

Chapter 4

The Effectiveness of Early Intervention for Children with Cognitive and General Developmental Delays

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INTRODUCTION

Young children who exhibit significantly delayed rates of cognitive development are the focus of this chapter. Despite wide variation in etiology (see Chapter 1 of this volume) and in course of development for this highly heterogeneous group of children, delays or impairments are apparent in virtually every facet of cognition, including information processing, problem solving, and especially the ability to apply information to new situations. Corresponding delays in motor, communication, language, and socioemotional development present a picture of global developmental delay for these youngsters. Although cognitive delays are the necessary condition for inclusion in this chapter, the term *general develop-*

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mental delay or simply *developmental delay* will be primarily used as a means of underscoring the comprehensive delays common to these children and the corresponding need for comprehensive intervention.

In this chapter, we will explore and evaluate the impact of broad-based early intervention programs directed exclusively at children with these general developmental delays. The general characteristics of this population will be examined first with special emphasis placed on children with Down syndrome. This will be followed by a discussion of the nature of early intervention programs, including a brief history as well as descriptions of the various approaches and educational or developmental models applied to intervention programs that are commonly found in the field. With this information as background, the existing early intervention literature for young developmentally delayed children will be summarized and presented in a manner designed not only to yield a critical analysis of the effectiveness of these programs, but also to permit the detection of any meaningful and consistent outcome patterns that may exist. Based on this more comprehensive analysis, a number of recommendations for the practitioner and other professionals will be generated.

DEVELOPMENTAL CHARACTERISTICS OF DELAYED CHILDREN

In general, developmentally delayed children tend to reach developmental milestones in a manner that is generally similar to that of nondelayed children, but at a much slower rate. All children with significant delays are likely to reach a lower final level of cognitive development but, as will be described, the actual rate, limits on development, and other characteristics vary with the nature and severity of the disabling condition. Although a pattern of general developmental delay may exist, differences across one or more areas of development in comparison to that which is expected on the basis of a child's overall cognitive level are not uncommon. Moreover, as discussed later, a number of qualitative differences in developmental processes have been identified as well.

The children described in this chapter are likely to be labeled as mentally retarded at some point once the clinical picture stabilizes. For this to occur, two major criteria, as defined by the American Association on Mental Deficiency (Grossman, 1983), must be met. The first involves lowered intellectual functioning as assessed by standardized tests of intelligence. Currently, although flexibility is stressed in this determination, an IQ below 70 will satisfy this criterion. The second criterion reflects aspects of impaired adaptive behavior, with milestone measures of social, motor, and communicative development being used to assess this dimension during infancy and early childhood.

The psychometric assessment serves as the primary basis for the classification

of the severity of the developmental delay. Children with IQs below 20–25 are classified as profoundly retarded, those between 20–25 and 35–40 as severely retarded, between 35–40 and 50–55 as moderately retarded, and those scoring between 50–55 and approximately 70 as mildly retarded. As a rough approximation, mildly delayed children develop at a rate about one half to two thirds that of normally developing children, and we can expect to see substantial developmental changes for the vast majority of these children, including walking and using language, during the early childhood period. In contrast, children with severe and profound delays make more limited progress toward major developmental milestones, with health, stimulation, and social interaction processes being primary concerns that extend throughout the first few years of life.

In practice and in the descriptive literature, this classification scheme for severity is often simplified by dividing delays into only two categories: those children with severe impairments (an IQ below 50) and those with mild delays (IQs 50–70). Despite the simplification, this distinction appears to be a useful one, with many important differences (apart from developmental rates and patterns) existing between children with severe and mild delays. From an etiological perspective, the cause for the conditions of approximately 50% of the more severely delayed children can be linked to identifiable prenatal problems in central nervous system development (Smith & Simons, 1975), with as many as a third of this group having chromosomal abnormalities. Although Down syndrome is the most prevalent chromosomal abnormality, the presumption that the vast majority of these children belong in the severely delayed category may no longer be valid (see later discussion).

Of the remaining 50%, approximately 10% of severe delays can be traced to problems during the perinatal and postnatal periods, with the final 40% falling into an undecided category in which no specific cause can be discerned. However, most of the difficulties for a considerable portion of the children in the undecided group can likely be attributed to prenatal defects in development because other evidence such as the abundance of certain major or minor anomalies that commonly co-occur are associated with prenatal onset (Smith & Simons, 1975). In fact, children with severe delays typically have a number of associated disabilities also, especially cerebral palsy and epilepsy (Jacobson & Janicki, 1983). Moreover, for the most part only isolated cases of severe delays within families are found; they are usually identified during the first 2 years and have a relatively small though noticeable association with socioeconomic status (Robinson & Robinson, 1976).

In contrast, mild developmental delay generally is confirmed later, accounts for as much as 60–75% of all instances of delays during infancy and early childhood, and has a much stronger association with socioeconomic status; its causes are less likely to be prenatal in origin, as few recognizable syndromes or related evidence are associated with these milder delays (Herbst & Baird, 1983;

Opitz, 1980). It is important to note that children identified as having mild delays in early childhood appear to differ from the mildly delayed population that is identified later, during the school years. Specifically, although the etiology for some proportion of the children in the mild group that is identified during early childhood may be associated with familial–environmental factors, it is much more likely that the majority of children for whom familial–environmental influences are primary ones will not be identified until they are of elementary school age. As such, they constitute part of a yet to-be-identified or at-risk group of youngsters, as described in Chapter 2. Those mildly delayed children who are actually identified during the preschool period tend to be those who have some clear biological basis for their delays or for whom a strong suspicion exists that implicates organic factors. In fact, a specific etiology can be identified for a substantial number of these children as early as 4 years of age (Herbst & Baird, 1983). This group of mildly delayed children may also manifest more prominent problems than those identified later, either behaviorally or developmentally, which are sufficient to set them apart from normal variations in growth and development. When school age is reached, however, large numbers of new mildly delayed children are identified, with relatively few having an established etiological basis, and the association with socioeconomic status increases.

These differences in the patterns of early identification for young developmentally delayed children have important implications for the evaluation of the effectiveness of early intervention because it is primarily this unique subgroup of mildly delayed children in conjunction with those with more severe delays that find their way into early intervention programs. Moreover, because so many children, especially those under 3 years of age, have a clear biological basis for their delays, early intervention research efforts have often been organized within etiologically homogenous groups. This is especially true for children with Down syndrome, as a substantial number of early intervention studies have focused on this subgroup. Accordingly, as background for the analysis of the effectiveness of early intervention, the general developmental course and characteristics of young Down syndrome children will be described in the following section.

Children with Down Syndrome

Since the mid-1970s, a more complete understanding of the character and expression of development of children with Down syndrome has been achieved through a series of extensive multidisciplinary studies. This examination of developmental characteristics has extended well beyond the traditional domains of cognitive and motor development, providing important insights into the social and emotional lives of these children as well as into underlying developmental processes. As a result, we now have a clearer appreciation of both the correspondence

that exists between the developmental characteristics of Down syndrome and normally developing children as well as an appreciation of areas of difference.

At a descriptive level, the most straightforward and frequently used approach to gather information has been to track the developmental achievements of Down syndrome children through cross-sectional and longitudinal studies. For cognitive development, continued but gradual improvement occurs (measures of mental age increase). However, the rate of development slows progressively, resulting in a general decline of measured intelligence throughout infancy and early childhood (Carr, 1975; J. A. Connolly, 1978; Melyn & White, 1973; Morgan, 1979; Share, 1975). Although group differences between normally developing and Down syndrome children can be detected during the first year of life through assessments of cognitive functioning, there is, nevertheless, a substantial overlap in level of functioning at this early age. However, as the decline proceeds from an average IQ of 55–60 at 1 year of age toward a mean IQ of 40–50 by the fifth year, Down syndrome children become a clearly distinct subgroup, with only relatively rare instances of children scoring above the mildly delayed range. It is not clear why their test performances decline, but it does *not* appear to be a result of a progressive deterioration of these children (see Carr, 1975). To some extent it may reflect a greater reliance on language-based test items, but much of the measured decline may well be traced to the fact that cognitive tests increasingly tap more demanding and general aspects of competence, adaptive behavior, and problem solving, thereby enhancing developmental differences in overall cognitive functioning.

Accordingly, the majority of Down syndrome children, even by age 3 years, test at the mild, low mild, and high moderate range of intelligence. This is the case even for those studies whose testing procedures were such that relatively little decline was observed during this 3-year period (Reed, Pueschel, Schnell, & Cronk, 1980). Interestingly, many of the early studies had suggested far greater limits on the cognitive abilities of Down syndrome children (see Connolly, 1978, for discussion). It appears that these changes in cognitive development from the early to more current studies can be attributed to improved environmental conditions for Down syndrome children, including the positive effects resulting from less frequent institutionalization (see Centerwall & Centerwall, 1960) and the increased availability of a wide range of high-quality intervention services for handicapped children and their families.

Even with improved cognitive status, variability in terms of severity of delay for Down syndrome children as a group remains extensive (Connolly, 1978; LaVeck & Brehm, 1978). Although these individual differences have been found to be associated strongly with a number of biomedical factors (especially the correlations between the degree of hypotonia and severity of cardiac defects with lower intellectual performance [Cicchetti & Sroufe, 1978; Reed et al., 1980]),

the factors contributing to these differences are not well understood. However, despite this variability within the group, there appears to be consistency in cognitive development over time for individual children. In one longitudinal study in which children were evaluated at 9-month intervals from birth to 3 years, considerable continuity was found (Reed et al., 1980). In particular, the shorter term correlation between 18 and 36 months on the Bayley Mental Scale was high ($r = .72$). Even the relationship between 6 and 36 months, a period of much less continuity for normally developing children (Honzik, 1976; Kopp & McCall, 1982), was unusually strong ($r = .53$). Overall, correlation coefficients remain especially high after 18 months of age (Kopp, 1983).

Corresponding delays also occur in other developmental domains, but the pattern varies from area to area. Motor development, although showing less of a difference from normal achievements during the first year, soon becomes similar to that of intellectual development (Carr, 1975; Reed et al., 1980). Feeding difficulties during the first 3 years also show a similar but less pronounced course, with delays of 10–33% occurring in gumming, chewing, finger feeding, food grasping, spoon grasping, and related milestones (Cullen, Cronk, Pueschel, Schnell, & Reed, 1981). Aspects of social development, although having a less delayed onset and a less noticeable decline, do display significant lags (Cullen et al., 1981; Melyn & White, 1973; Morgan, 1979). For example, Vineland social quotients, which contain a substantial number of self-help items at lower age levels, decline from a mean of 71.4 at 1 year of age to 66.7 at 1–3 years, and then to an average quotient of 57.3 at 3–5 years of age (Morgan, 1979). Interestingly, not only do declines in these domains parallel one another on the average for the group, but, as might be expected, the domains themselves are interrelated for individual children. Specifically, the magnitude of the correlations among motor, cognitive, and language development (see subsequent discussion) range from .5 to .8 within the first 3 years of life (Reed et al., 1980).

The language development of Down syndrome children has been repeatedly found to lag considerably behind other developmental domains (e.g., Share, 1975). This discrepancy is apparent even in young children as measures of receptive and expressive language fall below that expected on the basis of their cognitive development and may be related to unusual deficits in vocal imitation skills (Mahoney, Glover, & Finger, 1981) or specific oral–motor dysfunctions. Observations by Greenwald and Leonard (1979) have also indicated that young Down syndrome children manifest substantial verbal language deficits in comparison to their level of cognitive (sensorimotor) development.

Taken together, as evaluated in terms of rate of achievement of developmental milestones, Down syndrome children manifest substantial lags in all domains. The typical pattern consists of the appearance of delays early within the first year and a progressive slowing of the rate of development during the later period of infancy and early childhood. Social development seems to be least affected

during the first 3 years, whereas language development, especially expressive language, shows the most significant delays. For each child, progress across different developmental domains is significantly intercorrelated and most Down syndrome children fall within the mild and moderate ranges of cognitive functioning by age 5 years. Moreover, there is considerable individual consistency in relative rate of overall development across the early childhood period, and the degree of hypotonicity and severity of congenital heart disease are highly correlated with developmental progress.

Organization and Structure of Developmental Processes

An additional and important question regarding the developmental characteristics of Down syndrome children concerns the organization and structure of their cognitive processes as well as the relationship between cognition and other developmental domains. Correlations among different developmental areas have already been noted for milestone achievement, but information about interrelationships among processes and organizational features of development as compared to normally developing children has particularly important implications with regard to the design of early intervention programs.

These issues are not easily addressed but a number of creative research strategies have provided useful and important working hypotheses. In one study, the organization of sensorimotor skills of Down syndrome children (including object permanence, means-end, causality, etc.) was correlated with those of normally developing children matched in terms of mental age. Comparisons revealed a high correspondence in skills between these two groups (Mahoney et al., 1981). Moreover, the organization of these sensorimotor domains for Down syndrome children has been found to be related to language and communicative development in a manner similar to that of normally developing children (Greenwald & Leonard, 1979; Mahoney et al., 1981).

A second line of research has focused on the correspondence between cognitive and affective development. In the field of child development, recent theoretical and empirical advances have improved our understanding of the important organizational processes of attachment, affiliation, fear/wariness, and exploration-curiosity, as well as their relationships to cognitive development (Sroufe, 1979). A large-scale longitudinal investigation (Cicchetti & Pogge-Hesse, 1982; Cicchetti & Sroufe, 1978) has examined these cognitive-affective systems in Down syndrome children. In an extensive series of analyses, affective and cognitive development were shown to have as close an association for Down syndrome children as they do for normally developing children. Emotional reactions producing smiling and laughter, negative affect (especially defensive reactions to perceptual stimuli), patterns of attachment, interrelationships among different systems (affiliation, fear/wariness, etc.), and a correspondence with levels of cognitive development were all similar in their sequence, organization,

and relationships to those of normally developing children (Cicchetti & Pogge-Hesse, 1982). Other developmental patterns, such as the emergence of self-recognition, also appear to be similarly organized in Down syndrome children and to correspond to appropriate levels of cognitive development (Mans, Cicchetti, & Sroufe, 1978).

Although considerable evidence exists suggesting that the major developmental processes of Down syndrome children appear qualitatively similar to those of normally developing children, the limits of this generalization have yet to be established. Caution in extending these findings is certainly warranted because relatively few processes have been probed to date and little information is available regarding the organizational features of Down syndrome children's development beyond 3 years of age. Moreover, despite similarities in the structure or organization of developmental processes and the sequence of development, there are a number of characteristics of Down syndrome children that do appear to differ in important ways from nondelayed children. For example, although Down syndrome children's symbolic play correlates with mental age as expected (Hill & McCune-Nicolich, 1981; Odom, 1981), the characteristics of their spontaneous play with objects can be clearly distinguished from normally developing children matched in terms of developmental level. Even with appropriate toys and a supportive and attentive parent available, Down syndrome children are not as socially oriented nor do they use materials as effectively as nondelayed children. In particular, they are more likely to fail to monitor others, to fail to use opportunities to involve others in play adequately or initiate interactions, to have a more limited play repertoire, to fail to shift play activities readily, and to display frequent stereotypic and repetitive acts during play (Krakow & Kopp, 1982, 1983). Moreover, research focusing on the pretend play of Down syndrome children has revealed that these youngsters move through a somewhat different developmental sequence from that of nonhandicapped children, particularly in self-pretend play. In addition, Down syndrome children have unusual difficulty in progressing from single-scheme symbolic play (extending symbolism beyond themselves) to combinatorial symbolic play (combining single or multiple schemes), even though they appeared to be at the appropriate mental ages to do so (Hill & McCune-Nicolich, 1981).

Kopp (1983) suggested that these and other differences can be attributed to unusual deficits in information processing exhibited by Down syndrome children. In particular, problems in attending, discriminating, encoding, transforming, and transmitting complex or subtle stimuli may well underlie the failure of Down syndrome children to employ those interactive strategies necessary for appropriate developmental growth.

Another major difference is the apparent difficulty these children have in expressing affection and in modulating physiological arousal. Overall, children with Down syndrome manifest a lower level of affective expression than their

normally developing counterparts, even when matched in terms of cognitive level (Cicchetti & Sroufe, 1978). It is generally more difficult to elicit both positive affective responses, such as laughter to incongruous stimuli, and negative reactions, such as distress to separation and stranger approaches (Cicchetti & Serafica, 1981; Cicchetti & Sroufe, 1978). Even the full form of the early social smile of Down syndrome children appears reduced (Emde, Katz, & Thorpe, 1978). This apparent inability to generate sufficient tension to create an affective response may be attributable to difficulties in processing the information provided by environmental stimuli as well as to specific deficits in physiological arousal.

These cognitive–affective deficits are also likely to influence parents' judgments of their infant's temperament. Despite many similarities in temperament to normally developing babies (although more Down syndrome children are considered "difficult" by parents), the reduced arousal capacities of these children may lead parents to rate their children as lower in approachability. Similarly, difficulties in modulating arousal once threshold has been reached or the active roles parents must adopt during infancy in order to establish an interactional exchange can also influence temperament ratings of activity level (Bridges & Cicchetti, 1982).

Emotional responses in infancy serve as a primary means of communication between caregivers and children. Absence of a normally differentiated and difficult-to-arouse (and settle) affective system in an infant can certainly have adverse effects on the nature of the caregiver–child relationship. As Cicchetti and Sroufe (1978) point out:

It may be that parents of Down syndrome infants need to extend themselves much more than the typical caregiver, since they must assume more responsibility for helping the infant to generate tension and affect and to become emotionally engaged in the situation, and they must accept greater delays in the development of fully differentiated affective expression (e.g., laughter). Helping these infants sustain attention and build excitement is especially challenging. (p. 345)

Inadequate signaling by Down syndrome children and related characteristics are likely to require unusual parental adjustments in order to provide developmentally sound experiences and to establish synchronous and affectively warm interactions. Caregiver–child interactions that are associated with language and communicative development are perhaps most easily disrupted. Existing research suggests that, even at prelinguistic levels, Down syndrome children are much less interactive in parent–child communicative sequences than normally developing children at similar developmental levels. They tend to initiate far fewer interactions and are especially lacking in the use of eye contact to establish interactions, to "ask questions," or to receive information or comments on their ongoing behavior. Moreover, in contrast to those of normally developing chil-

dren, vocalization patterns of Down syndrome children are such that more vocal clashes with caregivers are likely to occur, proper turn-taking sequences are more difficult to establish, and parents are not able to expand upon their child's vocalizations and their intent as easily (Berger & Cunningham, 1983; Jones, 1980). As a consequence, much of the work of communication falls to parents, and a pattern that becomes more and more directive appears to be a common result. Although it is understandable how such a style of interaction can develop, it may be important to try to establish more mutual and synchronous interactive patterns at prelinguistic levels with the Down syndrome infant because these patterns appear to form a crucial foundation for later language development (Bruner, 1977). Of course, the problems parents may experience in adjusting communicative patterns in accord with the abilities of their Down syndrome infants and young children are far from universal phenomena (Crawley & Spiker, 1983; Rondal, 1978). Nevertheless, it is not surprising to find that many interaction difficulties persist. In fact, these problems may eventually be accompanied by a gradual decline in the amount of interaction between parents and children in the years ahead (Cheseldine & McConkey, 1979; see also Cunningham, Reuler, Blackwell, & Deck, 1981).

Children with Other Biologically Based Delays

The marked heterogeneity, in all respects, for children who have established or presumed biologically based developmental delays suggests that useful descriptive information on the course and characteristics of their development is not likely to extend meaningfully beyond generalities associated with severity of developmental delay. Given widely varying etiologies in particular, it would not be surprising to find that certain qualitative differences exist between this diverse group of children and more homogenous subgroups such as those with Down syndrome. An example of such a difference can be seen in a study on self-recognition. As discussed earlier, Down syndrome children show evidence of self-recognition when they reach appropriate developmental levels. However, when self-recognition tests are administered to a heterogeneous group of developmentally delayed children—children typical of those found in community based early intervention programs—responses are much more variable, with relatively few of these children showing any evidence of this cognitive achievement. This occurs even though assessed mental ages suggested that evidence for self-recognition should exist (Hill & Tomlin, 1981). Other research has also reported differences between Down syndrome children and a heterogeneous group of developmentally delayed children in their degree of social orientation and the extent to which they are engaged in interactions with toys (Krakow & Kopp, 1983).

Despite the fact that descriptions of the development and characteristics of

children with other biologically based delays must remain general, some important patterns, many similar to those for children with Down syndrome, do nevertheless emerge. For example, difficulties in caregiver-child interactions can be detected early (e.g., Greenberg, 1971), mismatches between parental speech complexity and children's capacities are not uncommon (Cunningham et al., 1981), children fail to deploy their attention adequately and do not effectively use the social and physical environmental resources available to them during play (Krakow & Kopp, 1983), and highly directive and less responsive patterns of relating can develop (Terdal, Jackson, & Garner, 1976)—all in a manner similar to that of the Down syndrome subgroup. Not only does their toy play lack spontaneity and flexibility (Krakow & Kopp, 1983), but developmentally delayed children seem unusually deficient in adopting systematic strategies in problem-solving tasks (Goodman, 1981).

Moreover, the peer relationships of developmentally delayed children in general during the preschool years show unusual deficits—deficits that exceed those that would be expected on the basis of their levels of cognitive development (Guralnick & Weinhouse, 1984). Most developmentally delayed preschool-age children appear to have extraordinary difficulty in establishing more than simple social exchanges with their peers, a problem that can be traced in part to the directive pattern of caregiver-child relations, to unusual deficits in language development, to the existence of behavioral problems and to other aspects of the social environment (Guralnick, 1986). It may also be a reflection of the information-processing difficulties described earlier (Kopp, 1983), now applied to the problem of establishing social relationships with one's peers. Whatever the case may be, developmentally delayed children appear to be at risk for a host of developmental problems beyond cognitive delay.

At a more global level, families in which a handicapped child is a member also appear to be unusually vulnerable to developing numerous problems (Crnic, Friedrich, & Greenberg, 1983). Yet such outcomes are far from inevitable; many families draw upon their resources not only to cope with but also to be enriched by their relationships with their handicapped family member. The nature of the outcome depends on a complex set of forces. Characteristics of the child and family as well as the availability of social support networks have been found to be important in governing the adaptive abilities of families (Crnic et al., 1983; Gallagher, Beckman, & Cross, 1983).

Finally, the value of tracking the development of diagnostic subgroups of children should be emphasized. Despite even substantial within-group variability, the developmental characteristics of diagnostic subgroups do provide some measure of control and can serve as a useful baseline for evaluating the effects of early intervention. As we have seen for Down syndrome children, specific developmental patterns for this subgroup have been reliably identified. The discovery of the fragile-X syndrome (Carpenter, Leichtman, & Say, 1982)

and fetal alcohol syndrome (Golden, Sokol, Kuhnert, & Bottoms, 1982; Steinhausen, Nestler, & Spohr, 1982) in recent years—syndromes involving relatively larger numbers of children—suggests the potential value of this strategy.

NATURE OF INTERVENTION PROGRAMS FOR CHILDREN WITH DEVELOPMENTAL DELAYS

The many problems likely to be encountered by young developmentally delayed children and their families provide an important framework for examining the effectiveness of early intervention efforts. Equally important, however, is an understanding of the nature, scope, and variations of the comprehensive intervention programs themselves. Accordingly, prior to our analyses of the effectiveness of intervention, a brief historical review of early intervention activities and a description of the major dimensions that characterize intervention programs will be presented.

Historical Background

Although prior to the 1900s a philosophical basis for the importance of the early childhood period existed (Lazerson, 1972), the actual catalyst for the development of educational programs may well have been the concern for children growing up in the squalid conditions of poverty. According to Maxim (1980), important educational reforms for young children were stimulated by a number of concerned individuals living in different countries. Programs for young children living in poverty were initiated in the late 1800s—early 1900s by such individuals as Owen in Scotland, Froebel in Germany, McMillan in England, and Montessori in Italy. In many respects, these programs were developed to offer poor children the opportunity to thrive in a more healthy and intellectually stimulating environment.

Concerns for the child from poverty circumstances were extended in this country to concerns for retarded and other children with handicapping conditions. There were two investigations conducted before the 1960s that offered promise for intervention with young developmentally delayed children through manipulation of the environmental context and/or the offering of educational programs during the early childhood period: the serendipitous but classic investigation conducted by Skeels (Skeels, 1966; Skeels & Dye, 1939) and the pioneer work of Kirk (1958).

