

Effectiveness of Developmental Intervention in the First Five Years of Life

Forrest C. Bennett, MD, and Michael J. Guralnick, PhD†*

Does early intervention really work? Despite all of the developmental momentum and progress of the last 20 years, this important question must still be acknowledged and addressed today by advocates and providers of developmental intervention services in the early years of life. The question is imperative for various reasons: scientific and professional credibility, economic cost effectiveness, and policy-making prioritization.

During the last two decades, health professionals who provide primary care for children have been increasingly encouraged to carefully and periodically monitor the developmental progress of all infants, toddlers, and young children in order to assure the earliest possible identification of delayed or deviant development. The principal rationale for this early detection recommendation is to be able to institute timely developmental interventions for such children. Simultaneously, a progressive increase has occurred in the various interventions and specific therapies available to developmentally delayed or at-risk children. These include such approaches as infant stimulation programs, developmental preschools, physical and occupational therapies, speech and language therapies, and a myriad of more controversial interventions. Developments like the Education for All Handicapped Children Act of 1975 (PL 94-142) and its subsequent 1986 amendments (PL 99-457) coupled with the organization of numerous parent advocacy groups (e.g., Down Syndrome Congress, National Society for Children and Adults with Autism, Association for Retarded Citizens, Parents of Premature Infants) have helped to increase the sophistication and expectations of many parents in terms of anticipated developmental services.

Nevertheless, a substantial difference in enthusiasm for early developmental intervention still frequently exists between pediatricians and

*Professor of Pediatrics, and Director, High-Risk Infant Follow-Up Program, University of Washington School of Medicine, Seattle, Washington

†Professor of Psychology and Pediatrics, and Director, Child Development and Mental Retardation Center, University of Washington, Seattle, Washington

other health care providers on the one hand and teachers, therapists, and parents on the other. Because of perceived negative physician attitudes, parents of developmentally disabled or at-risk children often come to view a teacher or therapist, rather than their physician, as their primary source of support and management recommendations. In fact, the physician in some cases may be perceived as an actual obstacle to obtaining appropriate developmental services. Thus, it is prudent for health care professionals to carefully consider these attitudinal differences, critically examine the current state of the art of early developmental interventions, and, hopefully, arrive at some rational conclusions about overall effectiveness in the prevention or amelioration of developmental disability and dysfunction.

Because developmental interventions in the first 5 years of life encompass a most heterogeneous group of individual strategies applied to diverse populations with quite different goals and objectives, it is necessary to be as specific as possible when evaluating efficacy. In this review we separately analyze three different types of early developmental intervention: (1) preventive interventions for infants and children at increased environmental risk; (2) preventive interventions for infants and children at increased biomedical risk; and (3) ameliorative interventions for infants and children with established developmental delays and disabilities. In this way the reader is able to consider the specific merits and evidence of effectiveness of each of the major intervention types.

DEVELOPMENTAL INTERVENTIONS FOR INFANTS AND CHILDREN AT INCREASED ENVIRONMENTAL RISK

Early intervention for children at increased risk of developmental delay and eventual school failure because of adverse socioenvironmental conditions (e.g., poverty, teenage pregnancy, potential abuse, or neglect) is best typified by the Head Start concept that began in the mid-1960s as part of President Lyndon Johnson's Great Society initiative. This program was a massive attempt to prevent developmental decline by offering preschool education to disadvantaged children of low socioeconomic status. In addition to these Head Start programs for 3- to 6-year-old children, a number of more intense and costly long-term research projects (e.g., Milwaukee, Carolina, Ypsilanti, Syracuse, Yale) have rigorously investigated the effects of very early and comprehensive intervention (birth to 6 years of age) on environmentally vulnerable infants and children. In fact, there are far more accumulated data concerning this type of developmental intervention than exist for the other two major types combined.¹²

What has been learned from these endeavors? Over the last two decades we have witnessed a striking evolution in thought about the ultimate effectiveness of this type of preventive intervention. The original concept underlying Head Start was that a relatively brief intervention in the early formative years could inoculate children against the ravages of their environments. Edward Zigler of Yale University, Head Start's first director, recalls: "In the 1960s we believed early childhood was a magic period during which minimal intervention efforts would have maximal,

indelible effects on the child."¹¹ After the sobering 1969 report on Head Start by the Westinghouse Learning Corporation, for many years there was much pessimism because initial follow-up studies indicated that early IQ gains by children in preschool programs dissipated by the time they reached third grade.¹⁶

