prove to be the product of an interaction between treatment intensity and duration, therapist competencies, and child characteristics. Until those variables are defined specifically and studied rigorously, the question of optimal treatment duration cannot be answered conclusively. Again, the only safe conclusion at this point seems to be that the best outcomes have been reported for children who participated in intensive behavioral intervention for at least 2 consecutive years, if not longer (Anderson et al., 1987; Birnbrauer & Leach, 1993; Fenske et al., 1985; Maurice, 1993; Perry et al., 1995; Lovaas, 1987; McEachin et al., 1993; Sheinkopf & Siegel, in press).

Quality

Still another dimension of behavioral intervention is the quality with which it is delivered. Arguably, quality might encompass variables like intensity and duration, but for purposes of this discussion it is defined as the extent to which those providing treatment do so in accordance with empirically validated best-practice standards as well as legal and ethical guidelines. This is another issue in early behavioral intervention for autism on which objective evidence is

How could we carefully describe intensity?

What's the best amount of time per wk?

sorely lacking; its importance is self-evident. With the exception of Anderson et al.'s measures of parents' skills, none of the studies published to date have provided any data about the competencies of therapists, teachers, or trainers, or objectively verified information about what they actually did during intervention sessions. As Birnbrauer and Leach (1993) argued, measurement of treatment quality and integrity should be a high-priority topic for future research.

Setting

The bulk of the research reviewed here dealt with early behavioral intervention that was largely home based, usually leading (when successful) to a combination of home-, community-, and school-based intervention. No direct comparisons of home- vs. school-based behavioral intervention for young children with autism have been published, to this author's knowledge. Given the well-documented effectiveness of school-, center-, and community-based programs for people with disabilities that use the methods of Applied Behavior Analysis, there is every reason to think that skilled parents, teachers, and therapists can provide effective behavioral intervention for young children in various settings. It is not the place but the quality with which treatment is delivered that is likely to play the greater role in producing good results. A couple of qualifications are in order, however: (a) Given the deficits in attending, observing, understanding spoken language, following instructions, and sustaining engagement in constructive activities that typify many young children with autism, initial instruction should take place in settings that are quiet and as free of distractions as possible; and (b) treatment must be extended to settings other than the primary one to produce lasting, generalized effects.

On the other hand, it makes good behavioral sense to teach children with autism in contexts that are as similar as possible to those in which their same-age peers live and learn. Since most very young children spend a good deal of their time at home, and learning how to function effectively within the family is one of the most important lessons of early life, it makes sense to provide behavioral intervention to very young children with autism in their homes, at least initially. Additionally, parental involvement in treatment may be a crucial component of effective behavioral intervention for young children with autism, and that may be enlisted more readily when treatment takes place in the home (Lovaas, 1987). Not all families, however, are able to take on an intensive home-based program, so it would seem best if a range of options were available, including school-based programs. Additionally,

it is entirely possible and very desirable to involve parents as active partners in treatment delivered primarily by a school or center; indeed, virtually every behavioral preschool program does so (Harris & Handleman, 1994).

Conclusion

While many questions remain to be answered by sound scientific studies, the results of research conducted so far have several implications for making decisions about treatment for young children with autism:

1. *The intervention of choice is intensive instruction using the methods of Applied Behavior Analysis. Intensive means that carefully planned learning opportunities are provided and reinforced at a high rate by trained teachers and therapists (including parents), under conditions that maximize the probability that the child will benefit from instruction, throughout most of every day, for a minimum of 2 years. It seems best to aim for at least 30 hours of intervention per week to begin with. That much time may not be necessary for every child, but if the intervention is delivered competently, the child is not likely to be harmed from participating for 30 hours or more a week, and is very likely to benefit substantially. After a while, if data show that the child does just as well with fewer hours, then the amount of time could be reduced.*

2. *Intervention should begin before the child reaches the age of 5.*

3. *To be effective, Applied Behavior Analysis treatment must be delivered by individuals with extensive training in the methods, ideally under the ongoing supervision of professionals who have advanced training and experience in Applied Behavior Analysis principles and methods.*

4. *The cost of providing intensive behavioral treatment for a young child with autism is minimal considering the gains that can be achieved. After about 2 years of intensive intervention, research would predict substantial cost reductions for most children, significantly lower or no continuing special expenditures for many. In contrast, the cost of lifelong specialized services to accommodate a severe disability—the likely outcome for most children with autism who do not receive early intensive behavioral intervention—runs into the millions of dollars for each individual (Birnbrauer & Leach, 1993; Lovaas, 1987). Autism is a low-incidence disorder, so the up-front investment in intensive behavioral intervention for any agency serving young autistic chil-*

dren is likely to be relatively low, and the payoffs potentially monumental. For children with autism and their families, the benefits could be priceless.

ACKNOWLEDGMENTS

Development of this chapter was supported by National Institute of Mental Health Grant MH5 0237-02 to the E. K. Shriver Center and The New England Center for Autism. A previous version was prepared to assist families who were seeking funding for behavioral programs, and was distributed as a working paper by The New England Center for Autism. I am grateful to Steve Luce, Catherine Maurice, and Tristram Smith for their helpful comments on a draft of this chapter, to Jennifer McIntire for her assistance in gathering background materials, to B. F. Skinner for giving us a science of behavior, and to the children, family members, teachers, therapists, and researchers whose achievements make that science live.

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