The longitudinal study conducted by Skeels and his colleagues on two groups of infants placed in different environments produced remarkable findings. Initially both groups of infants were residents of an orphanage and were at first

testing found to be comparable and functioning generally in the retarded or low normal range of intelligence. Thirteen of these infants were placed in an institution for the retarded as "house guests" of a group of retarded females and the ward staff (Skeels & Dye, 1939). These 13 children came to constitute the experimental group who, because of marked improvement in this actually more stimulating environment, were adopted and left the institution. The contrast group was composed of the children who remained wards of the state and resided in an institutional environment. Some 30 years later a follow-up study was completed, and as Skeels (1966) reports:

All 13 children in the experimental group were self supporting and none was a ward of an institution, public or private. In the contrast group of 12 children, one had died in adolescence following continued residence in a state institution for the mentally retarded, and four were still wards of institutions, one in a mental hospital, and the other three in institutions for the mentally retarded. In education, the disparity between the two groups was striking. The contrast group completed a median of less than the third grade. The experimental group completed a median of the 12th grade. (p.55)

This investigation has been criticized on methodological grounds, especially with regard to the exact nature of the disabilities of the subjects as well as concerns about the attribution of the difference between groups solely to the children's early experiences (Clarke & Clarke, 1976; Ramey & Baker-Ward, 1982). However, the potential for substantially altering the rate of intellectual development through environmental manipulation was established.

In 1958, Kirk reported the first formal attempt at ameliorating delayed development through early education. His investigation included 81 preschool children between the ages of 3 and 6 years with IQs that ranged from 45 to 80. These children were classified as mentally retarded in line with the conventions of the time. The subjects were from four different groups: a community experimental group in which the children attended a community-based preschool program, a community contrast group who attended no preschool program, an institutional experimental group who attended an institutional preschool program, and an institutional contrast group who did not attend any preschool program. Upon completion of the preschool experience, the experimental subjects in both the community and institutional preschool groups out-performed the contrast subjects. A follow-up after the first year of elementary school found that the initial differences between contrast and experimental community subjects tended to disappear either through an acceleration of the contrast subjects and/or limited change for children in the experimental group. Nevertheless, according to Kirk (1977), "The conclusion we drew from this experiment was that intervention at the preschool level accelerates the rate of mental and social development, while no intervention at that age level tends to allow the rate of mental and social development to slow" (p. 7).

In 1970 an extremely interesting monograph was published by the State of California's Department of Mental Hygiene (Rhodes, Gooch, Siegelman, Behrns, & Metzger, 1970). This study was a follow-up of work completed by Stedman and Eichorn (1964) that compared the development of a group of 10 home-reared Down syndrome children with 10 institutionalized Down syndrome children. Most comparisons in the Stedman and Eichorn study favored the home-reared children and thus a further experiment was formulated to see if programmatic changes in an institutional environment could produce changes in the Down syndrome children.

Changes were made in the children's physical setting, staff were specially trained, and a comprehensive intervention program was initiated. Training language skills was the primary focus of the program. The reported result indicated that positive changes were seen in the language behavior, intellectual growth, and social skills of a population previously thought by many to be uneducable (Rhodes et al., 1970).

Taken together, the findings of these studies and a host of other factors suggesting that intervention during the first 5 years of life can have a significant impact on development (see Chapter 1 of this volume) set the stage for a major effort initiated at the federal level to foster the development of early intervention programs for developmentally delayed and other handicapped preschool children.

Handicapped Children's Early Education Program

In 1968 the United States Congress enacted the Handicapped Children's Early Education Program (HCEEP). The major purpose of this federal program for young handicapped children was to develop, demonstrate, and disseminate effective early intervention models. Until recently the appropriations for the HCEEP have steadily increased, resulting in a growing number of programs and children being served. An article by Swan (1980) describes the considerable success of this federal venture as measured by the number of programs that have been continued in communities using local and/or state funds. In addition, an evaluation report indicates the enormously positive impact of these programs (Littlejohn Associates, 1982). Although much work needs to be done, there seems little doubt that from both historical and contemporary perspectives the impact of this federal program on the development of early intervention programs for handicapped infants and preschool-age children has been significant.

The final link to contemporary programs can be found in a number of exemplary programs developed in the early 1970s, many of which were supported by HCEEP funds. Descriptions of many of the notable programs that formed the groundwork for many of today's programs can be found in the influential volumes edited by Friedlander, Sterritt, and Kirk (1975) and Tjossem (1976).

CONTEMPORARY EARLY INTERVENTION MODELS

Expectations of the effects of contemporary early intervention models can be conveniently divided into direct impact, indirect impact, and societal benefits. Direct impact refers to program goals and objectives designed to alter the behavior of the child and the immediate family. Most programs see changing the child's behavior and supporting the family as their primary objectives, and thus intervention strategies are developed to reflect this focus. Indirect impact refers to changes in the child and family members that permit maintenance of the child in the least restrictive setting in terms of educational placement. A second important indirect impact is the family's or community's willingness to maintain the child in the home and community.

Finally, many programs suggest that the impact of early intervention programs on the child and family produce benefits for society. In a state-of-the-art report compiled by Interact (Garland, Swanson, Stone, & Woodruff, 1981) it is argued that early intervention assists parents in maintaining their child at home, thus reducing the costs of institutionalization, which the community must bear. Similarly, by maintaining developmentally delayed and disabled children more in the mainstream of regular education, significant savings to the taxpayer result as well (Bricker, Bailey, & Bruder, 1984).

Early intervention services for developmentally delayed children from birth through 5 years of age are typically provided by community programs and include a range of children from those designated as at-risk to the most profoundly impaired child. According to Filler (1983), the three service delivery models used by early intervention programs to serve these children are home-based, center-based, and a combination of home- and center-based. Often programs for infants deliver services in the home setting. The target is the parent or caregiver who is helped to acquire effective intervention skills to use with the child.

As implied in the name, the center-based model requires that the child be brought to an educational setting on a regular basis. The setting might be a classroom, a hospital, or a more informal arrangement. The focus in the center-based models is usually the child; however, many center-based programs stress parental involvement and may even provide structured training for the parent.

Some programs have adopted a combined approach in one of two ways. First, there are programs that stress training both in the classroom and in the home. Second, there are programs that serve children initially employing a home-based model and, after children reach a certain age or developmental level, they are transferred to the center-based component of the program. However, within these three basic service delivery models considerable variability can be found in terms of philosophical/curricular emphasis, instructional approaches, staffing

patterns, the nature of family involvement, the use of ancillary services, and assessment and evaluation strategies. These critical elements of early intervention programs are discussed in the following section.

Philosophical/Curricular Approach

An understanding of the philosophical orientation that underlies early intervention efforts is essential. Intervention decisions—including the choice of assessment and evaluation instruments, the determination of educational objectives, the selection of strategies for fostering development, and the construction or adaptation of curricular materials—should be governed by the program's philosophical orientation or approach.

Curricular approaches used by early intervention programs are distributed across a continuum from direct instruction (in which the child is given little choice over the nature of the instructional program) to those with an experiential emphasis (in which the child is free to choose from a variety of options throughout the instructional day). Harbin (1979) has suggested that current curricular models can be classified on the following continuum: experiential, Montessori, Piagetian, information-processing, diagnostic-prescriptive, or behavioral. As one moves away from the experiential end of the continuum the approach becomes increasingly teacher-directed. This is discussed in more detail in the section on instructional strategies.

The curricular emphasis chosen by a program not only guides its focus but should also dictate the content. The majority of programs providing services to developmentally delayed children tend to offer educational activities in a variety of developmental domains. The comprehensive nature of these programs is appropriate because by definition infants and young children with developmental delays tend to show deficits in many critical areas of functioning. There is often a need to assist the child in gaining skills in cognitive, communicative, social, self-help, and motor areas, thus making mandatory a comprehensive curricular approach.

Although programs can and do operate using a variety of orientations, a general developmental perspective encompassing many different models is most prominent. This orientation assumes that several underlying principles govern the nature and cause of growth and change. In particular, this position assumes that important developmental changes are both hierarchical and sequential. Current developmental progress by a child involves the integration and reorganization of earlier acquired skills, and development occurs in a general, consistent sequential order. In addition, this position assumes that many important developmental changes result from the resolution of disequilibrium between the child's current level of development and the demands of his or her environment. The challenges posed by the environment must be neither too simple nor too difficult

in relation to a child's developmental level in order for positive change to result (Hunt, 1961). The task of the interventionist within this model is to structure the environment in such a way as to place increasing demands on the delayed child's current level of functioning. By requiring the child to adapt actively to greater and greater environmental demands, growth and change are promoted. Finally, the approach assumes that what is critical to development may be specific behaviors in some cases, but often interventionists are addressing issues related to broad conceptual aspects of development, which require consideration of issues related to integration and interrelationships across behavioral domains.

Instructional Strategies

The instructional strategies adopted to present the curricular content often rely on some form of environmental programming, however implicit it may be according to varying curricular models. As articulated in behaviorally based strategies, the teaching staff arrange events to elicit and reinforce the occurrence of specific behaviors by the children. However, the rigor and rigidity with which the behavioral technology is employed varies considerably across programs. According to the Harbin (1979) continuum, a fair generalization might be that those programs reflecting the more teacher-directed approaches are the programs that tend to begin training focused on highly specific educational objectives using well-controlled presentation formats. As the child shows progress in the acquisition of the educational objective, the instructional presentation shifts to encourage generalization of the response to other settings and appropriate conditions. In contrast, those programs that are more child-directed tend to employ a more flexible use of this strategy. The child is encouraged to use a specific behavior in a variety of settings and conditions with the primary goal of making the response functional for the child. Once the response becomes functional, the use of well-controlled presentation formats is reduced. Application of an instructional technology requires that staff be skilled behavior managers and programmers if children are to make adequate progress.

Although the application of behaviorally based instructional strategies has been effective in many situations and for certain groups of children, researchers with a more cognitive orientation have questioned the utility and/or generalizability of the skills taught to children under such rigorously controlled and structured regimes. It is possible that these regimes tend to minimize flexibility and adaptability in that children are reinforced for careful adherence to an adult imposed structure. Flights of fancy, initiation of novel behavior, and variations in specified routines are not encouraged and may even be discouraged. Moreover, the technology often has been used to teach specific responses rather than to assist children in developing generative strategies that lead to problem solving and independence. Those favoring a behaviorally based technology argue that

the general strategy is sound but rather the manner in which interventionists have applied it needs correction.

Contemporary views held by many interventionists tend to favor instructional approaches that specify the goals and objectives for the child but leave the implementation to be decided, in part, by events occurring in the environment and by the interests of the child. For example, an educational goal might be to assist the child to use more agent–action–object phrases. Rather than using specific drills on a set number of predetermined phrases, the interventionist capitalizes on opportunities that arise during the day to stimulate the use of the targeted language forms. Using such an approach requires careful attention to the daily activities to assure that each child is receiving adequate training on selected objectives. Often it is difficult to monitor the training of each objective, and successful employment of such a system requires systematic collection of data on the child's progress toward specified objectives.

Family Involvement

Increasing numbers of programs are considering the family to be an integral member of the intervention team. From the development of individualized educational plans (IEPs) to their implementation, parents in particular are consulted and involved in the decision making and participate in many aspects of the educational–therapeutic effort for their child. An underlying principle of family involvement is to begin intervention sufficiently early in order to prevent or minimize potentially difficult or distressing parent–child and/or child–family relationships from developing. A second principle of family involvement focuses on the need for an ecological approach to intervention in order to assure maximum development in the young delayed child. As Bronfenbrenner (1975) has suggested, all elements of a child's environment need to work in concert if maximum benefit from intervention is to occur. An exceptionally fine preschool program can probably offset the effects of a nonstimulating after-school environment only partially. There is a need to coordinate home and school expectations, which demands designing an intervention program that includes as many facets of the child's life as possible.

The family situation itself should dictate where, when, how, and in what areas to begin intervention. As is done when designing child-related programs, it is necessary to assess the family situation, select objectives, intervene, and then evaluate progress toward the established objectives. It is also essential that most intervention programs that involve families be based on a balanced blend of a family's emotional needs, on information and assistance within the community, and on skill development. Moreover, families included in programs often have widely disparate cultural backgrounds, availability of resources, demands on their time and energy, educational experiences, belief and value systems, and

interests. Such divergence mandates program flexibility and individualization both in intervention objectives for families and in the method of reaching those objectives.

It is our contention, as well as that of many parents, that the professional should avoid becoming "the expert" and telling the parent what to do and how to do it (Roos, 1977; Sullivan, 1976). Rather, it is more helpful if a cooperative relationship evolves in which each individual contributes valuable information and skills. Becoming a member of the team is a responsibility that should be taken seriously by every parent and by every professional.

Training and Deployment of Staff

The professional staff is responsible for the shape and flavor of a program's content. The way in which the staff conducts the program is influenced by at least two important variables: the quality of their training and the fidelity with which they adhere to established program goals and objectives. No doubt other factors could be specified as well, but these two seem of overriding importance.

Personnel working in early intervention programs can be divided into two categories: direct service and support service. Direct service individuals are those interventionists, teaching aides, and/or parents who interact with the child on a regular and consistent basis; for example, the classroom teacher in a center-based program or a parent trainer in a home-based approach. Early interventionists and other direct service personnel are called on to fill a number of roles including developmental specialist, behavior manager, synthesizer, and evaluator. These roles have been discussed in detail by Iacino and Bricker (1978).

Support personnel include specialists such as physical therapists or communication specialists who have been trained in specific areas. The importance of obtaining the input and support of specialists from numerous health, educational, and social and behavioral disciplines is axiomatic for early intervention programs. In fact, prior to the initiation of a program a multidisciplinary diagnostic and assessment process should be conducted on each child. This often requires the participation of a physical therapist, occupational therapist, communication specialist, psychologist, medical personnel, and possibly others. Once a plan is developed on the basis of these assessments, the appropriate specialists should be available to formulate the daily intervention plan, to teach or supervise the direct intervention personnel in the delivery of the necessary therapeutic routines, to provide direct service as needed, and to evaluate the child's progress.

As indicated earlier, contributions from a variety of professionals are essential to the delivery of quality services to the delayed infant and young child. Because most programs cannot support a cadre of needed professionals on a full-time basis, specialists can be effectively used by adopting a consulting model. In such a model, the specialist functions primarily as an evaluator and consultant who

subsequently monitors the implementation of the developed program. The primary hands-on training of the child is provided by the classroom or home visitation staff and parents, rather than by specialists.

The consulting model has been adopted by many programs, in part because of financial exigencies; however, many staff, parents, and specialists have become convinced that, despite limitations for certain complex procedures, this model can be effective. Established training or therapeutic regimes can be employed throughout the day rather than for only brief periods when the specialist works directly with the child. Such practice increases total training time as well as enhances generalization across settings, people, and events (Bricker, 1976).

Assessment and Evaluation

The development of an evaluation plan and its implementation are essential for effective intervention. Evaluating individual change and programmatic impact requires that intervention methods and systems have appropriate evaluation procedures. Evaluation techniques should be able to determine the format and degree of success of intervention for individual children as well as the impact of programs on groups of children. Thus, evaluation serves three distinct but complementary functions: It guides the development of individual programming, it provides feedback about the success of individual programming, and it yields information for determining the value of an intervention system designed to benefit groups of children.

The need for a comprehensive evaluation of the child requires that the assessment battery be carefully constructed. This battery should tap the child's abilities across a wide range of domains because educational plans will be constructed on the basis of the initial assessment information. Second, assessment instruments should be geared to the developmental age of the child. Third, the evaluation instrument or format should be usable by available program personnel. Selection of a sophisticated instrument that cannot be administered appropriately by program personnel is of no value. Fourth, at least some of the assessment/evaluation tools should yield information that can be used to formulate educational objectives and related program plans. Finally, in addition to the more global assessments or evaluations that are administered at specific intervals, programs should develop procedures for the collection of daily or weekly probe data that indicate a child's progress towards established short-term educational or developmental objectives (Guralnick, 1975).

A useful assessment/evaluation system is essential for monitoring the impact of an intervention program. Accountability for all concerned is essential. Unfortunately, as will be seen, evaluation has not been given a high priority in many programs because resources have been limited. Accordingly, programs have

differed widely in the comprehensiveness of the initial assessments as well as their monitoring and summary evaluation efforts.

OUTCOMES OF EARLY INTERVENTION FOR DEVELOPMENTALLY DELAYED CHILDREN

With this information as background, the remainder of the chapter will be devoted to an analysis of the effectiveness of early intervention efforts for children with developmental delays. Studies selected for this review consisted of those that were published in 1975 or later and were found in peer-reviewed journals or professionally edited book chapters. To be included, a study must have reported child change measures, not only parent-related outcomes. Of equal importance, each study selected must have been designed to provide a comprehensive, broad-based program and have attempted to evaluate systematically the impact of early intervention within that framework. To facilitate discussion of these outcomes, the analysis has been divided into programs that served only children with Down syndrome and those that served children with general biologically based delays. Within each group a detailed table is provided consisting of a study-by-study summary of information on the nature of the intervention, the intervention parameters, the setting of the intervention effort, the role of parents, characteristics of the participating children, the experimental design, the outcome measures, and the results. A discussion of the outcomes for each group follows in an effort to draw at least tentative conclusions from these investigations.

Outcomes for Children with Down Syndrome

Despite the importance of and enormous interest in an evaluation of the effectiveness of early intervention programs for children with Down syndrome, only 11 studies met the criteria for inclusion in this review. Nevertheless, as inspection of Table 1 will reveal, a number of important characteristics and patterns did emerge. Virtually without exception, these early intervention efforts reflected a very strong reliance on a developmental framework as the basis for setting educational goals and objectives, and progress was evaluated in terms of change in each of a variety of developmental domains. As noted, programs were comprehensive, attempting to influence the general course of development including cognitive, language and communicative, personal-social, and gross motor areas. However, some programs did provide a special emphasis that was consistent with the interests of the designers, such as specific feeding training (Connolly, Morgan, Russell, & Richardson, 1980), language development (Kysela, Hill-

TABLE 1

Summary of early intervention studies for children with Down Syndrome^a

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Aronson & Fallstrom (1977)	Institution-based program, implemented by a junior psychologist under guidance of authors; most training was individualized and formulated to stimulate sensory, self-help, cognitive, motor, memory, emotional, social, and attentional areas; normal developmental sequences provided the basis for systematic training	Intervention time span was 1½ years; training sessions twice a week for a period of between 15 min and 1 hr; journals kept for each child on a weekly basis for continuing training	Institutional-based, psychologist trainer with input from authors for continuing training programs	No children ever lived at home (all entered the nursing home between ages 4–10 months); Nursing home provided normal preschool program but no involvement with the specialized training program
Bidder, Bryant, & Gray (1975)	Mothers received training on behavior modification techniques as they related to delayed children; efforts designed to encourage increased verbal and social interactions with child at home and toward greater competence and independence; training focused on all developmental domains and was individualized for each child; mothers recorded data based on home-training sessions; a discussion group relating to family and personal problems was also part of the program	Mothers in treatment group received 12 training sessions over a 6-month period, 2 hr per session; more intense (weekly) at beginning of the 6-month period; 1 meeting for fathers and baby-sitters	Home-based for intervention but mothers received training at center	Mothers were recipients of training and counseling, and were the primary service providers; records and data were collected by parents over the 6-month period

yard, McDonald, & Ahlsten-Taylor, 1981; Rynders & Horrobin, 1980), or cognitive and language training (Clunies-Ross, 1979).

An additional characteristic of these programs was the structured and directive nature of the intervention activities. Many programs described highly specific objectives, often conducted on a one-to-one or small-group basis with careful monitoring of progress on each of the objectives. A considerable number of programs relied extensively and explicitly on behaviorally based teaching strat-

Child characteristics	Experimental design	Outcome measures	Results
16 Down syndrome children living in a nursing home; experimental group had mean CA = 52.7 (range 26–69); MA = 20.6 (range 19–34); DQ = 39.4 (range 24–49); control group had mean CA = 51.3 (range 21–68), MA = 20.6 (range 13–35), DQ = 40.5 (range 18–57)	Children matched by age and sex and divided into experimental and control groups; MAs and DQs were almost identical at beginning of study for groups established in this manner	Griffiths Mental Development Scales with the 6 subscales of motor function, personal-social, hearing and speech, eye-hand coordination, performance, and practical judgment; both groups tested every 6 months; 12 months after training was completed retesting of both groups for follow-up was carried out	Intervention group showed greater increases in mental age (average gain = 10.5 months) and at a more rapid rate than control group (average rate = 3.5 months); held across all 6 subscales; All gains were progressive for all intervention children; during the 12-month follow-up, no statistically significant differences were found between the two groups in total test scores; note that 5 of 8 intervention and 3 control children were moved to other institutions during this no-treatment period
16 Down syndrome children ranging in age from 12 to 33 months participated in the study; experimental group mean CA = 23.8 months; control group 24.5 months; based on Griffiths Mental Development Scale, the mean MA of the experimental group was 16.6 months and the control 14.8 months at beginning of study	Children matched with regard to CA, MA, and sex were divided into two groups ($N = 8$ per group); experimental group mothers received training on behavioral techniques and counseling but controls only received typical interactions with health visitor and general practitioner; tester not aware of children's group membership	Griffiths Mental Development Scales; maternal reports	Significant differences in favor of the intervention group were found for language (mean gain 6.56 versus 2.56 months) and performance (mean gain 7 months versus 4.37 months) scales of the Griffiths; a strong trend also noted for the personal-social scale; the overall, locomotor, and eye-hand scales did not reveal any differences between the two groups; mothers reported increased knowledge and skills about their child's development and improved morale

(continued)

egies (e.g., Bidder, Bryant, & Gray, 1975; Hanson & Schwarz, 1978; Hayden & Haring, 1977; Kysela et al., 1981). Even when intervention was to be administered primarily by parents, detailed written materials and requests to collect progress data were considered vital aspects of the overall intervention strategy. Although there was an emphasis on behavioral objectives and goal setting, only about one third of the programs appeared to have a highly developed curriculum in a form that could be disseminated to others for replication.