In recent years a much more hopeful attitude has emerged as careful, long-term studies have revealed persistent functional effects despite the attenuation of initial IQ increases. The results from 11 separate programs (the Consortium for Longitudinal Studies) were critically summarized by Lazar and Darlington in their 1979 report "Lasting Effects After Preschool."¹⁵ The overwhelming majority of children in these preschool programs were low-income black children. This consensus report demonstrated that early education programs for disadvantaged children apparently had lasting, so-called " sleeper " effects that achieved statistical significance in the following areas: retention in grade (grade failure), assignment to special education, achievement test scores, and attitudes and values. When compared to controls (some randomized and some matched samples), program children were less likely to have been held back a grade or to be in special classes by middle childhood, were more likely to have higher mathematics achievement scores in the early grades with a suggestive trend also toward higher reading scores, and were more likely to give achievement-related reasons for being proud of themselves. One program, the Ypsilanti Perry Preschool Project, followed many children to 19 years of age and reported such encouraging outcomes as an increased likelihood of high school graduation as opposed to dropping out of school, an increased likelihood of being employed, a reduced incidence of ever having been arrested, and a reduced incidence of teenaged pregnancy.¹⁷

Several key program variables appear to particularly influence the long-term effectiveness of developmental interventions for infants and children at increased environmental risk.¹⁵ The preponderance of evidence seems to suggest that the intensity of programs (defined by amount and breadth of contact with children or families) is likely to have a direct and positive relationship on the degree of intellectual and other developmental or behavioral benefit derived by children participating in such programs. Programs that begin interventions early in life (i.e., birth to 3 years of age), continue comprehensive interventions to and even through elementary school entry, and provide family support services and parent education appear to be more effective than those programs beginning after age 3 and not involving parents. The greatest ability to prevent or slow the declines from average performance that typify disadvantaged populations is seen in those experimental projects (e.g., Carolina Abecedarian, Milwaukee) that were able to provide much more comprehensive interventions over a much longer period of time than the average Head Start program. Additionally, the personal abilities, attitudes, and stability of the program teachers seem to predict intervention effectiveness more than the employed preschool education model (e.g., Montessori, Piagetian, Distar, traditional nursery school). This is not to imply that variations in systematic curricula cannot be important but only that within a broad range of basically "humane environments" these variations on a theme seem not to be particularly potent.¹⁶

DEVELOPMENTAL INTERVENTIONS FOR INFANTS AND CHILDREN AT INCREASED BIOMEDICAL RISK

Neonatal Interventions

With the advent in the 1960s of neonatal intensive care technology and with the dramatic increase in survival of ever smaller and sicker and medically fragile infants throughout the 1970s and 1980s, a more recent development is the growth of interest in neonatal interventions aimed at preventing developmental deficits in infants at increased biologic risk.⁶ The most frequent targets of these intervention efforts have been low-birth-weight, premature survivors of neonatal intensive care, but full-term infants who have suffered potential brain insults (e.g., asphyxia, trauma, infection) and drug-exposed infants also have been increasingly included. Initial approaches to neonatal intervention tended to consist of one or more (multimodal) types of very early environmental manipulations: (1) tactile stimulation (sucking, massaging, flexing, positioning); (2) vestibular-kinesthetic stimulation (rocking, oscillating waterbeds); (3) auditory stimulation (singing, music boxes, recorded mother's voice, recorded heart beat); and (4) visual stimulation (decoration of surroundings, mobiles). Despite the considerable variability in methodology and results, most neonatal intervention studies have cited some short-term (6 to 12 months) growth, developmental, or medical benefits of these sensory enrichment approaches, usually administered by nurses caring for premature infants who are still hospitalized.²² No two studies seem to fully agree, many actually contradict one another, and the outcome variability is far too great for generalized programmatic recommendations, however.

In addition, potentially negative effects of these types of neonatal interventions must also be considered. Excess handling has been shown to exacerbate autonomic nervous system instability and to be associated with hypoxia, apnea, and bradycardia in premature infants.³⁶ Increasingly, many researchers believe it is inappropriate to attempt to "train" immature, disorganized premature infants in behavior expected from healthy, full-term infants. Gorski et al²⁵ have particularly recommended that interventions should be individualized, functional, modifiable, and sensitive to the autonomic and neurodevelopmental status of the particular infant.