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Clunies-Ross (1979)	Center-based and home-based instruction; Parent training provided in child management and home teaching; center-based program conducted by parents under staff supervision; curriculum consisted of comprehensive, structured programs in 6 developmental areas; 50% of instructional time focused on cognitive and language areas; normal developmental sequences provided guidelines for major objectives	3 intake groups (3 separate years); intervention time ranged from 4 months to 2 years; initial assessment occurred within 2 weeks of enrollment; children attended the intervention program 2-3 times per week (6 hr total time/week); prescribed instruction was conducted in small groups (1 staff to 2-3 children), or on a 1-to-1 staff-child basis; program objectives monitored each session, program reviews every 2 weeks; parent received 10-week training course; home teaching was conducted by parents 3 15-min sessions per day	Center-based for interdisciplinary team instruction, home-based parental instruction, parent training for implementation of home-based instruction	Provide generalization and consolidation of center-based programs; primary responsibility for self-care programs
Connolly, Morgan, Russell, & Richardson (1980)	Interdisciplinary program with professional teaching child and demonstrating techniques to parents for later home use; specific feeding training was singled out; general developmental model was basis with emphasis on intensive motor and sensory stimulation; group counseling and support for family was also provided	3-year program if enrolled early; maximum time, birth to 3 years; first 10 weeks in spring and fall, 1-hr group sessions, 1-hr individualized child teaching by professional alone, and 1 hr in group counseling with a professional to discuss issues and problems weekly; winter and summer, periodic follow-ups for evaluating and updating program; length of intervention varied for child but not continued after 3 years of age	Center-based for demonstration purposes but parents were expected to carry out home programs	Parents were primary service providers; instructed in general procedures and received counseling services

Child characteristics	Experimental design	Outcome measures	Results
36 Down syndrome children (35 trisomy 21, 1 translocation); average age at intake 14.3 months, age range 3–37 months	Pre–post without control or comparison group; progressive developmental achievements compared to initial assessment on Early Intervention Developmental Profile (EIDP); outcomes compared to normative patterns of Down syndrome children on existing developmental research (no systematic intervention)	EIDP administered at 4-month intervals following initial assessment; reported in mean developmental index scores	Progressive achievements of individuals ranged from large to moderate as measured by developmental index scores; continuous increments in developmental quotient were noted; for cognitive and language indices, children were developing at a rate of approximately 60% of CA; after 12–20 months of intervention, children scored at about 80% of CA; similar improvements occurred on other developmental domains; outcomes substantially replicated over 3 intake groups; younger groups began at higher developmental levels and maintained superiority over 12 months; also, the data suggested that rate of developmental progress was most rapid in 12–23-month age group
At age of intervention: Down syndrome, 0–2.5 years; 20 of original 40 children in group reassessed at 3.2–6.3 years (\bar{X} = 4.5)	Post-only comparisons with a specially constructed control group (no random assignment); matched on children referred to demonstration center but not enrolled in an EI program (N = 53); same CA and parental educational level as EI	Stanford–Binet or Cattell Infant Intelligence Scale, Vineland Social Maturity Scale	Statistically significant gains in IQ in favor of EI group (\bar{X} = 54.7 versus 42.9) and in SQ (\bar{X} = 64.4 versus 55.5); 65% of children in EI in mild AAMD level versus 24.5% in comparison group; no EI children classified as severe/profound for EI versus 19% for comparison

(continued)

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Hanson & Schwarz (1978)	Staff member visited homes weekly or biweekly, evaluated child's developmental status and established goals in conjunction with parent; detailed educational programs were provided as well as general recommendations for social and physical activities to promote development; normal developmental model with milestones as goals using behaviorally based teaching procedures	Average age of entry into program was 14 weeks, with average program involvement 24.4 months (range 15-30 months); parents were requested to carry out 4-5 different programs weekly with their child (10 trials per day per program)	Home-based program	Primary service providers with advice and teaching of staff home visitors
Hayden & Dmitriev (1975) Hayden & Haring (1977)	Interdisciplinary center-based model preschool program; structured program based on developmental sequences and behavioral objectives across all developmental domains; intensive, individualized program	Variable length of time spent in program; children in model preschool participated in intensive activities 1½-2 hr, 4 days per week	Center-based program	Active in all aspects of model program; parents trained to use strategies at home and participate in child's classrooms; attend parent meetings and group conferences

Parental involvement was a significant component in almost all 11 programs, and many were primarily home based. For infant and toddler programs, in particular, parents were either trained to be the primary service provider (e.g., Hanson & Schwarz, 1978; Rynders & Horrobin, 1980), or to provide additional programs at home, often reinforcing, supplementing, and generalizing lesson activities (e.g., Clunies-Ross, 1979; Kysela et al., 1981; Piper & Pless, 1980). Overall, the instructional burden for younger children was placed clearly on parents, with considerably less emphasis on counseling and support (but see

Child characteristics	Experimental design	Outcome measures	Results
12 Down syndrome children (11 trisomy 21, 1 mosaic), mixed socioeconomic backgrounds; included first 12 children referred from medical and social service agencies for intervention program; 4 children had significant cardiac defects	Post-only design with comparisons to published data on home-reared Down syndrome children's developmental milestones who were not enrolled in early intervention programs	Specific age of attainment of developmental milestones selected from different instruments; comparison data based on Share (1975), Share & French (1974), and Share & Veale (1974)	In comparison to "normative" group, children in the intervention program attained many motor and perceptual-motor milestones (e.g., rolls over, feeds with fingers, walks with no support) at an earlier age and with much less variability in time of attainment; delays in comparison to normal development were still apparent
94 Down syndrome children (95% trisomy 21, 3% mosaic, 2% translocation); analyses included children from model program now in public school ($N = 13$; median CA = 96 months); those currently enrolled in model preschool ($N = 53$; median CA = 42 months); and those enrolled in public school but no model preschool experience (contrast group; $N = 28$; median CA = 118 months)	Nonequivalent contrast group; the experimental group had attended the model preschool program while the control group, some of whom were matched for age with the experimental group, attended other programs; single scores taken from the child's performance on the Down's Syndrome Performance Inventory were used to examine the relationship between age and developmental level across children of different ages; both groups were similar on assessed demographic variables; data on children currently enrolled in the preschool were used for additional comparisons	Down's Syndrome Performance Inventory, Peabody Picture Vocabulary Test or Stanford-Binet; Denver Developmental Screening Test or Vineland Social Maturity Scale	Preliminary results suggest that model children do not show typical decline based on the Down's Performance Inventory at certain ages; graduates of model program and control group show variable changes but model group at higher overall level

(continued)

center-based comprehensive programs, e.g., Hayden & Haring, 1977; Ludlow & Allen, 1979).

In contrast to the consistency of parental responsibilities, the intensity and duration of intervention programs varied widely. With regard to intensity, comprehensive center-based preschool programs for Down syndrome children typically ranged from 2 to 5 hr per day. During that time, extensive services were delivered within a model that usually designated certain portions of the day for different developmental domains. Although each developmental area presu-

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Kysela, Hillyard, McDonald, & Ahlsten-Taylor (1981)	Direct and incidental teaching methods used in recognition of deficits in attention, memory, and generalization within a behaviorally based model; emphasis on language, but teaching activities included cognition, motor, self-help, and play	2 groups of children (2½–6 years) attended half-day sessions 4–5 days per week in center-based program; daily individual language sessions and group activities; 1 day a week given to maintenance checks; no information provided on intensity or frequency for home-based programs; children in both center-based and home-based programs began at different times (home-based mean age at initiation 13.5 months, center-based mean age at initiation all under age 3) and moved through the program at differing rates; total length of program varied and was not specified clearly but intervals spanned a period of 6–8 months for some children and 12–14 months or longer for others	Home-based until 2½ years, then center-based	Implementation of home-based programs as primary teaching agents; collection of criterion data; provide parent-initiated situations and opportunities for generalization for children enrolled in center-based program
Ludlow & Allen (1979)	Center-based interdisciplinary program providing intervention and planned preschool activities; supportive counseling and training of mothers also offered; home-based program requested to be administered daily as a continuation of center-based program; program geared to individual needs and curriculum consisted of speech stimulation, self-help training, locomotor training, and social development; guidelines for teaching objectives provided by developmental charts and assessments	Intervention groups participated in a developmental clinic 2 hr, 2–3 times a week; some children attended play groups or nursery schools; Adult-to-child ratio was usually 1-to-1; duration of program varied with age of entry, but all children participated for at least 2 years prior to their 5th birthday	Center-based for interdisciplinary team instruction, parental counseling and support; home-based for continued stimulation; normal playgroup involvement when prescribed for specific children to further independence and social acceptability	Parental participation in every area of center and home-based programs; supported by other parents; kept progress reports for home training

Child characteristics	Experimental design	Outcome measures	Results
<p>Home-based program, 22 children (13 male, 9 female); birth to 2½ years of age; mean age intervention initiated was 13.5 months; program included 19 Down syndrome children, 3 undiagnosed; 64% had other serious medical problems; center-based program, 8 Down syndrome children, 3 with associated serious medical problems (intervention began at a mean of 28.4 months)</p>	<p>Pre-post only; comparisons based on normative test data in relation to the expected decline in test performance over time</p>	<p>Bayley Scales of Infant Development, Stanford-Binet Intelligence Scale, and Reynell Developmental Language Scales, but used developmental rates because norms often were below children's level</p>	<p>Children's rate of development increased significantly as measured by the Bayley or Binet during the first 6-8 months of intervention and was maintained during the subsequent 6-8 months for both home- and center-based programs; children in the home program maintained even progress in expressive language but those in the center program had accelerated development; Both center- and home-based groups had an increased comprehension ratio during the first 6-8 months and continued a positive trend from that point</p>
<p>72 Down syndrome children in intervention group, 79 in home-reared comparison, and 33 in institutional comparison group; followed until 10 years of age; groups similar in socioeconomic status, family size, and parental age</p>	<p>Pre-post with 2 comparison groups: (1) children living at home not receiving intervention and (2) children placed in residential care prior to their second birthday; no random assignment; portions were retrospective</p>	<p>Stanford-Binet and Griffiths Scale as well as school placement information</p>	<p>The intervention group scored higher on the standardized tests particularly on personal-social and speech development; school placement suggested that early intervention helped to integrate children into the normal community</p>

(continued)

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Piper & Pless (1980)	Center-based program consisting of an interdisciplinary team with assignment of one staff member per child to be the primary therapist: Parent training provided in the form of demonstration and sets of written instructions. Normal developmental sequences provided guidelines for major objectives	Biweekly therapy sessions for 1 hr over a 6-month period; average CA for initiating treatment was about 9 months, but all children were below 2 years	Center-based for primary therapist intervention and parental demonstrations; home-based intervention between center-based sessions	Received training to provide additional and ongoing activities at home to stimulate development
Rynders & Horrobin (1980)	Center-based and home-based for preschool program; home-based only for infant program (0–30 months); center provided curriculum materials; home-based program conducted by parents using provided lesson plans, curriculum materials, and evaluation sheets; curriculum targeted concept utilization and communicative development within a developmental framework	3 intake groups; intervention duration was 5 years; age range of enrollment was 1–12 months; for infants, time spent on home lessons limited to 1 hr each day, 6 days per week; parent participants completed curriculum evaluation sheets daily; no lessons for preschool children at home except for 1 30-min reading session. Preschool consisted of a daily 5-hr program	Center-based for testing and home-based for implementation of lessons during infant program; center-based for preschool	Deliver lessons, collect evaluation data daily, help center to modify given lessons and develop new lessons for infant program; support program and provide reading experiences for 30–60-month-old children

^aAbbreviations used in the table are as follows: AAMD, American Association on Mental Deficiency; CA, chronological age; DQ, developmental

ably supported and reinforced the other, the structured program and small group or one-to-one directive activities were most characteristic of these programs. For the birth–3 years age group, the intensity of the intervention was much less demanding. Although it was often difficult to determine all of the relevant intervention parameters from the descriptions provided by the authors, intervention ranged from 2 to 6 hr per week on the average, which included both staff training time and parent-teaching activities. In addition to variations in intensity, the average duration of involvement in the program also varied extensively. Some programs were designed to be very short term (e.g., 6 months in the Piper & Pless, 1980, study), but even programs beginning in infancy were as long as 2,

Child characteristics	Experimental design	Outcome measures	Results
37 Down syndrome infants ($N = 21$ treatment group; $N = 16$ control group); mean CA of treatment group was 9.33 months, control group was 8.43; mean birth weight for experimental 2.949 g, for control 2.990 g; mean number of siblings for treatment group 0.95, control group 0.81; mean number of children with congenital heart disease in treatment group was 1.33; control group 1.38; mean number in residential care for treatment group 1.14, control group 1.06	Pre-post using random assignment according to date of admission to the program; after admission, preassessments were made using the Home Observation for Measurement of the Environment Inventory (HOME), the Griffiths Mental Development Scales, and child and family variables; mean maternal age for treatment group, 30.43, control group 29.81; no initial differences on basis of any variable (with one exception on a HOME subscale)	Griffiths Mental Development Scales; Home Observation for Measurement of the Environment Inventory	Mean developmental quotient on the Griffiths Scales declined over the 6-month period; In 2 of the 6 subscales, treatment group decreased less than control group; on the remaining 4 subscales the control group decreased less than treatment group; no statistically significant differences between the 2 groups were found
35 Down syndrome children (all trisomy 21) enrolled prior to 12 months of age; no children suffering from any serious health problems; additional criteria: (1) parental decision to raise child at home for first 5 years of life; (2) family intact; (3) maternal IQ score 90 or above; (4) parents' educational level at least 10th grade; (5) total family income at least \$6,000 (unless 1 or both parents were students); (6) parents used English as 1st language; and (7) family contained no more than 3 preschool-age children including the Down's syndrome child	Post-only (experimental $N = 17$) with specially formed distal control group ($N = 18$); all children enrolled on consecutive basis without exception if they met enrollment criteria stated earlier; comparisons on demographic, neurological, and psychometric variables at beginning of study indicated similar groups	Boehm Test of Basic Concepts; Stanford-Binet; Bruininks-Oseretsky; language samples	All children tested at 60 months; no statistically significant group differences appeared in the specified criterion variables (concept utilization and/or expressive language); however, significant differences did appear favoring treatment group in IQ score and in motor ability

quotient; MA, mental age; EI, early intervention; SQ, social quotient.

3, and 5 years (Connolly et al., 1980; Hanson & Schwarz, 1978; Rynders & Horrobin, 1980). For preschool programs, intervention typically ended at 5 years of age and rarely were any longer term follow-up efforts attempted (see Hayden & Haring, 1977; Ludlow & Allen, 1979).

It is important to note that virtually all of these "first generation" early intervention programs were experimental in nature. Services were often provided while curricula were being developed and modified continuously, and staff training and experience were very variable. In many respects, some of the more extensive intervention efforts were part of a series of demonstration projects with limited availability of well-tested instructional and curricular methods and mate-

rials. In fact, evaluation strategies and related research components were often superimposed on these demonstration programs. As a consequence, research and evaluation were not usually accorded a high priority, with limited resources being allocated to that component of the program.

Evaluation Efforts

In view of this, it is not surprising that efforts to evaluate the efficacy of these early intervention programs rarely conformed to usually accepted scientific standards. Testing and observations by independent staff, the establishment of interrater reliability, the development and use of instruments sensitive to and standardized for handicapped populations, and clear criteria for inclusion of subjects were not often found. Moreover, the random assignment of subjects to treatment conditions or the formation of appropriate contrast groups was extremely difficult to accomplish (see Chapter 1 of this volume for a discussion of these evaluation issues). As indicated in Table 1, with the possible exception of the Aronson and Fallstrom (1977), Bidder et al. (1975), and Piper and Pless (1980) investigations, most of the studies were forced to rely on means other than random assignment to determine whether their programs were effective. Often, decisions with regard to effectiveness were based upon comparisons with existing literature that traced the development of reasonably similar groups of Down syndrome children who had not received intervention. Another frequently used approach consisted of attempts to establish control groups by matching subjects in intervention and nonintervention groups on specific variables such as chronological age, developmental level, or socioeconomic status. However, in the absence of random assignment, the possibility of rival explanations accounting for any obtained differences other than those associated with intervention can never be entirely ruled out.

It is easy to be critical of the evaluation attempts of early childhood specialists, but it is far more difficult to suggest viable alternatives. Critics often belabor the point that suitable controls were not provided, thus rendering the reported outcome data uninterpretable as to program impact. Clearly the use of controls would be advantageous, but we cannot take lightly the impediments to establishing suitable comparison groups. Often ethical issues are involved. Can service legitimately be withheld from developmentally delayed or other handicapped children? The mandates of federal and state laws to identify and serve handicapped children have answered that question. Can we compare different approaches or strategies with matched groups of children? Often this is not possible because adequate numbers of similar children (e.g., same age, same family demographics, same handicapping conditions) are not available except perhaps in large metropolitan areas. Further, as noted earlier, most programs have not been provided with the necessary funds to conduct controlled evaluation in which independent testers assess the children with a variety of standardized and non-

standardized instruments. Nor do most early intervention program personnel have the necessary expertise to analyze and interpret quantitative outcomes. Finally, parents may offer barriers to the implementation of carefully controlled studies, for they may fail to appreciate encumbrances necessary for experimental research or strategies that do not appear to them to be of any immediate assistance to their child.

Without taking into account the many problems facing behavioral scientists interested in evaluating the outcomes of early intervention efforts for children with Down syndrome and those with cognitive delays in general, critics do children, parents, educators, other professionals, and the public a disservice. Unless there is some sense of rapprochement and compromise we will never move closer to the goal of achieving a meaningful evaluation of these early intervention programs. Moreover, as discussed next, despite research design limitations, a careful examination of existing studies has yielded certain consistencies and outcome patterns that allow us to establish what we believe is a strong working hypothesis with regard to the effectiveness of early intervention for children with Down syndrome. In particular, as we see it, the studies on early intervention for Down syndrome children conducted to date have provided sufficient information to enable us to provide strong recommendations on the specific issue relating to the prevention or amelioration of the reported decline in assessed cognitive ability of children with Down syndrome with increasing chronological age. Studies focusing on issues such as the relative significance of intervening during infancy in contrast to the preschool years and the importance of continuity in early intervention are unfortunately contradictory, but nevertheless provide some valuable directions for the future.

Analysis of Effectiveness

For children with Down syndrome, documentation of the decline, as well as possible explanations for the decline, in tested cognitive ability with increasing chronological age has been described in the first section of this chapter. Based on the findings of a substantial number of studies reviewed it now appears that this decline can be significantly reduced or entirely prevented during the period in which early intervention services are provided (Aronson & Fallstrom, 1977; Bidder et al., 1975; Clunies-Ross, 1979; Connolly et al., 1980; Hanson & Schwarz, 1978; Kysela et al., 1981; Ludlow & Allen, 1979; Rynders & Horrobin, 1980). This outcome held for studies that employed more global measures, such as standardized psychometric instruments, as well as more specific measures, such as achievement of specific developmental milestones or behavioral objectives. Moreover, these effects of early intervention were obtained not only for studies that were less well controlled in that only pre-post measures were obtained (e.g., Kysela et al., 1981) but were also obtained for (1) those studies with specially created control groups (e.g., Connolly et al., 1980); (2) a

well-designed study in which a carefully developed distal control group was established for comparison (Rynders & Horrobin, 1980); and (3) a rare study based on children matched on age and sex and presumably unsystematically assigned to experimental and control conditions yielding identical groups on critical factors prior to intervention (Aronson & Fallstrom, 1977; see also Bidder et al., 1975). A similar pattern of outcomes was observed for other developmental domains as well, but less consistency in the measures and corresponding outcomes was obtained.

Certainly bias in different forms cannot be ruled out entirely in any of these studies, particularly bias related to the absence of independent testers, and not all studies found that the decline could be modified (e.g., Piper & Pless, 1980; but see Bricker, Carlson, & Schwarz, 1981). Moreover, certain studies did not achieve results that corresponded to the programmatic emphasis of their program (see absence of language effects in Rynders & Horrobin, 1980). Nevertheless, the consistency of reported results as well as corresponding progress on process variables such as achievement of specific educational and developmental objectives in many of the studies is impressive.

The contention that early intervention programs for children with Down syndrome can have the effect of preventing the typical decline in intellectual functioning has received additional support in a study by Berry, Gunn, and Andrews (1984). In an important longitudinal investigation, these researchers independently evaluated at periodic intervals the development of 39 home-reared Australian-born Down syndrome children during the first 5 years of their lives, using the Bayley Scales of Infant Development and the Merrill-Palmer Scale as outcome measures. All children in the sample were drawn from a variety of early intervention programs operated by public and private agencies, programs that were not under the authors' control. Assessments of this sample revealed that across the first 5 years of life, the Down syndrome children gained steadily in mental age—gains that remained proportional to chronological age, i.e., no decline or plateau was observed. The authors state, "Perhaps the main effects of better services, which have become more widely available in the 1970s and early 1980s, are to stabilize development in Down's syndrome infants and toddlers and to provide a paradigm for consistent progression for these young children whatever their levels of ability" (p. 176). Similar outcomes have been reported for a large sample of Down syndrome children from birth to age 3 in the northeastern United States (Reed et al., 1980).

In contrast to findings related to the prevention or even elimination of the decline in cognitive test scores, only limited information is available with regard to the issues of the continuity and timing of early intervention, and much of it is contradictory. Aronson and Fallstrom (1977) have provided evidence as to what happens when intervention is discontinued. Specifically, a 1-year follow-up of their successful intervention program suggested that differences between inter-

vention and control children would be greatly diminished if the supportive environmental conditions were not maintained. In contrast, Connolly et al. (1980) reported that follow-up of children who had completed an early intervention program by 3 years of age still appeared to maintain most of their original gains approximately a 1½ years later and again 4 years later (Connolly, Morgan, & Russell, 1984). Because these studies differed on so many dimensions, including the potential for bias due to selective attrition of subjects, it is not possible to determine the sources of these contradictory findings.

The corollary issue of whether intervention is more effective if begun during infancy than if begun during the preschool period is equally contradictory. The Clunies-Ross (1979) data suggest that those children beginning intervention earlier are more likely to achieve higher developmental scores. Apparently what happens is that the younger children begin at an initially higher level (presumably prior to the usual declines) and whatever effects of early intervention that do occur remain proportional to that initial level. There were no indications, for example, that the development of children enrolled in early intervention after 2 years of age was accelerating at a level that would allow them to reach the same level as those beginning intervention earlier. These results are at best suggestive, as later enrollment may well be confounded with other factors such as parental motivations. Moreover, the absence of any effects of early intervention in the Piper and Pless (1980) study, which enrolled children at an average age of about 9 months, clearly suggests that the question of timing must await the findings of more extensive and more carefully designed systematic research.

OUTCOMES FOR CHILDREN WITH OTHER BIOLOGICALLY BASED DELAYS

We now turn to an examination of the effects of early intervention for an etiologically heterogeneous group of developmentally delayed children whose delays have a clear or presumed biological basis. It should be observed at the outset that this heterogeneity adds additional complexity and variability to the analysis of the effects of early intervention. Nevertheless, a series of 14 studies have been conducted that met our criteria and are summarized in Table 2.

As might be expected, the addition of significant numbers of severely and even profoundly handicapped children to early intervention programs created new challenges in the areas of curriculum development and evaluation. Because so many of these children had associated disorders such as cerebral palsy and sensory handicaps, the problem of providing effective early intervention programs became extraordinarily demanding. The often minute, detailed, step-by-step procedures required for appropriate intervention for this population of handicapped children were rather remarkable. Moreover, many programs served an

TABLE 2

Summary of early intervention studies for children with other biologically based delays^a

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Barna, Bidder, Gray, Clements, & Gardner (1980)	Used adaptations of Portage Project materials as curriculum guide for home training (see Shearer & Shearer, 1976)	Home visits within the Portage model varied from 5 to 25 months (duration of intervention)	Home-based	Parents responsible for administering intervention program, data collection, and collaborating with home visitors
Barrera, Routh, Parr, Johnson, Ahrendhorst, Goolsby, & Schroeder (1976)	Interdisciplinary team approach; 5 areas of treatment were included: gross motor, fine motor, language, perceptual-cognitive, and personal-social; developmental activities were eclectic, drawn from diverse sources	Center program met twice weekly for 3 hr; approximately 30 min was scheduled for each of the specific intervention activities; 1-to-1 training with observer for recording; program was evaluated over a 3-month period	Center- and home-based	Recipients of counseling services and specific training to continue treatment programs at home
Brassell & Dunst (1978)	Home-based program providing infants with sequential intervention experiences; multidisciplinary instructional approach and interdisciplinary team recommendations used to implement the program. Object-concept curriculum was primary focus of study and covered 6 sequential levels of functioning paralleling Piaget's 6 ordinal stages of sensorimotor development	Length of total program 4-5 months; home training demonstrations by staff once per week (1½ hr)	Home-based	Implementation of the demonstrated programs; treatment procedures carried out within the context of play and with materials available at home

Child characteristics	Experimental design	Outcome measures	Results
Although many different groups were part of this study, the focus here was on the 15 children diagnosed as developmentally delayed (exclusive of Down syndrome); prior to intervention, mean monthly gains in mental age were 0.61; no other information available	Pre-post testing without a control group; estimates of impact based on rate of progress during time in program in comparison to rate prior to program	Griffiths Mental Development Scales assessed at entry into the program, during program midpoint, and latest scores available; scores based on mental age gains per month	Delayed children increased their mean monthly rates of mental age growth from .61 to .72 after intervention; greatest gains were noted in the hearing-speech and performance sections of the Griffiths; considerable variability among children noted; no relationship was obtained between age of entry into program and rate of development; no statistical analyses provided
Total of 10 moderately and severely delayed children with varying etiologies; CA range 13-48 months with mean of 26.82 months; average functioning levels of evaluated areas range from 10-14 months; 3 children had lowest area in gross motor, 3 in language, 3 in perceptual-cognitive, 1 in fine motor; all had additional handicapping conditions	Variation of multiple baseline design; each child received treatment in lowest area of development plus 2 randomly selected areas; comparisons made to untreated domains (control areas)	Memphis Comprehensive Developmental Scale	Seven children completed at least 15 sessions over a 2-3-month period; when reevaluated the children were found to have made 6.43 months of progress in the areas selected as the lowest level of functioning, 2.43 months of progress in the randomly selected treatment areas, and 1.68 months in control areas; differences were not statistically significant between experimental and control areas, but progress in the lowest area of functioning was reliably higher than the other 2
Total number of children 91 infants (52 males, 39 females); 24 in experimental group, 67 in control group; heterogeneous group ranging from normal to profoundly retarded and from no motor dysfunction to severe motor dysfunction (over 65% of the children were mildly, moderately, or severely delayed); mean age of mother 26.8 years, 28.9 years for father; mean years in school for mother 11.0, 10.9 years for father; mean monthly gross income \$632	Pre-post with nonrandom controls; no differences between control and experimental groups on object-concept test prior to intervention; control group received general intervention but not object-concept curriculum	Scale I of the Uzgiris-Hunt Scales	Mean posttest scores for experimental group was significantly higher than control; pretest scores were used as a covariate

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters -	Setting	Role of parents
Bricker & Dow (1980)	Center-based model demonstration program; an interdisciplinary team approach was incorporated into the program; curricula areas included cognitive, communication, motor, and social/self-help; training lattices were constructed for first 3 domains by developmentally sequencing the instructional content based on order of acquisition; social/self-help behaviors incorporated into daily routine; instructional strategies were primarily behavioral in nature; strong emphasis on evaluation	Intervention began after the child entered program, was evaluated, and an IEP formulated; length of the total intervention program was 1 year, 5 days per week, 6 hr per day	Center-based, teaching staff and parents provided majority of direct instruction; support staff served as consultants; specialists conducted evaluations	Parents were involved in the areas of educational training, social services, and counseling; roles of both parents and program were specified in an individual contract
Bricker & Sheehan (1981)	Programs focused educationally on fine/gross motor, social/self-help, sensorimotor, and communication skills; large- and small-group instruction, individual intervention where necessary; interdisciplinary team approach; Center-based with home-based services to assist parents with moderately and severely handicapped children	Center-based instruction operated 5 days per week 2½ hr per day; 15-20 instructional activities initiated daily; home-based program consisted of weekly 1-hr visits to the home by interventionist; support specialists consulted as necessary; both programs began in the fall of the year and concluded in the spring (9-month span); overall 3-year project	Center-based (6 classrooms); all but 2 included at-risk and nonhandicapped peers in addition to handicapped children; home-based for children whose handicapping conditions ranged from moderate to severe	Individual instruction and/or participation in large and small groups (e.g., educational, social service, advocacy); parent implemented program activities, collected data, and developed skills to promote child's development

Child characteristics	Experimental design	Outcome measures	Results
Total number of children 50 (25 males, 25 females), age range for target population 7–54 months; mean age at program entry 27.6 months; 35 of 50 children severely or profoundly retarded, 13 moderately retarded, 1 each was mildly or not retarded; cultural, occupational, educational, and socioeconomic backgrounds varied widely	Pre–post with no controls; children were administered different numbers of performance tests dependent upon length of enrollment, at approximately 3-month intervals; number of administrations 2–6; minimum enrollment in program per child 8 months	Uniform Performance Assessment System (UPAS)	A summary of results for 40 children enrolled at least 8 months showed statistically significant improvement in each of the 4 domains (see curricula areas) and in the overall score in terms of the percent of items passed on the UPAS; at termination of program 88% of the children were placed in public schools, 4% in group homes, 2% in Head Start programs, 6% in other programs within same school
91 children participated in the evaluation; Age range at start of program was 5 months to 7 years; heterogeneous population ranged from normal to severely handicapped; some children had more than one impairment and 10 were nonambulatory; level of education for mother and father ranged widely; annual income ranged from under \$5,000 to over \$26,000	Pre–post without control groups; formal assessments conducted on all children in center-based program who met a 7-month interval criterion between pre- and posttest	Uniform Performance Assessment System (UPAS), Student Progress Record (SPR), Bayley Scales of Infant Development, and McCarthy Scales of Children's Abilities	For Bayley scores (CA at initial administration was approximately 18 months, $N = 35$, for this young group), mental age and psychomotor equivalent scores increased significantly although mean developmental indexes did not; all subgroups did show change except for children with severe delays; McCarthy scores for 56 older children (mean CA approximately = 46 months) showed significant increases for both MA and the general cognitive index (GCI); Mildly and moderately delayed groups showed these changes in one year of the program but not in another for GCI; MA differences were statistically reliable in all instances; all children in all groups showed reliable progress on the UPAS

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Goodman, Cecil, & Barker (1984)	Families in treatment group attended a hospital-affiliated program; teacher demonstrated techniques to parents; home visits provided by staff on as-needed basis; input received from different disciplines; educational program focused on broad developmental processes, such as imitation, sequential ordering, awareness of space, etc., but not specific skill acquisition; family counseling available	Families in treatment group attended programs between 2-5½ days per week; individualized lessons provided by staff; average length of program was 16 months	Center-based with occasional home visits	Received training but parents considered primary therapists
Moore, Fredericks, & Baldwin (1981)	Because study was retrospective, no details of the preschool intervention programs were provided; however, based on assessment instruments and prior work of the authors, programs were likely sequentially organized, directive, and behaviorally based	No details of preschool experience nor elementary school programs were provided	Center-based with an unspecified home component likely	Not specified

extensive range of developmentally delayed children in terms of both level of severity and chronological age, thereby creating a number of difficult organizational problems for interventionists.

Despite these increased demands, the curricular models were found to be highly similar to those for children with Down syndrome; that is, in utilizing a developmental framework to guide educational and developmental objectives in conjunction with a behavioral teaching technology. Some models even became standardized and were disseminated to other programs. For example, the studies by Revill and Blunden (1979) and Barna, Bidder, Gray, Clements, and Gardner (1980) used the Portage model (Shearer & Shearer, 1976). Others developed detailed training lattices linking one developmental objective to another, ensuring that the hierarchical and sequential nature of developmental processes were followed (Bricker & Dow, 1980). In contrast, some of the programs reviewed appeared to put together a loosely structured array of activities drawn from

Child characteristics	Experimental design	Outcome measures	Results
Children (treatment, $N = 35$; contrast, $N = 36$) had a wide range of confirmed or presumed biologically based delays; mean CA for all children was approximately 3 years (range 15 months to 5 years); families on welfare constituted 56% of the sample; mean IQ for treatment group was 55.6, for contrast group 59.3	Treatment group matched retrospectively to a contrast group selected on basis of initial age, IQ, and SES; treatment families must have been willing to participate and be included in program activities; however, 29 of the 36 contrast children did attend community programs that provided general support and care; testers not blind to group membership	Bayley Mental Scales of Infant Development or Stanford-Binet; ratio rather than deviation IQ scores used for Bayley	Treatment children significantly higher than contrast children during posttesting; mean gain was 8.1 versus 0.8 IQ points; 11 children in treatment group but only 2 in contrast group improved 15 points or more; children in particularly difficult home circumstances improved the most
Total number of children included was 151 (52 9-year-olds, mean age 103.6 months; 50 10-year-olds, mean age 119.8 months; and 49 11-year-olds, mean age 133.9 months); all children were moderately or severely retarded	Retrospective study comparing elementary age children (9-, 10-, 11-year-olds) who had 0, 1, or 2 or more years of preschool experience within a state-wide system; no control exerted over subjects who had different years of preschool experience; children were evaluated across three 1-year time periods	Student Progress Record	Results of students' performance indicated significant differences at ages 9, 10, and 11 in language, academic, self-help, and motor skill performance in favor of those who had at least 2 years of preschool experience

(continued)

numerous sources or failed to provide sufficient information with regard to the nature of those activities (e.g., Sandow, Clarke, Cox, & Stewart, 1981). Interestingly, most of the early intervention programs included in this analysis were part of larger scale systems providing services to a wide age range of children with widely varying levels of severity and etiologies. When studies did focus primarily on children with multiple handicaps (e.g., Barrera et al., 1976; Shapiro, Gordon, & Neiditch, 1977), the programmatic structure and goals were considerably different from those of the more broadly based intervention programs.

Parental involvement through home-based models was clearly a high priority for most of the studies, even for preschool-age children. Specialists were responsible for demonstrating techniques to parents and providing materials, suggestions, education, and support, but parents were often found to be the primary service providers. Models containing a strong center-based component (e.g.,

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Moxley-Haegert & Serbin (1983)	Home treatment of five skill-related exercises similar to those of Hanson & Schwarz (1978); developmental areas involved included fine and gross motor skills, language, spatial awareness, and object permanence; parents taught by therapist at pediatric service how to use materials and maintain records; developmental education group parents (see design section) also received special training to observe and detect progress of their child, to recognize the sequential nature of development, and to anticipate next milestones for their child	Materials supplied by program; parents were asked to carry out the exercises daily for one month; home visitors met once per week for first 3 weeks for all but control group	Home-based but training of parents took place at pediatric service	Primary service provider in home; parent used materials provided, maintained a journal, and recorded any developmental gains
Nielsen, Collins, Meisel, Lowry, Engh, & Johnson (1975)	Transdisciplinary approach; eclectic programming (primarily developmental in orientation) provided in area of sensory stimulation, language (encouraging vocalizations, imitation), motor development (neurodevelopmental methods), prespeech, and feeding domains	Varied with age of child; Home visits made once per week from birth to 3 years; occasional center-based individual sessions; parent-infant group children less than 1 year and new to program; Parents spent 1 hr per session with staff, child worked with other staff; group program: for CA 12-18 months, 3 hr, 4 mornings per week (attendance varied from 2 to 4 mornings per week with each child); total length of program 12 months	Home- and center-based	Primary change agent; support center-based programs

Child characteristics	Experimental design	Outcome measures	Results
<p>39 children (mean CA = 21.5 months) scoring at least 1 standard deviation below the mean on either the Bayley Mental Development Index (MDI) or the Psychomotor Development Index (PDI) were included; the 13 children in each of three groups (see design section) consisted of 6 severely (Bayley score less than 50) and 7 moderate to mildly delayed (Bayley score 50–80) children; varied etiologies; mean age of parental education 11.33 years; all three groups were similar in the Home Observation for Measurement of the Environment Inventory (HOME) scores and parent education level</p>	<p>Children of parents in the home treatment program were matched according to severity of delay and assigned randomly to 1 of 3 treatment groups: (1) a developmental education group which parents received training to help them recognize small gains in their child's development; (2) an education in child management group providing general information and social reinforcement similar to the treatment group but not specific to delays; and (3) a control group not receiving any intervention</p>	<p>Bayley Scales of Infant Development, a developmental knowledge test for parents, parent participation measures in home program, and skills specified to be taught; the assessment schedule consisted of pretreatment, a 1-month assessment, and a posttreatment assessment carried out 9–15 months later; specific assessments varied at these three time periods; assessors were not aware of which experimental condition was assigned to each family</p>	<p>At the 1-month assessment, amount of participation, knowledge of development, and accuracy of recognizing developmental gains of their children by parents in the developmental education group was significantly greater than either of the other two groups on most measures; similarly, children in the developmental education group learned more of the prescribed skills than either of the other 2 groups; on the Bayley scales, the developmental education group made greater improvements on the motor scale but not the mental scale; at follow-up, more parents in the developmental education group continued to be involved in their child's treatment program and significant gains in motor development were maintained at 1-year-follow-up; no group differences were obtained with regard to cognitive development at follow-up</p>
<p>Age range 0–3 years; 16 of 19 children participated in the evaluation using the Bayley; all 19 received The Denver Developmental Screening Test (DDST); varied etiologies and severity of developmental delay; mean CA at entry to program was 14.1 months (MA = 8.3 months)</p>	<p>Pre–post with no controls</p>	<p>Bayley Scales of Infant Development and Denver Developmental Screening Test (DDST)</p>	<p>Data showed a mean gain of 3.7 months in mental age and 3.9 months in motor age during the 5.4 mean months between first and second administration of the Bayley; no statistical tests provided; changes in mean age equivalents on DDST were statistically significant for the first 6 months but no further gains during the second 6 months</p>

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Revill & Blunden (1979)	The Portage Project model was applied (see Shearer & Shearer, 1976) involving weekly home visits and collaborative staff-parent goal setting and selection of educational activities	Weekly visits by home trainer for a period of 4 months	Home-based	Provide primary service, collect data, and monitor child's progress
Safford, Gregg, Schneider, & Sewell (1976)	Center-based program focusing on appropriate sensory experiences with minimal failure or frustration for both child and parent; interdisciplinary team approach and a 1-to-1 staff-to-child relationship was maintained; primary objective was to make child less irritable and easier for parent to manage; related objectives included increased verbal reactions, eye contact, and attending; relaxation, desensitization, feeding, and sensory stimulation activities were provided	One classroom with six children; five sessions (relaxation, sensory, relaxation, feeding, exploration) conducted each day; total length of program 6 months	Center-based	Facilitated carry-over of activities through staff offerings of specific suggestions mostly relating to positioning and feeding
Sandow, Clarke, Cox, & Stewart (1981)	Individualized learning programs were designed by experimenter and parents; no additional details were provided	Maximum program involvement over 3 years; for one intervention group, home visits occurred at 2-week intervals for 2-3 hr per visit; a second intervention group received a similar visit every 2 months; a matched distal control group did not receive any visits	Home-based	Primary service provider in conjunction with experimenter

Child characteristics	Experimental design	Outcome measures	Results
19 subjects from 2 geographic areas meeting the following criteria were included in the study: CA less than 4.5 years, child not attending nursery school more than 5 half-days per week, and child scored 78 or below on at least 2 subtests of the Griffiths Mental Development Scales; no other information provided	Pre-post without a control group; in addition, one of the two geographic groups entered the program with a planned delay of 2 months, allowing multiple baseline comparison of impact; baseline data were extensive	Pre-post measures taken weekly by home visitor for each designated skill; monthly recording of development on Portage checklist carried out in child's home; administration of the Griffiths Mental Development Scale at 2 months and again at 4 months	Both geographic groups completed nearly 90% of the tasks that were agreed on; Comparisons between pre-entry (baseline) and monthly assessments following entry into program on the number of Portage checklist skills gained per month revealed a substantial increase following program entry for each group; Griffiths scores showed limited and variable gains for either group; no statistical tests were presented
Total number of children 6 (5 male, 1 female); age range at onset of program was 20-45 months; IQs on Cattell Infant Intelligence Scale were 24, 28, 35, 40, 47, and 70; most children were irritable with poor eating and sleeping habits; Some rejected body contact, were self-stimulating, and self-abusive	Pre-post with no controls	Cattell Infant Intelligence Scale and Houston Test of Language Development	Gains across the 6-month period in assessed functional age equivalence in gross motor functioning occurred for all children (average age gain of 1.9 months); average gain in language age was 1.8 months; strong individual gains measured in perceptual and fine motor areas; no tests of statistical significance provided
32 severely delayed preschool children with a mean CA of 2 years 6 months and a mean MA of 1 year 3 months participated; wide range of SES and etiology; children remained in program until the age of 4 years 8 months; A matched group of 15 additional children were selected from a different community	2 matched intervention groups varying in frequency of home visits were evaluated on pre-post measures at annual intervals; a matched distal control group (no intervention) was also established	Assessments on the Cattell Infant Intelligence Scale occurred at program entry and at annual intervals thereafter; the Vineland Social Maturity Scale and specific criterion-referenced instruments were administered but not considered in the evaluation in detail	Both intervention groups gained in the Cattell at different rates but by the 3rd year both exceeded gains of the distal control. No differences were obtained between the 2 intervention groups on this measure

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Shapiro, Gordon, & Nieditch (1977)	Program based on developmental–interaction approach involving cognitive and motivational components; measured 8 dimensions of behavior	Children and their families participated in intensive stimulation program for a period of approximately 3 months as in-patients in a rehabilitation center	Center-based (in-patients at medical center)	Required to spend 1 full day per week in active participation at the center
Shearer & Shearer (1976)	Emphasis on self-help, motor, socialization, cognitive, and language domains; interdisciplinary program staff (all home teachers); precision teaching model followed; goals are developmentally sequenced using detailed behavioral objectives; curriculum cards and manuals guide and suggest educational activities	All instruction took place in home; home teacher writes activity and data collection charts, and models activities once per week for 1.5 hr per child; up to 3 activity plans written or modified per week; no prescribed frequency or intensity for parental instruction noted but strong encouragement for parents; project evaluated children within an 8-month period	*Home-based	Main change agent for child who also collects data and participates in selection of target behaviors

*Abbreviations used in the table are as follows: CA, chronological age; MA, mental age; SES, socioeconomic status.

Bricker & Dow, 1980) typically provided counseling in addition to working with parents to extend developmental programs to the home that were part of the center-based activities. For home-based programs, staff usually visited or consulted with parents on a weekly basis. During interim periods, parents were asked to carry out various activities as often as possible to try to meet certain mutually agreed-upon objectives prior to the next visit. Accordingly, the exact amount of intervention time that actually occurred could not be precisely determined in these models. In contrast, center-based models scheduled groups 2–5 times per week that ranged from 3 to 6 hr per day. Finally, the duration of early intervention programs was highly variable. Although some were evaluated across a relatively long intervention period of as much as 25 months (Barna et al., 1980), virtually all were shorter term programs, typically less than 12 months in duration.

Child characteristics	Experimental design	Outcome measures	Results
60 multiply handicapped children whose ages ranged from 18 to 36 months; medical diagnoses included cerebral palsy, spina bifida, and delayed development; no other information provided	Pre-post comparisons with no controls of coded anecdotal records maintained for each child	Anecdotal records by teachers written 3 times per week; logs coded on scales in the areas of interaction with materials, social responsiveness, expressive language, awareness of the environment, affect, gross and fine motor activity, and sensory responsiveness	Pre-post score differences indicated that the children were more responsive and functioning at a higher level in most areas coded than when they first entered the program; major areas not statistically significant included interaction with materials, fine motor activity, affect, and sensory responsiveness
Target population ranged from high risk to severe/multiply handicapped (birth to 6 years); average IQ 75; no other information available	Pre-post with no controls	Cattell Infant Intelligence Scale, Stanford-Binet Intelligence Test, Alpern-Boll Developmental Profile	Average child gained 13 months on developmental tests in the 8-month period; statistically significant gains were obtained on the Alpern-Boll (mean gain = 13.5); on the Stanford-Binet mean gain was 18.3 IQ points, also statistically significant

Analysis of Effectiveness

The difficulties in conducting meaningful evaluations that meet established scientific standards, discussed earlier in the section on children with Down syndrome, apply equally to early intervention programs for children with other biologically based delays. In fact, the group of studies that met the criteria for review in this section appeared to be much less sophisticated and less credible from a scientific perspective than those studies reviewed that focused exclusively on children with Down syndrome. With minor exceptions (e.g., Moxley-Haegert & Serbin, 1983) no effort was made to utilize independent observers or evaluators who were unaware of the intervention status of the children or families. Similarly, interrater reliability was rarely established, and many of the assessment instruments selected did not seem to have the capacity to be sufficiently sensitive to the range and complexity of delays exhibited by these children. Finally, as will be discussed, despite some creative efforts to establish control or

contrast groups, the overwhelming majority of studies relied on the least sophisticated experimental designs in order to evaluate the impact of their program.

Certainly, as described in Chapter 1 of this volume, these problems are part of the larger methodological and ethical problems faced by investigators seeking to conduct intervention research for handicapped populations. However, difficulties in experimental design for this particular group of studies may also be a reflection of the added burden of providing intervention services and developing instrumentation for such a heterogeneous group of children. This drain on already scarce resources was likely to have left limited support available for research and evaluation. Moreover, it is important to note that, in contrast to the programs for children with Down syndrome, very few studies were available that had systematically traced the general course of development for this diverse group of children in a manner useful for evaluation. As described in the first sections of this chapter, documentation of changes in measured cognitive skills with increasing chronological age obtained for children with Down syndrome were simply not available for children with other biologically based delays to serve as a framework for interpreting the outcomes of early intervention programs. In particular, the absence of these developmental expectations makes any appeal for effectiveness based primarily on changes in rates of development subsequent to program services less compelling.

These difficulties are reflected in the finding that a substantial number of studies compared changes from pre- to post-intervention without the benefit of a control group (Barna et al., 1980; Bricker & Dow, 1980; Bricker & Sheehan, 1981; Nielsen et al., 1975; Safford, Gregg, Schneider, & Sewell, 1976; Shapiro et al., 1977; Shearer & Shearer, 1976). In essence, these programs had no other alternative but to appeal to changes in the rate of development (such as number of months in mental age gained per unit of time as reflected in proportion measures or more directly in IQ scores) that coincided with the provision of early intervention services. The outcomes of these studies ranged widely, with one (Barna et al., 1980) not reporting any statistical analyses of their data at all and one claiming rates of development for children in the program to be nearly twice that prior to entry (Shearer & Shearer, 1976). Findings of the remaining programs were more modest (see Table 2) but nevertheless did indicate an increase in the rate of development sufficient in many instances not only to prevent any further disparities with normally developing children but also to be capable of reducing the differences to some small extent. An interesting variation of this pre-post design was a study reported by Revill and Blunden (1979) in which a geographically matched group postponed entry into the program for 2 months. Rate changes in the number of curricular skills gained did coincide with entry into the program, but gains for both groups on a standardized intelligence test were minor.

Four studies did attempt to form contrast or control groups in some manner to

enable them to make certain comparisons but random assignment was not possible. Goodman, Cecil, and Barker (1984) matched their treatment group retrospectively with children in community programs; Sandow et al. (1981) employed a distal control group presumably not receiving services; Brassell and Dunst (1978) compared the performance of experimental-group children to those not recommended for a specific form of intervention; and Barrera et al. (1976) used subjects as their own controls in a variation of a multiple-baseline design. Again, modifications in development as a result of early intervention were relatively modest, although Goodman et al. (1984) did report a mean gain of approximately 7 points on standardized intelligence tests above that of their contrast group. As noted earlier, each of these design strategies is fallible and their conclusions must be viewed accordingly.

The remaining prospective study was primarily concerned with evaluating the effectiveness of a particular type of parent education program utilizing both parent and child change measures (Moxley-Haegert & Serbin, 1983). This very well designed and executed study included a randomly assigned control group not receiving any intervention services. Comparisons on the Bayley Scales of Infant Development revealed reliable differences in favor of the treatment group on the motor but not on the mental scale after 1 month (average increase over control group was approximately 6% above pretest level), which was maintained at a 1-year follow-up.

Although most of the early intervention programs served children with widely varying degrees of severity of developmental delay, it was not generally possible due to insufficient numbers of children to distinguish whether proportional gains were made by subgroups classified by level of severity. Data from Bricker and Sheehan (1981) did, however, suggest that where developmental gains did occur, groups of severely, moderately, and mildly delayed children all showed relative increments in development. Proportionally small gains were reported for programs specifically devoted to severely delayed and multihandicapped groups (Barrera et al., 1976; Bricker & Dow, 1980; Safford et al., 1976; Sandow et al., 1981; Shapiro et al., 1977). Moreover, Bricker and Dow (1980) found that for a group of predominantly severely and profoundly delayed children pretest scores were the best predictors of posttest scores. Similar correlations for a much more heterogeneous group were also high between pre- and posttests, but pretest scores were not correlated with change scores (Goodman et al., 1984). In addition, in this latter study greater improvement occurred for children who were in highly stressed home environments.

It should be noted that substantial gains in curriculum related skill areas as measured by corresponding criterion-referenced type instruments were reported by many programs—gains that seemed reliable and correlated with entry into the program (Bricker & Dow, 1980; Bricker & Sheehan, 1981; Moxley-Haegert & Serbin, 1983; Revill & Blunden, 1979; Shearer & Shearer, 1976). These changes

should be considered important as they stand. At the same time, however, it is unclear whether the curriculum-based skills taught by prescribed instructional procedures produced generalized sets of skills and abilities. If standardized tests of general cognitive functioning reflect aspects of these generalized skills, then generalized gains must be considered modest. In fact, two studies found limited relationships between skill-related improvements and gains in general cognitive development (Moxley-Haegert & Serbin, 1983; Revill & Blunden, 1979).

It is certainly possible that the absence of these relationships and the modest gains found in the studies reviewed in this section in terms of standardized tests of general development may reflect an insensitivity of the instruments to detect important changes, as most of the tests were not designed for children with significant delays. In fact, the development of meaningful and appropriate evaluation instruments for many groups of handicapped children remains a major task for the future. It is also possible that important changes were occurring in domains not measured in the early intervention program evaluations. Improvements in social competence, emotional stability, motivational characteristics, parent-child relationships, and overall family functioning—all important potential outcomes of early intervention—were not systematically assessed (see Outcome Measures column in Table 2). Similarly, little is known about the longer term impact of early intervention. A retrospective analysis of children now of elementary school age comparing groups with varying degrees of preschool experience did yield positive relationships in support of the value of early intervention, but methodological problems make it very difficult to weigh this outcome strongly (Moore, Fredericks, & Baldwin, 1981). A 1-year reevaluation following termination of specific services did, however, indicate that gains could be maintained (Moxley-Haegert & Serbin, 1983).