Thus, contemporary approaches to neonatal developmental intervention are taking new directions.¹⁰ Rather than pursuing interventions that focus exclusively on doing something to the fragile recovering neonate, attention is instead being redirected to helping nursery staff and parents interpret the readiness cues of the immature infant and, correspondingly, to enhancing the quality of early parent-infant interactions, a variable known to influence the ultimate outcome of biologically at-risk infants. Als et al¹ have encouraged the incorporation of individualized care plans that reduce excessive environmental light, noise, and traffic and minimize intrusive handling into the regular routine of the intensive care nursery. They emphasize the advantages of this new infant protection approach in contrast to the more traditional infant stimulation modalities. Preliminary outcome data suggest both medical (e.g., diminished oxygen requirements, shortened hospitalization) and developmental (e.g., improved mental and

motor performance) gains for those experimental infants receiving this personalized care.

Despite these hopeful developments, some investigations of the effectiveness of nursery-based, neonatal interventions have documented the difficulty of normalizing outcome after the birth of a medically fragile infant. This is particularly true for the rapidly increasing number of doubly vulnerable infants who are at both biomedical and environmental risk of suboptimal development. Brown et al.,¹¹ discussing their failure with a combined infant- and parent-focused approach to involve socially disadvantaged mothers with their hospitalized infants, listed the impediments to maternal participation, including lack of transportation to and from the hospital, need to care for older children at home, inability to leave home because of cultural concerns about their own mothers, and crises of daily living (e.g., inadequate or no housing, lack of financial support). These current realities should serve to keep individual, limited neonatal intensive care unit (NICU) interventions in perspective and challenge investigators to develop innovative, comprehensive, coordinated approaches to the complex task of optimizing the developmental and behavioral outcome of low-birthweight, premature infants.

Interventions After Hospital Discharge

Several intervention programs for biologically vulnerable infants and their families have addressed these complexities and attempted to provide comprehensive developmental and support services after discharge from the intensive care nursery. Barrera et al.³ conducted a year-long home intervention with low-birthweight premature infants and their parents after nursery discharge. Study subjects were randomly assigned to one of three groups: (1) an infant-focused intervention group with the objective of stimulating and enhancing developmental skills; (2) a parent-focused intervention group with the objective of improving the quality of the parent-infant interaction; and (3) a no-treatment control group. A full-term no-treatment comparison group was also used. Their results indicated that although both intervention approaches were effective in modifying some aspects of the home environment and, to a lesser degree, in improving infants' cognitive development, the parent-focused approach seemed to have the greater impact. Both of the premature intervention groups consistently outperformed the premature control group on measures of cognitive development. Of long-term significance and concern, the full-term comparison group clearly outperformed all three premature groups at each evaluation age (4 to 16 months corrected age) on both mental and motor measures.

Resnick et al.¹⁶ reported similar results after a developmental intervention program that began while low-birthweight, premature infants were still hospitalized in the intensive care nursery and then continued into the home for the first 2 years of life. The intervention approach was primarily parent-focused and attempted to enhance the quality of the parent-child relationship. Experimental group infants scored significantly higher than control group infants on the Bayley Mental and Motor Scales at 12 and 24 months corrected age. These investigators have subsequently concluded

that it appears to be more advantageous developmentally to work directly with parents, modeling interventions for them to use with their infants, than to work exclusively with infants.¹⁵ Consequently, they believe that parents should be integrated into the developmental intervention program from the very beginning in the NICU so that they can learn to respond appropriately to the infant's cues and social overtures.

The most comprehensive, intense, controlled investigation ever performed on the effectiveness of developmental interventions for biologically vulnerable infants and toddlers has recently been completed and the initial phase (birth to 3 years) analyzed.⁵⁴ The Infant Health and Development Program (IHDP) is an eight-site (University of Arkansas, Albert Einstein College of Medicine, Harvard University, University of Miami, University of Pennsylvania, University of Texas Southwestern, University of Washington, and Yale University) collaborative clinical trial of a combination of health, developmental, and family services designed to optimize the long-term outcomes of low-birthweight, premature infants. The entire program was coordinated by the National Study Office at Stanford University.