Summary for Children with Other Biologically Based Delays

In the studies meeting the criteria for inclusion in this section of the review, reports of successful efforts to teach curriculum specific skills were widely noted, and parents were relied upon to provide vital, direct intervention services in most instances. However, reported gains in more general areas of development, especially cognitive domains, were more modest and the studies yielded little information as to the specific characteristics of either programs or children that might produce the most substantial benefits. As noted earlier, the heterogeneity of developmental delays and accompanying disabilities for this group of children may well have been responsible for the unusual experimental design and curriculum development problems experienced by this group of early intervention programs. Although some investigators were extremely clever in developing

designs that strengthened the link between programmatic efforts and developmental changes, a substantial proportion of programs were forced to rely on less sophisticated approaches. There were numerous signs from this literature that early intervention programs were having an impact but the difficulties noted earlier, the narrow focus of most outcome measures, the lack of follow-up, and the considerable instrumentation problems prevent us from going beyond these most tentative of statements.

Finally, the inclusion of a substantial number of children with severe and profound delays raises the issue as to what constitutes meaningful change for this subgroup of children. To some extent, of course, value judgments enter into all of our decision making in this field, but the impact and ultimate value of short-term changes in the development of severely and profoundly delayed young children occurring as a result of early intervention has been questioned in many quarters. Although it is beyond the scope of this chapter to discuss this issue in detail, it is important to note that a number of studies have reported benefits to these children that appear to have potentially important developmental and functional significance (Barrera et al., 1976; Bricker & Dow, 1980; Safford et al., 1976; Sandow et al., 1981). Follow-up studies of the long-term effects of early intervention efforts in relation to the impact of these programs on later life activities will be necessary to help evaluate this complex issue.

CONCLUSIONS AND RECOMMENDATIONS

Early intervention programs for children with general developmental delays are prominent features of contemporary service systems for young handicapped children. As we have seen (see Chapter 1 of this volume), there appears to be a logical and developmentally sound rationale for providing such services, but, of course, it is essential to examine empirically the extent to which the goals of early intervention programs have been accomplished. No attempt will be made in this section to summarize in any detail the numerous studies reviewed in this chapter, as summary statements have been presented at many points as part of the preceding analyses. However, we do feel that, despite the many problems associated with the evaluation of early intervention programs for developmentally delayed children, this review has many implications for the practitioner as well as for program and policy designers, researchers, parents, and evaluators.

Perhaps the most important implication these findings may have for health professionals, educators, parents, child development specialists, other practitioners, and policymakers, is the perspective they provide on early intervention issues. Specifically, this review has clearly not been an effort to arrive at a consensus opinion, as it would certainly result in oversimplifications and overex-

tensions, given the nature of existing research. Nor has it been an effort to present a devastating critique of published work—a task all too easy to accomplish. Rather, this review may be of special value in providing a sense of what to expect realistically in terms of developmental gains from intensive and extensive involvement in early intervention programs.

In particular, claims of utter failure of early intervention as well as claims of incredible success for the group of children described in this chapter can now be more critically appraised. Neither is accurate. There is, however, reason to project confidence that the decline in measured intelligence with increasing chronological age common to children with Down syndrome can be prevented and to some extent reversed. As we have seen, this was a generally consistent finding, holding across many different types of experimental designs and programs. It was the convergence of different sources of information that was perhaps most convincing. Unfortunately, for children whose delays could be attributed to a biological basis other than Down syndrome, the evidence was less satisfactory. As noted, the heterogeneity of the population and other factors resulted in less sophisticated designs overall, raising important questions about both the internal and the external validity of the findings. Nevertheless, the consistency of the results, even for the better controlled investigations, suggests that early intervention programs for these children may well have an effect of about the same order of magnitude as those directed toward children with Down syndrome, but with much more variability in the possible outcomes.

To some readers of this review the range and magnitude of outcomes that can be realistically expected to occur due to systematic early intervention will be disappointing, as no evidence can be found to support expectations for radical and dramatic changes. To others, these results will suggest that promising but yet tentative optimism with regard to achieving a meaningful impact on the lives of young developmentally delayed children through early intervention programs is the most reasonable position to maintain. Still others perhaps may see these outcomes as a confirmation of the power of biological determinism or the ineffectiveness of intervention procedures that are experiential in nature.

In our view, the second position—that early intervention is indeed a promising strategy, one that has in fact demonstrated its ability to produce consistent positive changes in the development of young delayed children—is most compatible with the facts. Aligning ourselves with this position seems especially appropriate when the entire early intervention enterprise is placed in perspective. In essence, the evaluation of impact was based upon a series of “first generation” early intervention programs. Curricula were being written and tested, administrative procedures were being developed, techniques for incorporating the input from many disciplines were being refined, and team-process strategies were being explored; often while services were being delivered. Moreover,

personnel preparation programs providing specialists to work with these children were limited, and many staffs were faced with a difficult on-the-job training experience. Finally, the measurement strategies were often questionable and restricted primarily to direct child change measures.

Whether better trained and experienced personnel, refined and well-tested curricula, as well as other strategies and resources designed to improve the quality of early intervention services will yield corresponding improvements in outcomes is a vital question for the future. Initial results suggest that this task should be actively encouraged. A fair appraisal for purposes of public policy as well as for individual decision making by professionals and parents regarding early intervention for developmentally delayed children must await the outcomes of a next generation of programs. In this next phase, researchers, evaluators, and program designers should seek to achieve a more enlightened family partnership and recognize more completely the implications of a broader ecological approach to intervention (Bronfenbrenner, 1977). It appears to be especially important to consider dimensions such as social support networks (Friedrich & Friedrich, 1981; O'Connor, 1983). Moreover, it may be helpful in subsequent programs to take a somewhat less directive and perhaps less artificial approach to intervention than that described in existing studies, relying more on the integration of intervention activities within the natural flow of family and school events. In addition, we recommend that measurement systems be expanded beyond primarily cognitive measures to assess potentially important outcomes of early intervention that have been generally excluded to date. Of particular importance are measures of social competence, motivation, family functioning, and problem-solving skills.

Of course, these recommendations do not resolve the basic difficulties inherent in conducting early intervention research for developmentally delayed children. The experimental design issues and strategies for extending evaluation beyond the short-term focus, characteristic of almost all the prospective studies reviewed, remain major barriers. Some suggestions for improving our experimental designs and establishing a meaningful data base for developmentally delayed and other groups of young handicapped children are described in the final chapter of this volume. Perhaps as these procedures are applied and additional studies are forthcoming more specific issues such as the relative value of early versus later intervention, the optimal intensity of programming, and determinations of which children are likely to benefit from specific early intervention approaches can be meaningfully addressed. Despite the fact that even tentative answers to these more detailed questions are not possible at this time, we are encouraged by the initial efforts of the studies analyzed in this review and look forward to the design and analysis of subsequent generations of early intervention programs for children with general developmental delays.

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Chapter 4

The Effectiveness of Early Intervention for Children with Cognitive and General Developmental Delays

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INTRODUCTION

Young children who exhibit significantly delayed rates of cognitive development are the focus of this chapter. Despite wide variation in etiology (see Chapter 1 of this volume) and in course of development for this highly heterogeneous group of children, delays or impairments are apparent in virtually every facet of cognition, including information processing, problem solving, and especially the ability to apply information to new situations. Corresponding delays in motor, communication, language, and socioemotional development present a picture of global developmental delay for these youngsters. Although cognitive delays are the necessary condition for inclusion in this chapter, the term *general develop-*

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mental delay or simply *developmental delay* will be primarily used as a means of underscoring the comprehensive delays common to these children and the corresponding need for comprehensive intervention.

In this chapter, we will explore and evaluate the impact of broad-based early intervention programs directed exclusively at children with these general developmental delays. The general characteristics of this population will be examined first with special emphasis placed on children with Down syndrome. This will be followed by a discussion of the nature of early intervention programs, including a brief history as well as descriptions of the various approaches and educational or developmental models applied to intervention programs that are commonly found in the field. With this information as background, the existing early intervention literature for young developmentally delayed children will be summarized and presented in a manner designed not only to yield a critical analysis of the effectiveness of these programs, but also to permit the detection of any meaningful and consistent outcome patterns that may exist. Based on this more comprehensive analysis, a number of recommendations for the practitioner and other professionals will be generated.

DEVELOPMENTAL CHARACTERISTICS OF DELAYED CHILDREN

In general, developmentally delayed children tend to reach developmental milestones in a manner that is generally similar to that of nondelayed children, but at a much slower rate. All children with significant delays are likely to reach a lower final level of cognitive development but, as will be described, the actual rate, limits on development, and other characteristics vary with the nature and severity of the disabling condition. Although a pattern of general developmental delay may exist, differences across one or more areas of development in comparison to that which is expected on the basis of a child's overall cognitive level are not uncommon. Moreover, as discussed later, a number of qualitative differences in developmental processes have been identified as well.

The children described in this chapter are likely to be labeled as mentally retarded at some point once the clinical picture stabilizes. For this to occur, two major criteria, as defined by the American Association on Mental Deficiency (Grossman, 1983), must be met. The first involves lowered intellectual functioning as assessed by standardized tests of intelligence. Currently, although flexibility is stressed in this determination, an IQ below 70 will satisfy this criterion. The second criterion reflects aspects of impaired adaptive behavior, with milestone measures of social, motor, and communicative development being used to assess this dimension during infancy and early childhood.

The psychometric assessment serves as the primary basis for the classification

of the severity of the developmental delay. Children with IQs below 20–25 are classified as profoundly retarded, those between 20–25 and 35–40 as severely retarded, between 35–40 and 50–55 as moderately retarded, and those scoring between 50–55 and approximately 70 as mildly retarded. As a rough approximation, mildly delayed children develop at a rate about one half to two thirds that of normally developing children, and we can expect to see substantial developmental changes for the vast majority of these children, including walking and using language, during the early childhood period. In contrast, children with severe and profound delays make more limited progress toward major developmental milestones, with health, stimulation, and social interaction processes being primary concerns that extend throughout the first few years of life.

In practice and in the descriptive literature, this classification scheme for severity is often simplified by dividing delays into only two categories: those children with severe impairments (an IQ below 50) and those with mild delays (IQs 50–70). Despite the simplification, this distinction appears to be a useful one, with many important differences (apart from developmental rates and patterns) existing between children with severe and mild delays. From an etiological perspective, the cause for the conditions of approximately 50% of the more severely delayed children can be linked to identifiable prenatal problems in central nervous system development (Smith & Simons, 1975), with as many as a third of this group having chromosomal abnormalities. Although Down syndrome is the most prevalent chromosomal abnormality, the presumption that the vast majority of these children belong in the severely delayed category may no longer be valid (see later discussion).

Of the remaining 50%, approximately 10% of severe delays can be traced to problems during the perinatal and postnatal periods, with the final 40% falling into an undecided category in which no specific cause can be discerned. However, most of the difficulties for a considerable portion of the children in the undecided group can likely be attributed to prenatal defects in development because other evidence such as the abundance of certain major or minor anomalies that commonly co-occur are associated with prenatal onset (Smith & Simons, 1975). In fact, children with severe delays typically have a number of associated disabilities also, especially cerebral palsy and epilepsy (Jacobson & Janicki, 1983). Moreover, for the most part only isolated cases of severe delays within families are found; they are usually identified during the first 2 years and have a relatively small though noticeable association with socioeconomic status (Robinson & Robinson, 1976).

In contrast, mild developmental delay generally is confirmed later, accounts for as much as 60–75% of all instances of delays during infancy and early childhood, and has a much stronger association with socioeconomic status; its causes are less likely to be prenatal in origin, as few recognizable syndromes or related evidence are associated with these milder delays (Herbst & Baird, 1983;

Opitz, 1980). It is important to note that children identified as having mild delays in early childhood appear to differ from the mildly delayed population that is identified later, during the school years. Specifically, although the etiology for some proportion of the children in the mild group that is identified during early childhood may be associated with familial–environmental factors, it is much more likely that the majority of children for whom familial–environmental influences are primary ones will not be identified until they are of elementary school age. As such, they constitute part of a yet to-be-identified or at-risk group of youngsters, as described in Chapter 2. Those mildly delayed children who are actually identified during the preschool period tend to be those who have some clear biological basis for their delays or for whom a strong suspicion exists that implicates organic factors. In fact, a specific etiology can be identified for a substantial number of these children as early as 4 years of age (Herbst & Baird, 1983). This group of mildly delayed children may also manifest more prominent problems than those identified later, either behaviorally or developmentally, which are sufficient to set them apart from normal variations in growth and development. When school age is reached, however, large numbers of new mildly delayed children are identified, with relatively few having an established etiological basis, and the association with socioeconomic status increases.

These differences in the patterns of early identification for young developmentally delayed children have important implications for the evaluation of the effectiveness of early intervention because it is primarily this unique subgroup of mildly delayed children in conjunction with those with more severe delays that find their way into early intervention programs. Moreover, because so many children, especially those under 3 years of age, have a clear biological basis for their delays, early intervention research efforts have often been organized within etiologically homogenous groups. This is especially true for children with Down syndrome, as a substantial number of early intervention studies have focused on this subgroup. Accordingly, as background for the analysis of the effectiveness of early intervention, the general developmental course and characteristics of young Down syndrome children will be described in the following section.

Children with Down Syndrome

Since the mid-1970s, a more complete understanding of the character and expression of development of children with Down syndrome has been achieved through a series of extensive multidisciplinary studies. This examination of developmental characteristics has extended well beyond the traditional domains of cognitive and motor development, providing important insights into the social and emotional lives of these children as well as into underlying developmental processes. As a result, we now have a clearer appreciation of both the correspondence

that exists between the developmental characteristics of Down syndrome and normally developing children as well as an appreciation of areas of difference.

At a descriptive level, the most straightforward and frequently used approach to gather information has been to track the developmental achievements of Down syndrome children through cross-sectional and longitudinal studies. For cognitive development, continued but gradual improvement occurs (measures of mental age increase). However, the rate of development slows progressively, resulting in a general decline of measured intelligence throughout infancy and early childhood (Carr, 1975; J. A. Connolly, 1978; Melyn & White, 1973; Morgan, 1979; Share, 1975). Although group differences between normally developing and Down syndrome children can be detected during the first year of life through assessments of cognitive functioning, there is, nevertheless, a substantial overlap in level of functioning at this early age. However, as the decline proceeds from an average IQ of 55–60 at 1 year of age toward a mean IQ of 40–50 by the fifth year, Down syndrome children become a clearly distinct subgroup, with only relatively rare instances of children scoring above the mildly delayed range. It is not clear why their test performances decline, but it does *not* appear to be a result of a progressive deterioration of these children (see Carr, 1975). To some extent it may reflect a greater reliance on language-based test items, but much of the measured decline may well be traced to the fact that cognitive tests increasingly tap more demanding and general aspects of competence, adaptive behavior, and problem solving, thereby enhancing developmental differences in overall cognitive functioning.

Accordingly, the majority of Down syndrome children, even by age 3 years, test at the mild, low mild, and high moderate range of intelligence. This is the case even for those studies whose testing procedures were such that relatively little decline was observed during this 3-year period (Reed, Pueschel, Schnell, & Cronk, 1980). Interestingly, many of the early studies had suggested far greater limits on the cognitive abilities of Down syndrome children (see Connolly, 1978, for discussion). It appears that these changes in cognitive development from the early to more current studies can be attributed to improved environmental conditions for Down syndrome children, including the positive effects resulting from less frequent institutionalization (see Centerwall & Centerwall, 1960) and the increased availability of a wide range of high-quality intervention services for handicapped children and their families.

Even with improved cognitive status, variability in terms of severity of delay for Down syndrome children as a group remains extensive (Connolly, 1978; LaVeck & Brehm, 1978). Although these individual differences have been found to be associated strongly with a number of biomedical factors (especially the correlations between the degree of hypotonia and severity of cardiac defects with lower intellectual performance [Cicchetti & Sroufe, 1978; Reed et al., 1980]),

the factors contributing to these differences are not well understood. However, despite this variability within the group, there appears to be consistency in cognitive development over time for individual children. In one longitudinal study in which children were evaluated at 9-month intervals from birth to 3 years, considerable continuity was found (Reed et al., 1980). In particular, the shorter term correlation between 18 and 36 months on the Bayley Mental Scale was high ($r = .72$). Even the relationship between 6 and 36 months, a period of much less continuity for normally developing children (Honzik, 1976; Kopp & McCall, 1982), was unusually strong ($r = .53$). Overall, correlation coefficients remain especially high after 18 months of age (Kopp, 1983).

Corresponding delays also occur in other developmental domains, but the pattern varies from area to area. Motor development, although showing less of a difference from normal achievements during the first year, soon becomes similar to that of intellectual development (Carr, 1975; Reed et al., 1980). Feeding difficulties during the first 3 years also show a similar but less pronounced course, with delays of 10–33% occurring in gumming, chewing, finger feeding, food grasping, spoon grasping, and related milestones (Cullen, Cronk, Pueschel, Schnell, & Reed, 1981). Aspects of social development, although having a less delayed onset and a less noticeable decline, do display significant lags (Cullen et al., 1981; Melyn & White, 1973; Morgan, 1979). For example, Vineland social quotients, which contain a substantial number of self-help items at lower age levels, decline from a mean of 71.4 at 1 year of age to 66.7 at 1–3 years, and then to an average quotient of 57.3 at 3–5 years of age (Morgan, 1979). Interestingly, not only do declines in these domains parallel one another on the average for the group, but, as might be expected, the domains themselves are interrelated for individual children. Specifically, the magnitude of the correlations among motor, cognitive, and language development (see subsequent discussion) range from .5 to .8 within the first 3 years of life (Reed et al., 1980).

The language development of Down syndrome children has been repeatedly found to lag considerably behind other developmental domains (e.g., Share, 1975). This discrepancy is apparent even in young children as measures of receptive and expressive language fall below that expected on the basis of their cognitive development and may be related to unusual deficits in vocal imitation skills (Mahoney, Glover, & Finger, 1981) or specific oral–motor dysfunctions. Observations by Greenwald and Leonard (1979) have also indicated that young Down syndrome children manifest substantial verbal language deficits in comparison to their level of cognitive (sensorimotor) development.

Taken together, as evaluated in terms of rate of achievement of developmental milestones, Down syndrome children manifest substantial lags in all domains. The typical pattern consists of the appearance of delays early within the first year and a progressive slowing of the rate of development during the later period of infancy and early childhood. Social development seems to be least affected

during the first 3 years, whereas language development, especially expressive language, shows the most significant delays. For each child, progress across different developmental domains is significantly intercorrelated and most Down syndrome children fall within the mild and moderate ranges of cognitive functioning by age 5 years. Moreover, there is considerable individual consistency in relative rate of overall development across the early childhood period, and the degree of hypotonicity and severity of congenital heart disease are highly correlated with developmental progress.

Organization and Structure of Developmental Processes

An additional and important question regarding the developmental characteristics of Down syndrome children concerns the organization and structure of their cognitive processes as well as the relationship between cognition and other developmental domains. Correlations among different developmental areas have already been noted for milestone achievement, but information about interrelationships among processes and organizational features of development as compared to normally developing children has particularly important implications with regard to the design of early intervention programs.

These issues are not easily addressed but a number of creative research strategies have provided useful and important working hypotheses. In one study, the organization of sensorimotor skills of Down syndrome children (including object permanence, means-end, causality, etc.) was correlated with those of normally developing children matched in terms of mental age. Comparisons revealed a high correspondence in skills between these two groups (Mahoney et al., 1981). Moreover, the organization of these sensorimotor domains for Down syndrome children has been found to be related to language and communicative development in a manner similar to that of normally developing children (Greenwald & Leonard, 1979; Mahoney et al., 1981).

A second line of research has focused on the correspondence between cognitive and affective development. In the field of child development, recent theoretical and empirical advances have improved our understanding of the important organizational processes of attachment, affiliation, fear/wariness, and exploration-curiosity, as well as their relationships to cognitive development (Sroufe, 1979). A large-scale longitudinal investigation (Cicchetti & Pogge-Hesse, 1982; Cicchetti & Sroufe, 1978) has examined these cognitive-affective systems in Down syndrome children. In an extensive series of analyses, affective and cognitive development were shown to have as close an association for Down syndrome children as they do for normally developing children. Emotional reactions producing smiling and laughter, negative affect (especially defensive reactions to perceptual stimuli), patterns of attachment, interrelationships among different systems (affiliation, fear/wariness, etc.), and a correspondence with levels of cognitive development were all similar in their sequence, organization,

and relationships to those of normally developing children (Cicchetti & Pogge-Hesse, 1982). Other developmental patterns, such as the emergence of self-recognition, also appear to be similarly organized in Down syndrome children and to correspond to appropriate levels of cognitive development (Mans, Cicchetti, & Sroufe, 1978).

Although considerable evidence exists suggesting that the major developmental processes of Down syndrome children appear qualitatively similar to those of normally developing children, the limits of this generalization have yet to be established. Caution in extending these findings is certainly warranted because relatively few processes have been probed to date and little information is available regarding the organizational features of Down syndrome children's development beyond 3 years of age. Moreover, despite similarities in the structure or organization of developmental processes and the sequence of development, there are a number of characteristics of Down syndrome children that do appear to differ in important ways from nondelayed children. For example, although Down syndrome children's symbolic play correlates with mental age as expected (Hill & McCune-Nicolich, 1981; Odom, 1981), the characteristics of their spontaneous play with objects can be clearly distinguished from normally developing children matched in terms of developmental level. Even with appropriate toys and a supportive and attentive parent available, Down syndrome children are not as socially oriented nor do they use materials as effectively as nondelayed children. In particular, they are more likely to fail to monitor others, to fail to use opportunities to involve others in play adequately or initiate interactions, to have a more limited play repertoire, to fail to shift play activities readily, and to display frequent stereotypic and repetitive acts during play (Krakow & Kopp, 1982, 1983). Moreover, research focusing on the pretend play of Down syndrome children has revealed that these youngsters move through a somewhat different developmental sequence from that of nonhandicapped children, particularly in self-pretend play. In addition, Down syndrome children have unusual difficulty in progressing from single-scheme symbolic play (extending symbolism beyond themselves) to combinatorial symbolic play (combining single or multiple schemes), even though they appeared to be at the appropriate mental ages to do so (Hill & McCune-Nicolich, 1981).

Kopp (1983) suggested that these and other differences can be attributed to unusual deficits in information processing exhibited by Down syndrome children. In particular, problems in attending, discriminating, encoding, transforming, and transmitting complex or subtle stimuli may well underlie the failure of Down syndrome children to employ those interactive strategies necessary for appropriate developmental growth.

Another major difference is the apparent difficulty these children have in expressing affection and in modulating physiological arousal. Overall, children with Down syndrome manifest a lower level of affective expression than their

normally developing counterparts, even when matched in terms of cognitive level (Cicchetti & Sroufe, 1978). It is generally more difficult to elicit both positive affective responses, such as laughter to incongruous stimuli, and negative reactions, such as distress to separation and stranger approaches (Cicchetti & Serafica, 1981; Cicchetti & Sroufe, 1978). Even the full form of the early social smile of Down syndrome children appears reduced (Emde, Katz, & Thorpe, 1978). This apparent inability to generate sufficient tension to create an affective response may be attributable to difficulties in processing the information provided by environmental stimuli as well as to specific deficits in physiological arousal.

These cognitive–affective deficits are also likely to influence parents' judgments of their infant's temperament. Despite many similarities in temperament to normally developing babies (although more Down syndrome children are considered "difficult" by parents), the reduced arousal capacities of these children may lead parents to rate their children as lower in approachability. Similarly, difficulties in modulating arousal once threshold has been reached or the active roles parents must adopt during infancy in order to establish an interactional exchange can also influence temperament ratings of activity level (Bridges & Cicchetti, 1982).