The specific interventions emphasized a family support orientation and included regular home visitation by a family educator throughout the infant's first 3 years of life, attendance at a full-day child development center between ages 1 and 3, transportation to and from this center, bimonthly parent education group meetings, and periodic health and developmental follow-up care from hospital discharge through 3 years of age. The overall intervention curriculum was coordinated at the University of North Carolina's Frank Porter Graham Child Development Center and was adapted from this center's extensive intervention experience with environmentally vulnerable infants.

The primary analysis study group consisted of 985 low-birthweight, premature infants across the eight sites. Approximately one third of study infants were randomized to the intervention group and received all of the enumerated services; two thirds were randomized to the follow-up group and received the same periodic health and developmental follow-up protocol from hospital discharge through 3 years of age but none of the educational interventions. Additionally, the study design called for differential enrollment according to birthweight; that is, approximately two thirds of randomized infants were relatively lighter (≤ 2000 g) and one third of the infants were relatively heavier (2001–2500 g). Birthweight was distributed evenly between the two study groups. Other initial status characteristics for which balance was sought in the randomization included gender, maternal age, maternal education, and maternal race.

A total of 908 study subjects (92.2% of the original group) were comprehensively assessed in terms of cognitive, behavioral, and health outcomes at 36 months of age (corrected for prematurity) by evaluators unaware of the child's group assignment. Intervention group children performed significantly better on the Stanford-Binet Intelligence Scale than follow-up group children. The effect of the intervention varied significantly with birthweight; the heavier intervention group scored an average of 13.2 IQ points higher than the heavier follow-up group, whereas the lighter intervention group scored an average of 6.6 IQ points higher than the

lighter follow-up group (both highly statistically significant intervention-follow-up group differences). Mothers of intervention group children reported significantly fewer behavior problems on the Achenbach Child Behavior Checklist than mothers of follow-up group children. No significant group differences were found in growth parameters, scales of health status, or incidence of serious health conditions.

The IHDP and other developmental intervention programs after hospital discharge demonstrate the usefulness of helping families to help their biologically vulnerable infants. Most successful programs have used a comprehensive combination of family support, parent education, and child development approaches. Although it is virtually impossible in most of these programs to specifically relate positive outcome effects to individual components of the overall intervention plan, it seems highly probable that these broad, complex approaches are more likely to result in meaningful, persistent improvements than are narrow, simplistic approaches. It is also probable that successful developmental intervention programs for this population, like those for environmentally vulnerable infants, are costly in terms of both human resources and financial expenditures. Therefore, these efforts should be directed to the target population most likely to benefit, i.e., those doubly vulnerable infants at combined biomedical and environmental risk. Simultaneously, programs that have demonstrated developmental effectiveness in the first 3 years of a child's life must attempt to maintain their cohorts in order to critically evaluate the preschool and school aged outcomes after the termination of early interventions. The IHDP cohort has been maintained and assessed to age 5, with more than 90% of subjects still participating. Follow-up with further assessment and group comparison to age 8 is planned.

DEVELOPMENTAL INTERVENTIONS FOR INFANTS AND CHILDREN WITH ESTABLISHED DISABILITIES

Investigators seeking to evaluate the effectiveness of early intervention for children with documented developmental disabilities are faced with an unusually complex and difficult task. In part, this is a consequence of the diverse nature of the population itself; one that includes children with a substantial range of types, causes, and severities of disabilities. Similarly, family resources and related characteristics known to affect developmental outcomes also vary widely, thereby requiring numerous replications before outcome patterns can be established with confidence. Moreover, as is the case for children at environmental or biomedical risk, early intervention is a term that represents a multidimensional concept²⁹ in which services vary dramatically in relation to program features, including the duration, intensity, age at which intervention begins, the curriculum model adopted, comprehensiveness of the intervention, and the nature of family involvement, to name a few key dimensions. As moderated by child and family characteristics, the effectiveness of early intervention, however measured, is certain to vary with the configuration of program features that characterize early intervention programs.²⁶

Global Approaches

Despite this complexity, it is nevertheless possible to gain a sense for the general pattern of outcomes through applications of the meta-analysis technique²⁴ to the field of early intervention. In this procedure, individual outcomes from investigations ranging substantially in terms of program features and child and family factors are transformed to yield effect sizes measured in standard deviation units. As applied here, effect sizes reflect the impact of early intervention compared to control or contrast conditions. These measures are then aggregated across studies to determine if global statistical patterns exist. Although not without its critics, the meta-analysis technique has been applied successfully to many fields in the health, social, and behavioral sciences.

Two meta-analyses relying on an extensive early intervention research database have been carried out for children with established disabilities. One consisted of all intervention studies meeting specific inclusion criteria involving children birth to 5 years of age. A total of 74 studies and 215 effect sizes were selected.¹⁴ A similar analysis using a subset of the dataset, utilizing slightly different inclusion criteria, and restricting subjects to children birth to 3 years of age was also carried out. Thirty-one studies involving 91 effect sizes were selected.⁴⁹ These analyses revealed that a modest but positive impact is associated with the provision of early intervention services. Specifically, effect sizes of one half to three quarters of a standard deviation can be expected. As applied to cognitive development, by far the most commonly used measure of child outcome, this means that children enrolled in early intervention programs can expect, on average, to obtain an increase on standard tests of intelligence of approximately 8 to 12 IQ points in comparison to those not receiving intervention services.

It must be recognized, however, that the database on which these analyses have been conducted contains many flaws from a scientific perspective. The lack of sufficient resources for careful and systematic evaluations, the rapidly changing nature of intervention approaches, practical issues of program control, and ethical considerations regarding assignment of children to control or contrast groups contributed to the methodologic inadequacies that have characterized many of the studies in this database. In fact, virtually every review of the early intervention literature has commented on a variety of methodologic problems.^{9, 13, 18, 19, 21, 23, 51}

Yet despite these criticisms, evidence from a number of sources continues to support the finding that this modest impact revealed by the meta-analyses is a fair representation of the overall effectiveness of early intervention. For example, when only studies judged to be of higher scientific quality are included in the larger meta-analysis,¹⁴ the effect size is, in fact, reduced but remains nevertheless at approximately 0.40. Moreover, when in-depth qualitative analyses of the existing literature are carried out, similar beneficial effects are reported.³⁰

An alternative approach to evaluating the effectiveness of early intervention for an important, perhaps prototypical group of children, has been to capitalize on the fact that children with Down syndrome exhibit a progressive decline in assessed cognitive development throughout the first

few years of life in the *absence* of early intervention.³¹ Longitudinal studies in which intervention is provided to this population reveals that, after an initial decrement that occurs during the first 12 to 18 months, further declines can be prevented from occurring.^{7, 44, 48} The cognitive development of the children, of course, remains significantly compromised, typically stabilizing in the moderately delayed range. It is important, however, to note that the effect size associated with the prevention of further declines in cognitive development is approximately one half to three quarters of a standard deviation. Consequently, overall outcome analysis serves an important purpose by establishing the parameters with regard to what families can reasonably expect to result from participation in early intervention programs. Moreover, these global analyses also provide an empirical framework for interpreting the potential value of new interventions or treatments. In particular, familiarity with the range of expected outcomes is essential in order to understand the significance of unusual claims of efficacy.

It is interesting to note that these global patterns of outcome conform to the perceptions of many practitioner groups. For example, one detailed survey of pediatricians revealed a belief that high-quality early intervention services are of value to both children and families, with the magnitude of the effects generally consistent with existing research findings.³²

Effects of Specific Program Features and Child-Family Characteristics

Although global analyses serve important functions, other more focused approaches are needed to enable the field of early intervention to advance further. Specifically, in order to refine, enhance, or make early intervention services more efficient, we must look closely at individual program features.^{28, 41} Perhaps through analyses of these program features and how they are moderated by child and family characteristics it will be possible at some point to match children and families with a configuration of early intervention program features likely to be most effective and efficient.

In fairness, the relatively new field of early intervention remains far from achieving that goal. We are beginning to understand the impact of some of the critical features of early intervention programs, however. Moreover, these analyses also provide insight into the possible mechanisms that mediate the effects of early intervention. Accordingly, in the next sections, a brief summary of the effectiveness of two program features, age of start and family involvement, are discussed along with an important child characteristic factor, the severity of the disability. Special emphasis is placed on identifying configurations of these and related program factors most likely to result in more effective early intervention programs for infants and children with established disabilities.