Emotional responses in infancy serve as a primary means of communication between caregivers and children. Absence of a normally differentiated and difficult-to-arouse (and settle) affective system in an infant can certainly have adverse effects on the nature of the caregiver–child relationship. As Cicchetti and Sroufe (1978) point out:

It may be that parents of Down syndrome infants need to extend themselves much more than the typical caregiver, since they must assume more responsibility for helping the infant to generate tension and affect and to become emotionally engaged in the situation, and they must accept greater delays in the development of fully differentiated affective expression (e.g., laughter). Helping these infants sustain attention and build excitement is especially challenging. (p. 345)

Inadequate signaling by Down syndrome children and related characteristics are likely to require unusual parental adjustments in order to provide developmentally sound experiences and to establish synchronous and affectively warm interactions. Caregiver–child interactions that are associated with language and communicative development are perhaps most easily disrupted. Existing research suggests that, even at prelinguistic levels, Down syndrome children are much less interactive in parent–child communicative sequences than normally developing children at similar developmental levels. They tend to initiate far fewer interactions and are especially lacking in the use of eye contact to establish interactions, to "ask questions," or to receive information or comments on their ongoing behavior. Moreover, in contrast to those of normally developing chil-

dren, vocalization patterns of Down syndrome children are such that more vocal clashes with caregivers are likely to occur, proper turn-taking sequences are more difficult to establish, and parents are not able to expand upon their child's vocalizations and their intent as easily (Berger & Cunningham, 1983; Jones, 1980). As a consequence, much of the work of communication falls to parents, and a pattern that becomes more and more directive appears to be a common result. Although it is understandable how such a style of interaction can develop, it may be important to try to establish more mutual and synchronous interactive patterns at prelinguistic levels with the Down syndrome infant because these patterns appear to form a crucial foundation for later language development (Bruner, 1977). Of course, the problems parents may experience in adjusting communicative patterns in accord with the abilities of their Down syndrome infants and young children are far from universal phenomena (Crawley & Spiker, 1983; Rondal, 1978). Nevertheless, it is not surprising to find that many interaction difficulties persist. In fact, these problems may eventually be accompanied by a gradual decline in the amount of interaction between parents and children in the years ahead (Cheseldine & McConkey, 1979; see also Cunningham, Reuler, Blackwell, & Deck, 1981).

Children with Other Biologically Based Delays

The marked heterogeneity, in all respects, for children who have established or presumed biologically based developmental delays suggests that useful descriptive information on the course and characteristics of their development is not likely to extend meaningfully beyond generalities associated with severity of developmental delay. Given widely varying etiologies in particular, it would not be surprising to find that certain qualitative differences exist between this diverse group of children and more homogenous subgroups such as those with Down syndrome. An example of such a difference can be seen in a study on self-recognition. As discussed earlier, Down syndrome children show evidence of self-recognition when they reach appropriate developmental levels. However, when self-recognition tests are administered to a heterogeneous group of developmentally delayed children—children typical of those found in community based early intervention programs—responses are much more variable, with relatively few of these children showing any evidence of this cognitive achievement. This occurs even though assessed mental ages suggested that evidence for self-recognition should exist (Hill & Tomlin, 1981). Other research has also reported differences between Down syndrome children and a heterogeneous group of developmentally delayed children in their degree of social orientation and the extent to which they are engaged in interactions with toys (Krakow & Kopp, 1983).

Despite the fact that descriptions of the development and characteristics of

children with other biologically based delays must remain general, some important patterns, many similar to those for children with Down syndrome, do nevertheless emerge. For example, difficulties in caregiver-child interactions can be detected early (e.g., Greenberg, 1971), mismatches between parental speech complexity and children's capacities are not uncommon (Cunningham et al., 1981), children fail to deploy their attention adequately and do not effectively use the social and physical environmental resources available to them during play (Krakow & Kopp, 1983), and highly directive and less responsive patterns of relating can develop (Terdal, Jackson, & Garner, 1976)—all in a manner similar to that of the Down syndrome subgroup. Not only does their toy play lack spontaneity and flexibility (Krakow & Kopp, 1983), but developmentally delayed children seem unusually deficient in adopting systematic strategies in problem-solving tasks (Goodman, 1981).

Moreover, the peer relationships of developmentally delayed children in general during the preschool years show unusual deficits—deficits that exceed those that would be expected on the basis of their levels of cognitive development (Guralnick & Weinhouse, 1984). Most developmentally delayed preschool-age children appear to have extraordinary difficulty in establishing more than simple social exchanges with their peers, a problem that can be traced in part to the directive pattern of caregiver-child relations, to unusual deficits in language development, to the existence of behavioral problems and to other aspects of the social environment (Guralnick, 1986). It may also be a reflection of the information-processing difficulties described earlier (Kopp, 1983), now applied to the problem of establishing social relationships with one's peers. Whatever the case may be, developmentally delayed children appear to be at risk for a host of developmental problems beyond cognitive delay.

At a more global level, families in which a handicapped child is a member also appear to be unusually vulnerable to developing numerous problems (Crnic, Friedrich, & Greenberg, 1983). Yet such outcomes are far from inevitable; many families draw upon their resources not only to cope with but also to be enriched by their relationships with their handicapped family member. The nature of the outcome depends on a complex set of forces. Characteristics of the child and family as well as the availability of social support networks have been found to be important in governing the adaptive abilities of families (Crnic et al., 1983; Gallagher, Beckman, & Cross, 1983).

Finally, the value of tracking the development of diagnostic subgroups of children should be emphasized. Despite even substantial within-group variability, the developmental characteristics of diagnostic subgroups do provide some measure of control and can serve as a useful baseline for evaluating the effects of early intervention. As we have seen for Down syndrome children, specific developmental patterns for this subgroup have been reliably identified. The discovery of the fragile-X syndrome (Carpenter, Leichtman, & Say, 1982)

and fetal alcohol syndrome (Golden, Sokol, Kuhnert, & Bottoms, 1982; Steinhausen, Nestler, & Spohr, 1982) in recent years—syndromes involving relatively larger numbers of children—suggests the potential value of this strategy.

NATURE OF INTERVENTION PROGRAMS FOR CHILDREN WITH DEVELOPMENTAL DELAYS

The many problems likely to be encountered by young developmentally delayed children and their families provide an important framework for examining the effectiveness of early intervention efforts. Equally important, however, is an understanding of the nature, scope, and variations of the comprehensive intervention programs themselves. Accordingly, prior to our analyses of the effectiveness of intervention, a brief historical review of early intervention activities and a description of the major dimensions that characterize intervention programs will be presented.

Historical Background

Although prior to the 1900s a philosophical basis for the importance of the early childhood period existed (Lazerson, 1972), the actual catalyst for the development of educational programs may well have been the concern for children growing up in the squalid conditions of poverty. According to Maxim (1980), important educational reforms for young children were stimulated by a number of concerned individuals living in different countries. Programs for young children living in poverty were initiated in the late 1800s—early 1900s by such individuals as Owen in Scotland, Froebel in Germany, McMillan in England, and Montessori in Italy. In many respects, these programs were developed to offer poor children the opportunity to thrive in a more healthy and intellectually stimulating environment.

Concerns for the child from poverty circumstances were extended in this country to concerns for retarded and other children with handicapping conditions. There were two investigations conducted before the 1960s that offered promise for intervention with young developmentally delayed children through manipulation of the environmental context and/or the offering of educational programs during the early childhood period: the serendipitous but classic investigation conducted by Skeels (Skeels, 1966; Skeels & Dye, 1939) and the pioneer work of Kirk (1958).

The longitudinal study conducted by Skeels and his colleagues on two groups of infants placed in different environments produced remarkable findings. Initially both groups of infants were residents of an orphanage and were at first

testing found to be comparable and functioning generally in the retarded or low normal range of intelligence. Thirteen of these infants were placed in an institution for the retarded as "house guests" of a group of retarded females and the ward staff (Skeels & Dye, 1939). These 13 children came to constitute the experimental group who, because of marked improvement in this actually more stimulating environment, were adopted and left the institution. The contrast group was composed of the children who remained wards of the state and resided in an institutional environment. Some 30 years later a follow-up study was completed, and as Skeels (1966) reports:

All 13 children in the experimental group were self supporting and none was a ward of an institution, public or private. In the contrast group of 12 children, one had died in adolescence following continued residence in a state institution for the mentally retarded, and four were still wards of institutions, one in a mental hospital, and the other three in institutions for the mentally retarded. In education, the disparity between the two groups was striking. The contrast group completed a median of less than the third grade. The experimental group completed a median of the 12th grade. (p.55)

This investigation has been criticized on methodological grounds, especially with regard to the exact nature of the disabilities of the subjects as well as concerns about the attribution of the difference between groups solely to the children's early experiences (Clarke & Clarke, 1976; Ramey & Baker-Ward, 1982). However, the potential for substantially altering the rate of intellectual development through environmental manipulation was established.

In 1958, Kirk reported the first formal attempt at ameliorating delayed development through early education. His investigation included 81 preschool children between the ages of 3 and 6 years with IQs that ranged from 45 to 80. These children were classified as mentally retarded in line with the conventions of the time. The subjects were from four different groups: a community experimental group in which the children attended a community-based preschool program, a community contrast group who attended no preschool program, an institutional experimental group who attended an institutional preschool program, and an institutional contrast group who did not attend any preschool program. Upon completion of the preschool experience, the experimental subjects in both the community and institutional preschool groups out-performed the contrast subjects. A follow-up after the first year of elementary school found that the initial differences between contrast and experimental community subjects tended to disappear either through an acceleration of the contrast subjects and/or limited change for children in the experimental group. Nevertheless, according to Kirk (1977), "The conclusion we drew from this experiment was that intervention at the preschool level accelerates the rate of mental and social development, while no intervention at that age level tends to allow the rate of mental and social development to slow" (p. 7).

In 1970 an extremely interesting monograph was published by the State of California's Department of Mental Hygiene (Rhodes, Gooch, Siegelman, Behrns, & Metzger, 1970). This study was a follow-up of work completed by Stedman and Eichorn (1964) that compared the development of a group of 10 home-reared Down syndrome children with 10 institutionalized Down syndrome children. Most comparisons in the Stedman and Eichorn study favored the home-reared children and thus a further experiment was formulated to see if programmatic changes in an institutional environment could produce changes in the Down syndrome children.

Changes were made in the children's physical setting, staff were specially trained, and a comprehensive intervention program was initiated. Training language skills was the primary focus of the program. The reported result indicated that positive changes were seen in the language behavior, intellectual growth, and social skills of a population previously thought by many to be uneducable (Rhodes et al., 1970).

Taken together, the findings of these studies and a host of other factors suggesting that intervention during the first 5 years of life can have a significant impact on development (see Chapter 1 of this volume) set the stage for a major effort initiated at the federal level to foster the development of early intervention programs for developmentally delayed and other handicapped preschool children.

Handicapped Children's Early Education Program

In 1968 the United States Congress enacted the Handicapped Children's Early Education Program (HCEEP). The major purpose of this federal program for young handicapped children was to develop, demonstrate, and disseminate effective early intervention models. Until recently the appropriations for the HCEEP have steadily increased, resulting in a growing number of programs and children being served. An article by Swan (1980) describes the considerable success of this federal venture as measured by the number of programs that have been continued in communities using local and/or state funds. In addition, an evaluation report indicates the enormously positive impact of these programs (Littlejohn Associates, 1982). Although much work needs to be done, there seems little doubt that from both historical and contemporary perspectives the impact of this federal program on the development of early intervention programs for handicapped infants and preschool-age children has been significant.

The final link to contemporary programs can be found in a number of exemplary programs developed in the early 1970s, many of which were supported by HCEEP funds. Descriptions of many of the notable programs that formed the groundwork for many of today's programs can be found in the influential volumes edited by Friedlander, Sterritt, and Kirk (1975) and Tjossem (1976).

CONTEMPORARY EARLY INTERVENTION MODELS

Expectations of the effects of contemporary early intervention models can be conveniently divided into direct impact, indirect impact, and societal benefits. Direct impact refers to program goals and objectives designed to alter the behavior of the child and the immediate family. Most programs see changing the child's behavior and supporting the family as their primary objectives, and thus intervention strategies are developed to reflect this focus. Indirect impact refers to changes in the child and family members that permit maintenance of the child in the least restrictive setting in terms of educational placement. A second important indirect impact is the family's or community's willingness to maintain the child in the home and community.

Finally, many programs suggest that the impact of early intervention programs on the child and family produce benefits for society. In a state-of-the-art report compiled by Interact (Garland, Swanson, Stone, & Woodruff, 1981) it is argued that early intervention assists parents in maintaining their child at home, thus reducing the costs of institutionalization, which the community must bear. Similarly, by maintaining developmentally delayed and disabled children more in the mainstream of regular education, significant savings to the taxpayer result as well (Bricker, Bailey, & Bruder, 1984).

Early intervention services for developmentally delayed children from birth through 5 years of age are typically provided by community programs and include a range of children from those designated as at-risk to the most profoundly impaired child. According to Filler (1983), the three service delivery models used by early intervention programs to serve these children are home-based, center-based, and a combination of home- and center-based. Often programs for infants deliver services in the home setting. The target is the parent or caregiver who is helped to acquire effective intervention skills to use with the child.

As implied in the name, the center-based model requires that the child be brought to an educational setting on a regular basis. The setting might be a classroom, a hospital, or a more informal arrangement. The focus in the center-based models is usually the child; however, many center-based programs stress parental involvement and may even provide structured training for the parent.

Some programs have adopted a combined approach in one of two ways. First, there are programs that stress training both in the classroom and in the home. Second, there are programs that serve children initially employing a home-based model and, after children reach a certain age or developmental level, they are transferred to the center-based component of the program. However, within these three basic service delivery models considerable variability can be found in terms of philosophical/curricular emphasis, instructional approaches, staffing

patterns, the nature of family involvement, the use of ancillary services, and assessment and evaluation strategies. These critical elements of early intervention programs are discussed in the following section.

Philosophical/Curricular Approach

An understanding of the philosophical orientation that underlies early intervention efforts is essential. Intervention decisions—including the choice of assessment and evaluation instruments, the determination of educational objectives, the selection of strategies for fostering development, and the construction or adaptation of curricular materials—should be governed by the program's philosophical orientation or approach.

Curricular approaches used by early intervention programs are distributed across a continuum from direct instruction (in which the child is given little choice over the nature of the instructional program) to those with an experiential emphasis (in which the child is free to choose from a variety of options throughout the instructional day). Harbin (1979) has suggested that current curricular models can be classified on the following continuum: experiential, Montessori, Piagetian, information-processing, diagnostic-prescriptive, or behavioral. As one moves away from the experiential end of the continuum the approach becomes increasingly teacher-directed. This is discussed in more detail in the section on instructional strategies.

The curricular emphasis chosen by a program not only guides its focus but should also dictate the content. The majority of programs providing services to developmentally delayed children tend to offer educational activities in a variety of developmental domains. The comprehensive nature of these programs is appropriate because by definition infants and young children with developmental delays tend to show deficits in many critical areas of functioning. There is often a need to assist the child in gaining skills in cognitive, communicative, social, self-help, and motor areas, thus making mandatory a comprehensive curricular approach.

Although programs can and do operate using a variety of orientations, a general developmental perspective encompassing many different models is most prominent. This orientation assumes that several underlying principles govern the nature and cause of growth and change. In particular, this position assumes that important developmental changes are both hierarchical and sequential. Current developmental progress by a child involves the integration and reorganization of earlier acquired skills, and development occurs in a general, consistent sequential order. In addition, this position assumes that many important developmental changes result from the resolution of disequilibrium between the child's current level of development and the demands of his or her environment. The challenges posed by the environment must be neither too simple nor too difficult

in relation to a child's developmental level in order for positive change to result (Hunt, 1961). The task of the interventionist within this model is to structure the environment in such a way as to place increasing demands on the delayed child's current level of functioning. By requiring the child to adapt actively to greater and greater environmental demands, growth and change are promoted. Finally, the approach assumes that what is critical to development may be specific behaviors in some cases, but often interventionists are addressing issues related to broad conceptual aspects of development, which require consideration of issues related to integration and interrelationships across behavioral domains.

Instructional Strategies

The instructional strategies adopted to present the curricular content often rely on some form of environmental programming, however implicit it may be according to varying curricular models. As articulated in behaviorally based strategies, the teaching staff arrange events to elicit and reinforce the occurrence of specific behaviors by the children. However, the rigor and rigidity with which the behavioral technology is employed varies considerably across programs. According to the Harbin (1979) continuum, a fair generalization might be that those programs reflecting the more teacher-directed approaches are the programs that tend to begin training focused on highly specific educational objectives using well-controlled presentation formats. As the child shows progress in the acquisition of the educational objective, the instructional presentation shifts to encourage generalization of the response to other settings and appropriate conditions. In contrast, those programs that are more child-directed tend to employ a more flexible use of this strategy. The child is encouraged to use a specific behavior in a variety of settings and conditions with the primary goal of making the response functional for the child. Once the response becomes functional, the use of well-controlled presentation formats is reduced. Application of an instructional technology requires that staff be skilled behavior managers and programmers if children are to make adequate progress.

Although the application of behaviorally based instructional strategies has been effective in many situations and for certain groups of children, researchers with a more cognitive orientation have questioned the utility and/or generalizability of the skills taught to children under such rigorously controlled and structured regimes. It is possible that these regimes tend to minimize flexibility and adaptability in that children are reinforced for careful adherence to an adult imposed structure. Flights of fancy, initiation of novel behavior, and variations in specified routines are not encouraged and may even be discouraged. Moreover, the technology often has been used to teach specific responses rather than to assist children in developing generative strategies that lead to problem solving and independence. Those favoring a behaviorally based technology argue that

the general strategy is sound but rather the manner in which interventionists have applied it needs correction.

Contemporary views held by many interventionists tend to favor instructional approaches that specify the goals and objectives for the child but leave the implementation to be decided, in part, by events occurring in the environment and by the interests of the child. For example, an educational goal might be to assist the child to use more agent–action–object phrases. Rather than using specific drills on a set number of predetermined phrases, the interventionist capitalizes on opportunities that arise during the day to stimulate the use of the targeted language forms. Using such an approach requires careful attention to the daily activities to assure that each child is receiving adequate training on selected objectives. Often it is difficult to monitor the training of each objective, and successful employment of such a system requires systematic collection of data on the child's progress toward specified objectives.

Family Involvement

Increasing numbers of programs are considering the family to be an integral member of the intervention team. From the development of individualized educational plans (IEPs) to their implementation, parents in particular are consulted and involved in the decision making and participate in many aspects of the educational–therapeutic effort for their child. An underlying principle of family involvement is to begin intervention sufficiently early in order to prevent or minimize potentially difficult or distressing parent–child and/or child–family relationships from developing. A second principle of family involvement focuses on the need for an ecological approach to intervention in order to assure maximum development in the young delayed child. As Bronfenbrenner (1975) has suggested, all elements of a child's environment need to work in concert if maximum benefit from intervention is to occur. An exceptionally fine preschool program can probably offset the effects of a nonstimulating after-school environment only partially. There is a need to coordinate home and school expectations, which demands designing an intervention program that includes as many facets of the child's life as possible.

The family situation itself should dictate where, when, how, and in what areas to begin intervention. As is done when designing child-related programs, it is necessary to assess the family situation, select objectives, intervene, and then evaluate progress toward the established objectives. It is also essential that most intervention programs that involve families be based on a balanced blend of a family's emotional needs, on information and assistance within the community, and on skill development. Moreover, families included in programs often have widely disparate cultural backgrounds, availability of resources, demands on their time and energy, educational experiences, belief and value systems, and

interests. Such divergence mandates program flexibility and individualization both in intervention objectives for families and in the method of reaching those objectives.

It is our contention, as well as that of many parents, that the professional should avoid becoming "the expert" and telling the parent what to do and how to do it (Roos, 1977; Sullivan, 1976). Rather, it is more helpful if a cooperative relationship evolves in which each individual contributes valuable information and skills. Becoming a member of the team is a responsibility that should be taken seriously by every parent and by every professional.

Training and Deployment of Staff

The professional staff is responsible for the shape and flavor of a program's content. The way in which the staff conducts the program is influenced by at least two important variables: the quality of their training and the fidelity with which they adhere to established program goals and objectives. No doubt other factors could be specified as well, but these two seem of overriding importance.

Personnel working in early intervention programs can be divided into two categories: direct service and support service. Direct service individuals are those interventionists, teaching aides, and/or parents who interact with the child on a regular and consistent basis; for example, the classroom teacher in a center-based program or a parent trainer in a home-based approach. Early interventionists and other direct service personnel are called on to fill a number of roles including developmental specialist, behavior manager, synthesizer, and evaluator. These roles have been discussed in detail by Iacino and Bricker (1978).

Support personnel include specialists such as physical therapists or communication specialists who have been trained in specific areas. The importance of obtaining the input and support of specialists from numerous health, educational, and social and behavioral disciplines is axiomatic for early intervention programs. In fact, prior to the initiation of a program a multidisciplinary diagnostic and assessment process should be conducted on each child. This often requires the participation of a physical therapist, occupational therapist, communication specialist, psychologist, medical personnel, and possibly others. Once a plan is developed on the basis of these assessments, the appropriate specialists should be available to formulate the daily intervention plan, to teach or supervise the direct intervention personnel in the delivery of the necessary therapeutic routines, to provide direct service as needed, and to evaluate the child's progress.

As indicated earlier, contributions from a variety of professionals are essential to the delivery of quality services to the delayed infant and young child. Because most programs cannot support a cadre of needed professionals on a full-time basis, specialists can be effectively used by adopting a consulting model. In such a model, the specialist functions primarily as an evaluator and consultant who

subsequently monitors the implementation of the developed program. The primary hands-on training of the child is provided by the classroom or home visitation staff and parents, rather than by specialists.

The consulting model has been adopted by many programs, in part because of financial exigencies; however, many staff, parents, and specialists have become convinced that, despite limitations for certain complex procedures, this model can be effective. Established training or therapeutic regimes can be employed throughout the day rather than for only brief periods when the specialist works directly with the child. Such practice increases total training time as well as enhances generalization across settings, people, and events (Bricker, 1976).

Assessment and Evaluation

The development of an evaluation plan and its implementation are essential for effective intervention. Evaluating individual change and programmatic impact requires that intervention methods and systems have appropriate evaluation procedures. Evaluation techniques should be able to determine the format and degree of success of intervention for individual children as well as the impact of programs on groups of children. Thus, evaluation serves three distinct but complementary functions: It guides the development of individual programming, it provides feedback about the success of individual programming, and it yields information for determining the value of an intervention system designed to benefit groups of children.

The need for a comprehensive evaluation of the child requires that the assessment battery be carefully constructed. This battery should tap the child's abilities across a wide range of domains because educational plans will be constructed on the basis of the initial assessment information. Second, assessment instruments should be geared to the developmental age of the child. Third, the evaluation instrument or format should be usable by available program personnel. Selection of a sophisticated instrument that cannot be administered appropriately by program personnel is of no value. Fourth, at least some of the assessment/evaluation tools should yield information that can be used to formulate educational objectives and related program plans. Finally, in addition to the more global assessments or evaluations that are administered at specific intervals, programs should develop procedures for the collection of daily or weekly probe data that indicate a child's progress towards established short-term educational or developmental objectives (Guralnick, 1975).

A useful assessment/evaluation system is essential for monitoring the impact of an intervention program. Accountability for all concerned is essential. Unfortunately, as will be seen, evaluation has not been given a high priority in many programs because resources have been limited. Accordingly, programs have

differed widely in the comprehensiveness of the initial assessments as well as their monitoring and summary evaluation efforts.

OUTCOMES OF EARLY INTERVENTION FOR DEVELOPMENTALLY DELAYED CHILDREN

With this information as background, the remainder of the chapter will be devoted to an analysis of the effectiveness of early intervention efforts for children with developmental delays. Studies selected for this review consisted of those that were published in 1975 or later and were found in peer-reviewed journals or professionally edited book chapters. To be included, a study must have reported child change measures, not only parent-related outcomes. Of equal importance, each study selected must have been designed to provide a comprehensive, broad-based program and have attempted to evaluate systematically the impact of early intervention within that framework. To facilitate discussion of these outcomes, the analysis has been divided into programs that served only children with Down syndrome and those that served children with general biologically based delays. Within each group a detailed table is provided consisting of a study-by-study summary of information on the nature of the intervention, the intervention parameters, the setting of the intervention effort, the role of parents, characteristics of the participating children, the experimental design, the outcome measures, and the results. A discussion of the outcomes for each group follows in an effort to draw at least tentative conclusions from these investigations.