Age of Start. Despite the existence of a strong rationale based on models of neural plasticity, the organization of personality development, and the ability to minimize secondary complications suggesting that interventions provided earlier to developmentally disabled children will result ultimately in better developmental outcomes,^{2, 29, 32} available research

is inconclusive on this issue. The large scale meta-analysis involving children from birth to 5 years of age¹⁴ found effect sizes to be similar regardless of the time that intervention was initiated. In contrast, the meta-analysis conducted by Shonkoff and Hauser-Cram⁴⁹ focusing on children from birth to 3 years of age did suggest that better outcomes were associated with earlier intervention. This finding applied only to mildly handicapped children, however, because those children enrolled in early intervention before 6 months of age had better outcomes than those enrolled at a later time. Finally, a number of studies currently being carried out under the auspices of the Early Intervention Research Institute at Utah State University are investigating the age of start issue.⁵⁷ This ongoing series of studies uses longitudinal prospective designs with random assignment to treatment and control conditions and represents an excellent example of a university research team collaborating effectively with community service providers. Preliminary findings from this group of studies indicate that moderate or no differences occur as a function of age of start for various child and family outcome measures.

The ability of comprehensive early intervention programs for children with Down syndrome begun soon enough to halt the progressive decline in cognitive development described earlier is relevant to the age of start issue. One hypothesis regarding the mediators of this effect is that comprehensive early interventions are able to minimize the emergence of dysfunctional parent-child relationships.²⁸ For various reasons, including uncertainties about their child's development, the impact on their own family life, and other stressful circumstances that exist compounded by problems in reading their child's social cues, many families of children with handicaps find it difficult to provide an appropriately stimulating and responsive environment for their child.³⁹ By initiating comprehensive services early, particularly if those services contain an effective family involvement component, a secondary cumulative deficit resulting from parent-child mismatches may be minimized. Accordingly, if this hypothesis is valid, age of start may well turn out to be an important program feature, but only when it occurs in conjunction with an effective form of the family involvement program factor. This issue is addressed in the following section.

Family Involvement. As a global program factor, family involvement has not been found to be strongly associated with improved developmental outcomes for developmentally disabled children.¹⁴ A modest relationship, however, has been obtained between those early intervention programs with more extensive planned parent involvement, an outcome based on the smaller data set focusing on children from birth to 3 years of age.⁴⁹ In addition, this latter analysis also revealed that early intervention programs that involved children and parents together rather than separately were more effective. Finally, a number of studies from the Early Intervention Research Institute⁵⁷ have not found any substantial impact on child development as a consequence of family involvement.

Despite the consistent pattern of limited effects of family involvement in this population, it must be recognized that most of the studies on which

these conclusions were based defined family involvement principally in terms of a parent participation or didactic role. It is the case that parent participation in informational and support groups as well as assisting program staff to carry out certain didactic functions in the home has been the most prevalent form of family involvement.⁵⁷ A reconceptualization of the role of families in the context of early intervention services has occurred in recent years, however. Emphasis is now placed on strengthening natural parent-child relationships rather than encouraging therapeutic or didactic roles. Moreover, supporting families to become more competent and independent is a primary goal, particularly in relation to fostering active problem solving regarding developmental issues. These goals also ensure that a more balanced parent-professional partnership is achieved (family empowerment).¹⁷ In fact, these new approaches are firmly grounded in contemporary family systems theory and well-established ecologic and developmental models.^{3, 4, 10, 52} Moreover, many of these principles are embodied in the Individualized Family Service Plan component of Public Law 99-457, the new federal law establishing coordinated, comprehensive, and family-focused services for children birth to 3 years of age.

Comprehensive Services. This contemporary approach to family involvement also illustrates the linkages that naturally exist among program features. In this instance, more contemporary models of family involvement in early intervention programs are closely associated with more comprehensive service approaches. In general, comprehensive early intervention programs address developmental issues associated with all developmental domains, not only the primary disability. In contrast to this more integrative approach, models that focus on disability-specific interventions, such as forms of physical therapy, typically involve parents as therapeutic agents to enhance and extend specific therapies.

When the configuration of program features consisting of comprehensive early intervention in conjunction with more contemporary models of family involvement is part of an early intervention program, some promising results have been obtained. For example, Dunst et al²⁰ found a positive connection between social support procedures designed to strengthen families and developmental outcomes for children. Specifically, it is interesting to note that the children of parents who were more satisfied with their level of social support obtained smaller declines in cognitive development over a 1-year period. A correlational study by Mahoney and Powell¹⁸ also suggested that developmental gains were closely associated with an intervention program that fostered more natural parent-child relationships. A final example can be found in a well-designed investigation that contrasted a parent-focused comprehensive intervention for children with cerebral palsy with a more narrowly focused physical therapy treatment protocol.⁴³ Results clearly favored the more comprehensive program, with a pattern of actual decline in the rate of motor development observed for the disability-specific treatment group. Although selected questionnaire and checklist measures related to family factors have not suggested what might account for these differences,⁴² the ability of more comprehensive programs to improve the coping abilities of families remains a viable hypothesis.

Social Competence. The linkage between the program features of family involvement and comprehensiveness as well as that involving age of start suggests further that outcome measures that extend beyond cognitive, motor, or other domain-specific aspects of development might reveal even stronger effects of early intervention. In fact, this particular configuration of program features would be expected to improve children's developing social competence substantially.²⁷ Others in the field have commented on the importance of social competence as a potentially important measure of the effectiveness of early intervention programs,⁵³ but program developers and evaluators have not yet adequately responded. Future evaluations of efficacy should strongly consider measures of social competence.

Severity of Disability. Of all of the child-family characteristics that can moderate the effects of program features associated with early intervention programs, the severity of a child's disability exerts the most profound influence. In fact, the level of severity of a child's disability at the time early intervention begins can easily account for 50% to 75% of the variance in developmental changes.^{43, 50}

Beyond this general influence, however, a number of studies have revealed that the effects of early intervention do not occur uniformly for each level of severity. Early research by Bricker and Dow⁶ indicated that the more severely delayed the children, the less responsive they are to early intervention. More recently, a comprehensive descriptive study of children with a range of developmental delays as well as those with motor impairments confirmed this pattern.⁵⁰ In particular, after 1 year of community-based early intervention, children with severe delays had smaller relative increases in mental age than those with mild or moderate delays. These results are consistent with the meta-analysis reported earlier⁴⁹ in which intervention occurring before 6 months of age produced a greater impact than intervention begun at a later time, but only for children with mild delays. Findings by Dunst et al²⁰ and White⁵⁷ also point to the unusual difficulties experienced by more severely handicapped children.

It is important to note that children with more severe disabilities are often recipients of more intensive services. This linkage can explain, in part, the absence of a strong association between intensity of service and developmental outcome.^{14, 49, 50} The reduced effects of early intervention for children with severe handicaps do not necessarily hold for all types of disabilities, however. A widely publicized investigation by Lovaas³⁷ has indicated that early (younger than 4 years of age) intervention for children diagnosed as autistic can produce dramatic improvements in their development and function. Intensity of treatment was a key feature here, but age of start also may have been a significant program factor for this outcome to be realized.

These findings highlight once again the interrelationships that exist between both program factors and child-family characteristics. Severity of a disability is an important characteristic to consider, but our ability to develop and evaluate intervention strategies in the future should consider other child and family characteristics as well, particularly the type or origin

of a child's disability. In fact, efforts are now underway to obtain a better understanding of the developmental processes and biobehavioral characteristics of specific etiologic groups of children. Investigations of children with Down syndrome, fragile X syndrome, and fetal alcohol syndrome are prominent examples of this approach.^{15-24, 31} It is anticipated that knowledge derived from a better understanding of these children will lead to more innovative intervention strategies that, in turn, might improve developmental outcomes for even the more severely handicapped children.

SUMMARY

Developmental intervention in the first 5 years of life is an expanding, complex enterprise. Documenting efficacy by traditional scientific methods has proven to be elusive for a number of practical reasons, e.g., target population heterogeneity, methodology variability, inadequate outcome measures, and cost of longitudinal cohort designs. Nevertheless, despite these shortcomings, there is accumulating research information as to which types of intervention approaches are likely to be most beneficial to specific groups of infants and children and their families. It is quite clear that preventive strategies for at-risk children and families are different than ameliorative strategies for children with established disabilities. It is also clear that comprehensive evaluation of effectiveness must include consideration of both functional child gains (e.g., social, communication, mobility, and adaptive skills) and enhancement of family function. It is the pediatrician's responsibility to be adequately informed about contemporary developmental interventions in order to balance parental hopes and needs with potential benefits.

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Address reprint requests to

Forrest C. Bennett, MD
Department of Pediatrics
Child Development and Mental Retardation Center (WJ-10)
University of Washington
Seattle, WA 98195