Outcomes for Children with Down Syndrome

Despite the importance of and enormous interest in an evaluation of the effectiveness of early intervention programs for children with Down syndrome, only 11 studies met the criteria for inclusion in this review. Nevertheless, as inspection of Table 1 will reveal, a number of important characteristics and patterns did emerge. Virtually without exception, these early intervention efforts reflected a very strong reliance on a developmental framework as the basis for setting educational goals and objectives, and progress was evaluated in terms of change in each of a variety of developmental domains. As noted, programs were comprehensive, attempting to influence the general course of development including cognitive, language and communicative, personal-social, and gross motor areas. However, some programs did provide a special emphasis that was consistent with the interests of the designers, such as specific feeding training (Connolly, Morgan, Russell, & Richardson, 1980), language development (Kysela, Hill-

TABLE 1

Summary of early intervention studies for children with Down Syndrome^a

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Aronson & Fallstrom (1977)	Institution-based program, implemented by a junior psychologist under guidance of authors; most training was individualized and formulated to stimulate sensory, self-help, cognitive, motor, memory, emotional, social, and attentional areas; normal developmental sequences provided the basis for systematic training	Intervention time span was 1½ years; training sessions twice a week for a period of between 15 min and 1 hr; journals kept for each child on a weekly basis for continuing training	Institutional-based, psychologist trainer with input from authors for continuing training programs	No children ever lived at home (all entered the nursing home between ages 4–10 months); Nursing home provided normal preschool program but no involvement with the specialized training program
Bidder, Bryant, & Gray (1975)	Mothers received training on behavior modification techniques as they related to delayed children; efforts designed to encourage increased verbal and social interactions with child at home and toward greater competence and independence; training focused on all developmental domains and was individualized for each child; mothers recorded data based on home-training sessions; a discussion group relating to family and personal problems was also part of the program	Mothers in treatment group received 12 training sessions over a 6-month period, 2 hr per session; more intense (weekly) at beginning of the 6-month period; 1 meeting for fathers and baby-sitters	Home-based for intervention but mothers received training at center	Mothers were recipients of training and counseling, and were the primary service providers; records and data were collected by parents over the 6-month period

yard, McDonald, & Ahlsten-Taylor, 1981; Rynders & Horrobin, 1980), or cognitive and language training (Clunies-Ross, 1979).

An additional characteristic of these programs was the structured and directive nature of the intervention activities. Many programs described highly specific objectives, often conducted on a one-to-one or small-group basis with careful monitoring of progress on each of the objectives. A considerable number of programs relied extensively and explicitly on behaviorally based teaching strat-

Child characteristics	Experimental design	Outcome measures	Results
16 Down syndrome children living in a nursing home; experimental group had mean CA = 52.7 (range 26–69); MA = 20.6 (range 19–34); DQ = 39.4 (range 24–49); control group had mean CA = 51.3 (range 21–68), MA = 20.6 (range 13–35), DQ = 40.5 (range 18–57)	Children matched by age and sex and divided into experimental and control groups; MAs and DQs were almost identical at beginning of study for groups established in this manner	Griffiths Mental Development Scales with the 6 subscales of motor function, personal-social, hearing and speech, eye-hand coordination, performance, and practical judgment; both groups tested every 6 months; 12 months after training was completed retesting of both groups for follow-up was carried out	Intervention group showed greater increases in mental age (average gain = 10.5 months) and at a more rapid rate than control group (average rate = 3.5 months); held across all 6 subscales; All gains were progressive for all intervention children; during the 12-month follow-up, no statistically significant differences were found between the two groups in total test scores; note that 5 of 8 intervention and 3 control children were moved to other institutions during this no-treatment period
16 Down syndrome children ranging in age from 12 to 33 months participated in the study; experimental group mean CA = 23.8 months; control group 24.5 months; based on Griffiths Mental Development Scale, the mean MA of the experimental group was 16.6 months and the control 14.8 months at beginning of study	Children matched with regard to CA, MA, and sex were divided into two groups ($N = 8$ per group); experimental group mothers received training on behavioral techniques and counseling but controls only received typical interactions with health visitor and general practitioner; tester not aware of children's group membership	Griffiths Mental Development Scales; maternal reports	Significant differences in favor of the intervention group were found for language (mean gain 6.56 versus 2.56 months) and performance (mean gain 7 months versus 4.37 months) scales of the Griffiths; a strong trend also noted for the personal-social scale; the overall, locomotor, and eye-hand scales did not reveal any differences between the two groups; mothers reported increased knowledge and skills about their child's development and improved morale

(continued)

egies (e.g., Bidder, Bryant, & Gray, 1975; Hanson & Schwarz, 1978; Hayden & Haring, 1977; Kysela et al., 1981). Even when intervention was to be administered primarily by parents, detailed written materials and requests to collect progress data were considered vital aspects of the overall intervention strategy. Although there was an emphasis on behavioral objectives and goal setting, only about one third of the programs appeared to have a highly developed curriculum in a form that could be disseminated to others for replication.

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Clunies-Ross (1979)	Center-based and home-based instruction; Parent training provided in child management and home teaching; center-based program conducted by parents under staff supervision; curriculum consisted of comprehensive, structured programs in 6 developmental areas; 50% of instructional time focused on cognitive and language areas; normal developmental sequences provided guidelines for major objectives	3 intake groups (3 separate years); intervention time ranged from 4 months to 2 years; initial assessment occurred within 2 weeks of enrollment; children attended the intervention program 2-3 times per week (6 hr total time/week); prescribed instruction was conducted in small groups (1 staff to 2-3 children), or on a 1-to-1 staff-child basis; program objectives monitored each session, program reviews every 2 weeks; parent received 10-week training course; home teaching was conducted by parents 3 15-min sessions per day	Center-based for interdisciplinary team instruction, home-based parental instruction, parent training for implementation of home-based instruction	Provide generalization and consolidation of center-based programs; primary responsibility for self-care programs
Connolly, Morgan, Russell, & Richardson (1980)	Interdisciplinary program with professional teaching child and demonstrating techniques to parents for later home use; specific feeding training was singled out; general developmental model was basis with emphasis on intensive motor and sensory stimulation; group counseling and support for family was also provided	3-year program if enrolled early; maximum time, birth to 3 years; first 10 weeks in spring and fall, 1-hr group sessions, 1-hr individualized child teaching by professional alone, and 1 hr in group counseling with a professional to discuss issues and problems weekly; winter and summer, periodic follow-ups for evaluating and updating program; length of intervention varied for child but not continued after 3 years of age	Center-based for demonstration purposes but parents were expected to carry out home programs	Parents were primary service providers; instructed in general procedures and received counseling services

Child characteristics	Experimental design	Outcome measures	Results
36 Down syndrome children (35 trisomy 21, 1 translocation); average age at intake 14.3 months, age range 3–37 months	Pre–post without control or comparison group; progressive developmental achievements compared to initial assessment on Early Intervention Developmental Profile (EIDP); outcomes compared to normative patterns of Down syndrome children on existing developmental research (no systematic intervention)	EIDP administered at 4-month intervals following initial assessment; reported in mean developmental index scores	Progressive achievements of individuals ranged from large to moderate as measured by developmental index scores; continuous increments in developmental quotient were noted; for cognitive and language indices, children were developing at a rate of approximately 60% of CA; after 12–20 months of intervention, children scored at about 80% of CA; similar improvements occurred on other developmental domains; outcomes substantially replicated over 3 intake groups; younger groups began at higher developmental levels and maintained superiority over 12 months; also, the data suggested that rate of developmental progress was most rapid in 12–23-month age group
At age of intervention: Down syndrome, 0–2.5 years; 20 of original 40 children in group reassessed at 3.2–6.3 years (\bar{X} = 4.5)	Post-only comparisons with a specially constructed control group (no random assignment); matched on children referred to demonstration center but not enrolled in an EI program (N = 53); same CA and parental educational level as EI	Stanford–Binet or Cattell Infant Intelligence Scale, Vineland Social Maturity Scale	Statistically significant gains in IQ in favor of EI group (\bar{X} = 54.7 versus 42.9) and in SQ (\bar{X} = 64.4 versus 55.5); 65% of children in EI in mild AAMD level versus 24.5% in comparison group; no EI children classified as severe/profound for EI versus 19% for comparison

(continued)

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Hanson & Schwarz (1978)	Staff member visited homes weekly or biweekly, evaluated child's developmental status and established goals in conjunction with parent; detailed educational programs were provided as well as general recommendations for social and physical activities to promote development; normal developmental model with milestones as goals using behaviorally based teaching procedures	Average age of entry into program was 14 weeks, with average program involvement 24.4 months (range 15-30 months); parents were requested to carry out 4-5 different programs weekly with their child (10 trials per day per program)	Home-based program	Primary service providers with advice and teaching of staff home visitors
Hayden & Dmitriev (1975) Hayden & Haring (1977)	Interdisciplinary center-based model preschool program; structured program based on developmental sequences and behavioral objectives across all developmental domains; intensive, individualized program	Variable length of time spent in program; children in model preschool participated in intensive activities 1½-2 hr, 4 days per week	Center-based program	Active in all aspects of model program; parents trained to use strategies at home and participate in child's classrooms; attend parent meetings and group conferences

Parental involvement was a significant component in almost all 11 programs, and many were primarily home based. For infant and toddler programs, in particular, parents were either trained to be the primary service provider (e.g., Hanson & Schwarz, 1978; Rynders & Horrobin, 1980), or to provide additional programs at home, often reinforcing, supplementing, and generalizing lesson activities (e.g., Clunies-Ross, 1979; Kysela et al., 1981; Piper & Pless, 1980). Overall, the instructional burden for younger children was placed clearly on parents, with considerably less emphasis on counseling and support (but see

Child characteristics	Experimental design	Outcome measures	Results
12 Down syndrome children (11 trisomy 21, 1 mosaic), mixed socioeconomic backgrounds; included first 12 children referred from medical and social service agencies for intervention program; 4 children had significant cardiac defects	Post-only design with comparisons to published data on home-reared Down syndrome children's developmental milestones who were not enrolled in early intervention programs	Specific age of attainment of developmental milestones selected from different instruments; comparison data based on Share (1975), Share & French (1974), and Share & Veale (1974)	In comparison to "normative" group, children in the intervention program attained many motor and perceptual-motor milestones (e.g., rolls over, feeds with fingers, walks with no support) at an earlier age and with much less variability in time of attainment; delays in comparison to normal development were still apparent
94 Down syndrome children (95% trisomy 21, 3% mosaic, 2% translocation); analyses included children from model program now in public school ($N = 13$; median CA = 96 months); those currently enrolled in model preschool ($N = 53$; median CA = 42 months); and those enrolled in public school but no model preschool experience (contrast group: $N = 28$; median CA = 118 months)	Nonequivalent contrast group; the experimental group had attended the model preschool program while the control group, some of whom were matched for age with the experimental group, attended other programs; single scores taken from the child's performance on the Down's Syndrome Performance Inventory were used to examine the relationship between age and developmental level across children of different ages; both groups were similar on assessed demographic variables; data on children currently enrolled in the preschool were used for additional comparisons	Down's Syndrome Performance Inventory, Peabody Picture Vocabulary Test or Stanford-Binet; Denver Developmental Screening Test or Vineland Social Maturity Scale	Preliminary results suggest that model children do not show typical decline based on the Down's Performance Inventory at certain ages; graduates of model program and control group show variable changes but model group at higher overall level

(continued)

center-based comprehensive programs, e.g., Hayden & Haring, 1977; Ludlow & Allen, 1979).

In contrast to the consistency of parental responsibilities, the intensity and duration of intervention programs varied widely. With regard to intensity, comprehensive center-based preschool programs for Down syndrome children typically ranged from 2 to 5 hr per day. During that time, extensive services were delivered within a model that usually designated certain portions of the day for different developmental domains. Although each developmental area presu-

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Kysela, Hillyard, McDonald, & Ahlsten-Taylor (1981)	Direct and incidental teaching methods used in recognition of deficits in attention, memory, and generalization within a behaviorally based model; emphasis on language, but teaching activities included cognition, motor, self-help, and play	2 groups of children (2½–6 years) attended half-day sessions 4–5 days per week in center-based program; daily individual language sessions and group activities; 1 day a week given to maintenance checks; no information provided on intensity or frequency for home-based programs; children in both center-based and home-based programs began at different times (home-based mean age at initiation 13.5 months, center-based mean age at initiation all under age 3) and moved through the program at differing rates; total length of program varied and was not specified clearly but intervals spanned a period of 6–8 months for some children and 12–14 months or longer for others	Home-based until 2½ years, then center-based	Implementation of home-based programs as primary teaching agents; collection of criterion data; provide parent-initiated situations and opportunities for generalization for children enrolled in center-based program
Ludlow & Allen (1979)	Center-based interdisciplinary program providing intervention and planned preschool activities; supportive counseling and training of mothers also offered; home-based program requested to be administered daily as a continuation of center-based program; program geared to individual needs and curriculum consisted of speech stimulation, self-help training, locomotor training, and social development; guidelines for teaching objectives provided by developmental charts and assessments	Intervention groups participated in a developmental clinic 2 hr, 2–3 times a week; some children attended play groups or nursery schools; Adult-to-child ratio was usually 1-to-1; duration of program varied with age of entry, but all children participated for at least 2 years prior to their 5th birthday	Center-based for interdisciplinary team instruction, parental counseling and support; home-based for continued stimulation; normal playgroup involvement when prescribed for specific children to further independence and social acceptability	Parental participation in every area of center and home-based programs; supported by other parents; kept progress reports for home training

Child characteristics	Experimental design	Outcome measures	Results
<p>Home-based program, 22 children (13 male, 9 female); birth to 2½ years of age; mean age intervention initiated was 13.5 months; program included 19 Down syndrome children, 3 undiagnosed; 64% had other serious medical problems; center-based program, 8 Down syndrome children, 3 with associated serious medical problems (intervention began at a mean of 28.4 months)</p>	<p>Pre-post only; comparisons based on normative test data in relation to the expected decline in test performance over time</p>	<p>Bayley Scales of Infant Development, Stanford-Binet Intelligence Scale, and Reynell Developmental Language Scales, but used developmental rates because norms often were below children's level</p>	<p>Children's rate of development increased significantly as measured by the Bayley or Binet during the first 6-8 months of intervention and was maintained during the subsequent 6-8 months for both home- and center-based programs; children in the home program maintained even progress in expressive language but those in the center program had accelerated development; Both center- and home-based groups had an increased comprehension ratio during the first 6-8 months and continued a positive trend from that point</p>
<p>72 Down syndrome children in intervention group, 79 in home-reared comparison, and 33 in institutional comparison group; followed until 10 years of age; groups similar in socioeconomic status, family size, and parental age</p>	<p>Pre-post with 2 comparison groups: (1) children living at home not receiving intervention and (2) children placed in residential care prior to their second birthday; no random assignment; portions were retrospective</p>	<p>Stanford-Binet and Griffiths Scale as well as school placement information</p>	<p>The intervention group scored higher on the standardized tests particularly on personal-social and speech development; school placement suggested that early intervention helped to integrate children into the normal community</p>

(continued)

TABLE 1 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Piper & Pless (1980)	Center-based program consisting of an interdisciplinary team with assignment of one staff member per child to be the primary therapist: Parent training provided in the form of demonstration and sets of written instructions. Normal developmental sequences provided guidelines for major objectives	Biweekly therapy sessions for 1 hr over a 6-month period; average CA for initiating treatment was about 9 months, but all children were below 2 years	Center-based for primary therapist intervention and parental demonstrations; home-based intervention between center-based sessions	Received training to provide additional and ongoing activities at home to stimulate development
Rynders & Horrobin (1980)	Center-based and home-based for preschool program; home-based only for infant program (0-30 months); center provided curriculum materials; home-based program conducted by parents using provided lesson plans, curriculum materials, and evaluation sheets; curriculum targeted concept utilization and communicative development within a developmental framework	3 intake groups; intervention duration was 5 years; age range of enrollment was 1-12 months; for infants, time spent on home lessons limited to 1 hr each day, 6 days per week; parent participants completed curriculum evaluation sheets daily; no lessons for preschool children at home except for 1 30-min reading session. Preschool consisted of a daily 5-hr program	Center-based for testing and home-based for implementation of lessons during infant program; center-based for preschool	Deliver lessons, collect evaluation data daily, help center to modify given lessons and develop new lessons for infant program; support program and provide reading experiences for 30-60-month-old children

^aAbbreviations used in the table are as follows: AAMD, American Association on Mental Deficiency; CA, chronological age; DQ, developmental

ably supported and reinforced the other, the structured program and small group or one-to-one directive activities were most characteristic of these programs. For the birth-3 years age group, the intensity of the intervention was much less demanding. Although it was often difficult to determine all of the relevant intervention parameters from the descriptions provided by the authors, intervention ranged from 2 to 6 hr per week on the average, which included both staff training time and parent-teaching activities. In addition to variations in intensity, the average duration of involvement in the program also varied extensively. Some programs were designed to be very short term (e.g., 6 months in the Piper & Pless, 1980, study), but even programs beginning in infancy were as long as 2,

Child characteristics	Experimental design	Outcome measures	Results
37 Down syndrome infants ($N = 21$ treatment group; $N = 16$ control group); mean CA of treatment group was 9.33 months, control group was 8.43; mean birth weight for experimental 2,949 g, for control 2,990 g; mean number of siblings for treatment group 0.95, control group 0.81; mean number of children with congenital heart disease in treatment group was 1.33; control group 1.38; mean number in residential care for treatment group 1.14, control group 1.06	Pre-post using random assignment according to date of admission to the program; after admission, preassessments were made using the Home Observation for Measurement of the Environment Inventory (HOME), the Griffiths Mental Development Scales, and child and family variables; mean maternal age for treatment group, 30.43, control group 29.81; no initial differences on basis of any variable (with one exception on a HOME subscale)	Griffiths Mental Development Scales; Home Observation for Measurement of the Environment Inventory	Mean developmental quotient on the Griffiths Scales declined over the 6-month period; In 2 of the 6 subscales, treatment group decreased less than control group; on the remaining 4 subscales the control group decreased less than treatment group; no statistically significant differences between the 2 groups were found
35 Down syndrome children (all trisomy 21) enrolled prior to 12 months of age; no children suffering from any serious health problems; additional criteria: (1) parental decision to raise child at home for first 5 years of life; (2) family intact; (3) maternal IQ score 90 or above; (4) parents' educational level at least 10th grade; (5) total family income at least \$6,000 (unless 1 or both parents were students); (6) parents used English as 1st language; and (7) family contained no more than 3 preschool-age children including the Down's syndrome child	Post-only (experimental $N = 17$) with specially formed distal control group ($N = 18$); all children enrolled on consecutive basis without exception if they met enrollment criteria stated earlier; comparisons on demographic, neurological, and psychometric variables at beginning of study indicated similar groups	Boehm Test of Basic Concepts; Stanford-Binet; Bruininks-Oseretsky; language samples	All children tested at 60 months; no statistically significant group differences appeared in the specified criterion variables (concept utilization and/or expressive language); however, significant differences did appear favoring treatment group in IQ score and in motor ability

quotient; MA, mental age; EI, early intervention; SQ, social quotient.

3, and 5 years (Connolly et al., 1980; Hanson & Schwarz, 1978; Rynders & Horrobin, 1980). For preschool programs, intervention typically ended at 5 years of age and rarely were any longer term follow-up efforts attempted (see Hayden & Haring, 1977; Ludlow & Allen, 1979).

It is important to note that virtually all of these "first generation" early intervention programs were experimental in nature. Services were often provided while curricula were being developed and modified continuously, and staff training and experience were very variable. In many respects, some of the more extensive intervention efforts were part of a series of demonstration projects with limited availability of well-tested instructional and curricular methods and mate-

rials. In fact, evaluation strategies and related research components were often superimposed on these demonstration programs. As a consequence, research and evaluation were not usually accorded a high priority, with limited resources being allocated to that component of the program.

Evaluation Efforts

In view of this, it is not surprising that efforts to evaluate the efficacy of these early intervention programs rarely conformed to usually accepted scientific standards. Testing and observations by independent staff, the establishment of inter-rater reliability, the development and use of instruments sensitive to and standardized for handicapped populations, and clear criteria for inclusion of subjects were not often found. Moreover, the random assignment of subjects to treatment conditions or the formation of appropriate contrast groups was extremely difficult to accomplish (see Chapter 1 of this volume for a discussion of these evaluation issues). As indicated in Table 1, with the possible exception of the Aronson and Fallstrom (1977), Bidder et al. (1975), and Piper and Pless (1980) investigations, most of the studies were forced to rely on means other than random assignment to determine whether their programs were effective. Often, decisions with regard to effectiveness were based upon comparisons with existing literature that traced the development of reasonably similar groups of Down syndrome children who had not received intervention. Another frequently used approach consisted of attempts to establish control groups by matching subjects in intervention and nonintervention groups on specific variables such as chronological age, developmental level, or socioeconomic status. However, in the absence of random assignment, the possibility of rival explanations accounting for any obtained differences other than those associated with intervention can never be entirely ruled out.

It is easy to be critical of the evaluation attempts of early childhood specialists, but it is far more difficult to suggest viable alternatives. Critics often belabor the point that suitable controls were not provided, thus rendering the reported outcome data uninterpretable as to program impact. Clearly the use of controls would be advantageous, but we cannot take lightly the impediments to establishing suitable comparison groups. Often ethical issues are involved. Can service legitimately be withheld from developmentally delayed or other handicapped children? The mandates of federal and state laws to identify and serve handicapped children have answered that question. Can we compare different approaches or strategies with matched groups of children? Often this is not possible because adequate numbers of similar children (e.g., same age, same family demographics, same handicapping conditions) are not available except perhaps in large metropolitan areas. Further, as noted earlier, most programs have not been provided with the necessary funds to conduct controlled evaluation in which independent testers assess the children with a variety of standardized and non-

standardized instruments. Nor do most early intervention program personnel have the necessary expertise to analyze and interpret quantitative outcomes. Finally, parents may offer barriers to the implementation of carefully controlled studies, for they may fail to appreciate encumbrances necessary for experimental research or strategies that do not appear to them to be of any immediate assistance to their child.

Without taking into account the many problems facing behavioral scientists interested in evaluating the outcomes of early intervention efforts for children with Down syndrome and those with cognitive delays in general, critics do children, parents, educators, other professionals, and the public a disservice. Unless there is some sense of rapprochement and compromise we will never move closer to the goal of achieving a meaningful evaluation of these early intervention programs. Moreover, as discussed next, despite research design limitations, a careful examination of existing studies has yielded certain consistencies and outcome patterns that allow us to establish what we believe is a strong working hypothesis with regard to the effectiveness of early intervention for children with Down syndrome. In particular, as we see it, the studies on early intervention for Down syndrome children conducted to date have provided sufficient information to enable us to provide strong recommendations on the specific issue relating to the prevention or amelioration of the reported decline in assessed cognitive ability of children with Down syndrome with increasing chronological age. Studies focusing on issues such as the relative significance of intervening during infancy in contrast to the preschool years and the importance of continuity in early intervention are unfortunately contradictory, but nevertheless provide some valuable directions for the future.

Analysis of Effectiveness

For children with Down syndrome, documentation of the decline, as well as possible explanations for the decline, in tested cognitive ability with increasing chronological age has been described in the first section of this chapter. Based on the findings of a substantial number of studies reviewed it now appears that this decline can be significantly reduced or entirely prevented during the period in which early intervention services are provided (Aronson & Fallstrom, 1977; Bidder et al., 1975; Clunies-Ross, 1979; Connolly et al., 1980; Hanson & Schwarz, 1978; Kysela et al., 1981; Ludlow & Allen, 1979; Rynders & Horrobin, 1980). This outcome held for studies that employed more global measures, such as standardized psychometric instruments, as well as more specific measures, such as achievement of specific developmental milestones or behavioral objectives. Moreover, these effects of early intervention were obtained not only for studies that were less well controlled in that only pre-post measures were obtained (e.g., Kysela et al., 1981) but were also obtained for (1) those studies with specially created control groups (e.g., Connolly et al., 1980); (2) a

well-designed study in which a carefully developed distal control group was established for comparison (Rynders & Horrobin, 1980); and (3) a rare study based on children matched on age and sex and presumably unsystematically assigned to experimental and control conditions yielding identical groups on critical factors prior to intervention (Aronson & Fallstrom, 1977; see also Bidder et al., 1975). A similar pattern of outcomes was observed for other developmental domains as well, but less consistency in the measures and corresponding outcomes was obtained.

Certainly bias in different forms cannot be ruled out entirely in any of these studies, particularly bias related to the absence of independent testers, and not all studies found that the decline could be modified (e.g., Piper & Pless, 1980; but see Bricker, Carlson, & Schwarz, 1981). Moreover, certain studies did not achieve results that corresponded to the programmatic emphasis of their program (see absence of language effects in Rynders & Horrobin, 1980). Nevertheless, the consistency of reported results as well as corresponding progress on process variables such as achievement of specific educational and developmental objectives in many of the studies is impressive.

The contention that early intervention programs for children with Down syndrome can have the effect of preventing the typical decline in intellectual functioning has received additional support in a study by Berry, Gunn, and Andrews (1984). In an important longitudinal investigation, these researchers independently evaluated at periodic intervals the development of 39 home-reared Australian-born Down syndrome children during the first 5 years of their lives, using the Bayley Scales of Infant Development and the Merrill-Palmer Scale as outcome measures. All children in the sample were drawn from a variety of early intervention programs operated by public and private agencies, programs that were not under the authors' control. Assessments of this sample revealed that across the first 5 years of life, the Down syndrome children gained steadily in mental age—gains that remained proportional to chronological age, i.e., no decline or plateau was observed. The authors state, "Perhaps the main effects of better services, which have become more widely available in the 1970s and early 1980s, are to stabilize development in Down's syndrome infants and toddlers and to provide a paradigm for consistent progression for these young children whatever their levels of ability" (p. 176). Similar outcomes have been reported for a large sample of Down syndrome children from birth to age 3 in the northeastern United States (Reed et al., 1980).

In contrast to findings related to the prevention or even elimination of the decline in cognitive test scores, only limited information is available with regard to the issues of the continuity and timing of early intervention, and much of it is contradictory. Aronson and Fallstrom (1977) have provided evidence as to what happens when intervention is discontinued. Specifically, a 1-year follow-up of their successful intervention program suggested that differences between inter-

vention and control children would be greatly diminished if the supportive environmental conditions were not maintained. In contrast, Connolly et al. (1980) reported that follow-up of children who had completed an early intervention program by 3 years of age still appeared to maintain most of their original gains approximately a 1½ years later and again 4 years later (Connolly, Morgan, & Russell, 1984). Because these studies differed on so many dimensions, including the potential for bias due to selective attrition of subjects, it is not possible to determine the sources of these contradictory findings.

The corollary issue of whether intervention is more effective if begun during infancy than if begun during the preschool period is equally contradictory. The Clunies-Ross (1979) data suggest that those children beginning intervention earlier are more likely to achieve higher developmental scores. Apparently what happens is that the younger children begin at an initially higher level (presumably prior to the usual declines) and whatever effects of early intervention that do occur remain proportional to that initial level. There were no indications, for example, that the development of children enrolled in early intervention after 2 years of age was accelerating at a level that would allow them to reach the same level as those beginning intervention earlier. These results are at best suggestive, as later enrollment may well be confounded with other factors such as parental motivations. Moreover, the absence of any effects of early intervention in the Piper and Pless (1980) study, which enrolled children at an average age of about 9 months, clearly suggests that the question of timing must await the findings of more extensive and more carefully designed systematic research.

OUTCOMES FOR CHILDREN WITH OTHER BIOLOGICALLY BASED DELAYS

We now turn to an examination of the effects of early intervention for an etiologically heterogeneous group of developmentally delayed children whose delays have a clear or presumed biological basis. It should be observed at the outset that this heterogeneity adds additional complexity and variability to the analysis of the effects of early intervention. Nevertheless, a series of 14 studies have been conducted that met our criteria and are summarized in Table 2.

As might be expected, the addition of significant numbers of severely and even profoundly handicapped children to early intervention programs created new challenges in the areas of curriculum development and evaluation. Because so many of these children had associated disorders such as cerebral palsy and sensory handicaps, the problem of providing effective early intervention programs became extraordinarily demanding. The often minute, detailed, step-by-step procedures required for appropriate intervention for this population of handicapped children were rather remarkable. Moreover, many programs served an

TABLE 2

Summary of early intervention studies for children with other biologically based delays^a

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Barna, Bidder, Gray, Clements, & Gardner (1980)	Used adaptations of Portage Project materials as curriculum guide for home training (see Shearer & Shearer, 1976)	Home visits within the Portage model varied from 5 to 25 months (duration of intervention)	Home-based	Parents responsible for administering intervention program, data collection, and collaborating with home visitors
Barrera, Routh, Parr, Johnson, Ahrendhorst, Goolsby, & Schroeder (1976)	Interdisciplinary team approach; 5 areas of treatment were included: gross motor, fine motor, language, perceptual-cognitive, and personal-social; developmental activities were eclectic, drawn from diverse sources	Center program met twice weekly for 3 hr; approximately 30 min was scheduled for each of the specific intervention activities; 1-to-1 training with observer for recording; program was evaluated over a 3-month period	Center- and home-based	Recipients of counseling services and specific training to continue treatment programs at home
Brassell & Dunst (1978)	Home-based program providing infants with sequential intervention experiences; multidisciplinary instructional approach and interdisciplinary team recommendations used to implement the program. Object-concept curriculum was primary focus of study and covered 6 sequential levels of functioning paralleling Piaget's 6 ordinal stages of sensorimotor development	Length of total program 4-5 months; home training demonstrations by staff once per week (1½ hr)	Home-based	Implementation of the demonstrated programs; treatment procedures carried out within the context of play and with materials available at home

Child characteristics	Experimental design	Outcome measures	Results
Although many different groups were part of this study, the focus here was on the 15 children diagnosed as developmentally delayed (exclusive of Down syndrome); prior to intervention, mean monthly gains in mental age were 0.61; no other information available	Pre-post testing without a control group; estimates of impact based on rate of progress during time in program in comparison to rate prior to program	Griffiths Mental Development Scales assessed at entry into the program, during program midpoint, and latest scores available; scores based on mental age gains per month	Delayed children increased their mean monthly rates of mental age growth from .61 to .72 after intervention; greatest gains were noted in the hearing-speech and performance sections of the Griffiths; considerable variability among children noted; no relationship was obtained between age of entry into program and rate of development; no statistical analyses provided
Total of 10 moderately and severely delayed children with varying etiologies; CA range 13-48 months with mean of 26.82 months; average functioning levels of evaluated areas range from 10-14 months; 3 children had lowest area in gross motor, 3 in language, 3 in perceptual-cognitive, 1 in fine motor; all had additional handicapping conditions	Variation of multiple baseline design; each child received treatment in lowest area of development plus 2 randomly selected areas; comparisons made to untreated domains (control areas)	Memphis Comprehensive Developmental Scale	Seven children completed at least 15 sessions over a 2-3-month period; when reevaluated the children were found to have made 6.43 months of progress in the areas selected as the lowest level of functioning, 2.43 months of progress in the randomly selected treatment areas, and 1.68 months in control areas; differences were not statistically significant between experimental and control areas, but progress in the lowest area of functioning was reliably higher than the other 2
Total number of children 91 infants (52 males, 39 females); 24 in experimental group, 67 in control group; heterogeneous group ranging from normal to profoundly retarded and from no motor dysfunction to severe motor dysfunction (over 65% of the children were mildly, moderately, or severely delayed); mean age of mother 26.8 years, 28.9 years for father; mean years in school for mother 11.0, 10.9 years for father; mean monthly gross income \$632	Pre-post with nonrandom controls; no differences between control and experimental groups on object-concept test prior to intervention; control group received general intervention but not object-concept curriculum	Scale I of the Uzgiris-Hunt Scales	Mean posttest scores for experimental group was significantly higher than control; pretest scores were used as a covariate

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Bricker & Dow (1980)	Center-based model demonstration program; an interdisciplinary team approach was incorporated into the program; curricula areas included cognitive, communication, motor, and social/self-help; training lattices were constructed for first 3 domains by developmentally sequencing the instructional content based on order of acquisition; social/self-help behaviors incorporated into daily routine; instructional strategies were primarily behavioral in nature; strong emphasis on evaluation	Intervention began after the child entered program, was evaluated, and an IEP formulated; length of the total intervention program was 1 year, 5 days per week, 6 hr per day	Center-based, teaching staff and parents provided majority of direct instruction; support staff served as consultants; specialists conducted evaluations	Parents were involved in the areas of educational training, social services, and counseling; roles of both parents and program were specified in an individual contract
Bricker & Sheehan (1981)	Programs focused educationally on fine/gross motor, social/self-help, sensorimotor, and communication skills; large- and small-group instruction, individual intervention where necessary; interdisciplinary team approach; Center-based with home-based services to assist parents with moderately and severely handicapped children	Center-based instruction operated 5 days per week 2½ hr per day; 15-20 instructional activities initiated daily; home-based program consisted of weekly 1-hr visits to the home by interventionist; support specialists consulted as necessary; both programs began in the fall of the year and concluded in the spring (9-month span); overall 3-year project	Center-based (6 classrooms); all but 2 included at-risk and nonhandicapped peers in addition to handicapped children; home-based for children whose handicapping conditions ranged from moderate to severe	Individual instruction and/or participation in large and small groups (e.g., educational, social service, advocacy); parent implemented program activities, collected data, and developed skills to promote child's development

Child characteristics	Experimental design	Outcome measures	Results
Total number of children 50 (25 males, 25 females), age range for target population 7-54 months; mean age at program entry 27.6 months; 35 of 50 children severely or profoundly retarded, 13 moderately retarded, 1 each was mildly or not retarded; cultural, occupational, educational, and socioeconomic backgrounds varied widely	Pre-post with no controls; children were administered different numbers of performance tests dependent upon length of enrollment, at approximately 3-month intervals; number of administrations 2-6; minimum enrollment in program per child 8 months	Uniform Performance Assessment System (UPAS)	A summary of results for 40 children enrolled at least 8 months showed statistically significant improvement in each of the 4 domains (see curricula areas) and in the overall score in terms of the percent of items passed on the UPAS; at termination of program 88% of the children were placed in public schools, 4% in group homes, 2% in Head Start programs, 6% in other programs within same school
91 children participated in the evaluation; Age range at start of program was 5 months to 7 years; heterogeneous population ranged from normal to severely handicapped; some children had more than one impairment and 10 were nonambulatory; level of education for mother and father ranged widely; annual income ranged from under \$5,000 to over \$26,000	Pre-post without control groups; formal assessments conducted on all children in center-based program who met a 7-month interval criterion between pre- and posttest	Uniform Performance Assessment System (UPAS), Student Progress Record (SPR), Bayley Scales of Infant Development, and McCarthy Scales of Children's Abilities	For Bayley scores (CA at initial administration was approximately 18 months, $N = 35$, for this young group), mental age and psychomotor equivalent scores increased significantly although mean developmental indexes did not; all subgroups did show change except for children with severe delays; McCarthy scores for 56 older children (mean CA approximately = 46 months) showed significant increases for both MA and the general cognitive index (GCI); Mildly and moderately delayed groups showed these changes in one year of the program but not in another for GCI; MA differences were statistically reliable in all instances; all children in all groups showed reliable progress on the UPAS

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Goodman, Cecil, & Barker (1984)	Families in treatment group attended a hospital-affiliated program; teacher demonstrated techniques to parents; home visits provided by staff on as-needed basis; input received from different disciplines; educational program focused on broad developmental processes, such as imitation, sequential ordering, awareness of space, etc., but not specific skill acquisition; family counseling available	Families in treatment group attended programs between 2-5½ days per week; individualized lessons provided by staff; average length of program was 16 months	Center-based with occasional home visits	Received training but parents considered primary therapists
Moore, Fredericks, & Baldwin (1981)	Because study was retrospective, no details of the preschool intervention programs were provided; however, based on assessment instruments and prior work of the authors, programs were likely sequentially organized, directive, and behaviorally based	No details of preschool experience nor elementary school programs were provided	Center-based with an unspecified home component likely	Not specified

extensive range of developmentally delayed children in terms of both level of severity and chronological age, thereby creating a number of difficult organizational problems for interventionists.

Despite these increased demands, the curricular models were found to be highly similar to those for children with Down syndrome; that is, in utilizing a developmental framework to guide educational and developmental objectives in conjunction with a behavioral teaching technology. Some models even became standardized and were disseminated to other programs. For example, the studies by Revill and Blunden (1979) and Barna, Bidder, Gray, Clements, and Gardner (1980) used the Portage model (Shearer & Shearer, 1976). Others developed detailed training lattices linking one developmental objective to another, ensuring that the hierarchical and sequential nature of developmental processes were followed (Bricker & Dow, 1980). In contrast, some of the programs reviewed appeared to put together a loosely structured array of activities drawn from

Child characteristics	Experimental design	Outcome measures	Results
Children (treatment, $N = 35$; contrast, $N = 36$) had a wide range of confirmed or presumed biologically based delays; mean CA for all children was approximately 3 years (range 15 months to 5 years); families on welfare constituted 56% of the sample; mean IQ for treatment group was 55.6, for contrast group 59.3	Treatment group matched retrospectively to a contrast group selected on basis of initial age, IQ, and SES; treatment families must have been willing to participate and be included in program activities; however, 29 of the 36 contrast children did attend community programs that provided general support and care; testers not blind to group membership	Bayley Mental Scales of Infant Development or Stanford-Binet; ratio rather than deviation IQ scores used for Bayley	Treatment children significantly higher than contrast children during posttesting; mean gain was 8.1 versus 0.8 IQ points; 11 children in treatment group but only 2 in contrast group improved 15 points or more; children in particularly difficult home circumstances improved the most
Total number of children included was 151 (52 9-year-olds, mean age 103.6 months; 50 10-year-olds, mean age 119.8 months; and 49 11-year-olds, mean age 133.9 months); all children were moderately or severely retarded	Retrospective study comparing elementary age children (9-, 10-, 11-year-olds) who had 0, 1, or 2 or more years of preschool experience within a state-wide system; no control exerted over subjects who had different years of preschool experience; children were evaluated across three 1-year time periods	Student Progress Record	Results of students' performance indicated significant differences at ages 9, 10, and 11 in language, academic, self-help, and motor skill performance in favor of those who had at least 2 years of preschool experience

(continued)

numerous sources or failed to provide sufficient information with regard to the nature of those activities (e.g., Sandow, Clarke, Cox, & Stewart, 1981). Interestingly, most of the early intervention programs included in this analysis were part of larger scale systems providing services to a wide age range of children with widely varying levels of severity and etiologies. When studies did focus primarily on children with multiple handicaps (e.g., Barrera et al., 1976; Shapiro, Gordon, & Neiditch, 1977), the programmatic structure and goals were considerably different from those of the more broadly based intervention programs.

Parental involvement through home-based models was clearly a high priority for most of the studies, even for preschool-age children. Specialists were responsible for demonstrating techniques to parents and providing materials, suggestions, education, and support, but parents were often found to be the primary service providers. Models containing a strong center-based component (e.g.,

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Moxley-Haegert & Serbin (1983)	Home treatment of five skill-related exercises similar to those of Hanson & Schwarz (1978); developmental areas involved included fine and gross motor skills, language, spatial awareness, and object permanence; parents taught by therapist at pediatric service how to use materials and maintain records; developmental education group parents (see design section) also received special training to observe and detect progress of their child, to recognize the sequential nature of development, and to anticipate next milestones for their child	Materials supplied by program; parents were asked to carry out the exercises daily for one month; home visitors met once per week for first 3 weeks for all but control group	Home-based but training of parents took place at pediatric service	Primary service provider in home; parent used materials provided, maintained a journal, and recorded any developmental gains
Nielsen, Collins, Meisel, Lowry, Engh, & Johnson (1975)	Transdisciplinary approach; eclectic programming (primarily developmental in orientation) provided in area of sensory stimulation, language (encouraging vocalizations, imitation), motor development (neurodevelopmental methods), prespeech, and feeding domains	Varied with age of child: Home visits made once per week from birth to 3 years; occasional center-based individual sessions; parent-infant group children less than 1 year and new to program; Parents spent 1 hr per session with staff, child worked with other staff; group program: for CA 12-18 months, 3 hr, 4 mornings per week (attendance varied from 2 to 4 mornings per week with each child); total length of program 12 months	Home- and center-based	Primary change agent; support center-based programs

Child characteristics	Experimental design	Outcome measures	Results
<p>39 children (mean CA = 21.5 months) scoring at least 1 standard deviation below the mean on either the Bayley Mental Development Index (MDI) or the Psychomotor Development Index (PDI) were included; the 13 children in each of three groups (see design section) consisted of 6 severely (Bayley score less than 50) and 7 moderate to mildly delayed (Bayley score 50–80) children; varied etiologies; mean age of parental education 11.33 years; all three groups were similar in the Home Observation for Measurement of the Environment Inventory (HOME) scores and parent education level</p>	<p>Children of parents in the home treatment program were matched according to severity of delay and assigned randomly to 1 of 3 treatment groups: (1) a developmental education group which parents received training to help them recognize small gains in their child's development; (2) an education in child management group providing general information and social reinforcement similar to the treatment group but not specific to delays; and (3) a control group not receiving any intervention</p>	<p>Bayley Scales of Infant Development, a developmental knowledge test for parents, parent participation measures in home program, and skills specified to be taught; the assessment schedule consisted of pretreatment, a 1-month assessment, and a posttreatment assessment carried out 9–15 months later; specific assessments varied at these three time periods; assessors were not aware of which experimental condition was assigned to each family</p>	<p>At the 1-month assessment, amount of participation, knowledge of development, and accuracy of recognizing developmental gains of their children by parents in the developmental education group was significantly greater than either of the other two groups on most measures; similarly, children in the developmental education group learned more of the prescribed skills than either of the other 2 groups; on the Bayley scales, the developmental education group made greater improvements on the motor scale but not the mental scale; at follow-up, more parents in the developmental education group continued to be involved in their child's treatment program and significant gains in motor development were maintained at 1-year-follow-up; no group differences were obtained with regard to cognitive development at follow-up</p>
<p>Age range 0–3 years; 16 of 19 children participated in the evaluation using the Bayley; all 19 received The Denver Developmental Screening Test (DDST); varied etiologies and severity of developmental delay; mean CA at entry to program was 14.1 months (MA = 8.3 months)</p>	<p>Pre–post with no controls</p>	<p>Bayley Scales of Infant Development and Denver Developmental Screening Test (DDST)</p>	<p>Data showed a mean gain of 3.7 months in mental age and 3.9 months in motor age during the 5.4 mean months between first and second administration of the Bayley; no statistical tests provided; changes in mean age equivalents on DDST were statistically significant for the first 6 months but no further gains during the second 6 months</p>

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Revill & Blunden (1979)	The Portage Project model was applied (see Shearer & Shearer, 1976) involving weekly home visits and collaborative staff-parent goal setting and selection of educational activities	Weekly visits by home trainer for a period of 4 months	Home-based	Provide primary service, collect data, and monitor child's progress
Safford, Gregg, Schneider, & Sewell (1976)	Center-based program focusing on appropriate sensory experiences with minimal failure or frustration for both child and parent; interdisciplinary team approach and a 1-to-1 staff-to-child relationship was maintained; primary objective was to make child less irritable and easier for parent to manage; related objectives included increased verbal reactions, eye contact, and attending; relaxation, desensitization, feeding, and sensory stimulation activities were provided	One classroom with six children; five sessions (relaxation, sensory, relaxation, feeding, exploration) conducted each day; total length of program 6 months	Center-based	Facilitated carry-over of activities through staff offerings of specific suggestions mostly relating to positioning and feeding
Sandow, Clarke, Cox, & Stewart (1981)	Individualized learning programs were designed by experimenter and parents; no additional details were provided	Maximum program involvement over 3 years; for one intervention group, home visits occurred at 2-week intervals for 2-3 hr per visit; a second intervention group received a similar visit every 2 months; a matched distal control group did not receive any visits	Home-based	Primary service provider in conjunction with experimenter

Child characteristics	Experimental design	Outcome measures	Results
19 subjects from 2 geographic areas meeting the following criteria were included in the study: CA less than 4.5 years, child not attending nursery school more than 5 half-days per week, and child scored 78 or below on at least 2 subtests of the Griffiths Mental Development Scales; no other information provided	Pre-post without a control group; in addition, one of the two geographic groups entered the program with a planned delay of 2 months, allowing multiple baseline comparison of impact; baseline data were extensive	Pre-post measures taken weekly by home visitor for each designated skill; monthly recording of development on Portage checklist carried out in child's home; administration of the Griffiths Mental Development Scale at 2 months and again at 4 months	Both geographic groups completed nearly 90% of the tasks that were agreed on; Comparisons between pre-entry (baseline) and monthly assessments following entry into program on the number of Portage checklist skills gained per month revealed a substantial increase following program entry for each group; Griffiths scores showed limited and variable gains for either group; no statistical tests were presented
Total number of children 6 (5 male, 1 female); age range at onset of program was 20-45 months; IQs on Cattell Infant Intelligence Scale were 24, 28, 35, 40, 47, and 70; most children were irritable with poor eating and sleeping habits; Some rejected body contact, were self-stimulating, and self-abusive	Pre-post with no controls	Cattell Infant Intelligence Scale and Houston Test of Language Development	Gains across the 6-month period in assessed functional age equivalence in gross motor functioning occurred for all children (average age gain of 1.9 months); average gain in language age was 1.8 months; strong individual gains measured in perceptual and fine motor areas; no tests of statistical significance provided
32 severely delayed preschool children with a mean CA of 2 years 6 months and a mean MA of 1 year 3 months participated; wide range of SES and etiology; children remained in program until the age of 4 years 8 months; A matched group of 15 additional children were selected from a different community	2 matched intervention groups varying in frequency of home visits were evaluated on pre-post measures at annual intervals; a matched distal control group (no intervention) was also established	Assessments on the Cattell Infant Intelligence Scale occurred at program entry and at annual intervals thereafter; the Vineland Social Maturity Scale and specific criterion-referenced instruments were administered but not considered in the evaluation in detail	Both intervention groups gained in the Cattell at different rates but by the 3rd year both exceeded gains of the distal control. No differences were obtained between the 2 intervention groups on this measure

(continued)

TABLE 2 (Continued)

Reference	Nature of intervention	Intervention parameters	Setting	Role of parents
Shapiro, Gordon, & Nieditch (1977)	Program based on developmental–interaction approach involving cognitive and motivational components; measured 8 dimensions of behavior	Children and their families participated in intensive stimulation program for a period of approximately 3 months as in-patients in a rehabilitation center	Center-based (in-patients at medical center)	Required to spend 1 full day per week in active participation at the center
Shearer & Shearer (1976)	Emphasis on self-help, motor, socialization, cognitive, and language domains; interdisciplinary program staff (all home teachers); precision teaching model followed; goals are developmentally sequenced using detailed behavioral objectives; curriculum cards and manuals guide and suggest educational activities	All instruction took place in home; home teacher writes activity and data collection charts, and models activities once per week for 1.5 hr per child; up to 3 activity plans written or modified per week; no prescribed frequency or intensity for parental instruction noted but strong encouragement for parents; project evaluated children within an 8-month period	*Home-based	Main change agent for child who also collects data and participates in selection of target behaviors

*Abbreviations used in the table are as follows: CA, chronological age; MA, mental age; SES, socioeconomic status.

Bricker & Dow, 1980) typically provided counseling in addition to working with parents to extend developmental programs to the home that were part of the center-based activities. For home-based programs, staff usually visited or consulted with parents on a weekly basis. During interim periods, parents were asked to carry out various activities as often as possible to try to meet certain mutually agreed-upon objectives prior to the next visit. Accordingly, the exact amount of intervention time that actually occurred could not be precisely determined in these models. In contrast, center-based models scheduled groups 2–5 times per week that ranged from 3 to 6 hr per day. Finally, the duration of early intervention programs was highly variable. Although some were evaluated across a relatively long intervention period of as much as 25 months (Barna et al., 1980), virtually all were shorter term programs, typically less than 12 months in duration.

Child characteristics	Experimental design	Outcome measures	Results
60 multiply handicapped children whose ages ranged from 18 to 36 months; medical diagnoses included cerebral palsy, spina bifida, and delayed development; no other information provided	Pre-post comparisons with no controls of coded anecdotal records maintained for each child	Anecdotal records by teachers written 3 times per week; logs coded on scales in the areas of interaction with materials, social responsiveness, expressive language, awareness of the environment, affect, gross and fine motor activity, and sensory responsiveness	Pre-post score differences indicated that the children were more responsive and functioning at a higher level in most areas coded than when they first entered the program; major areas not statistically significant included interaction with materials, fine motor activity, affect, and sensory responsiveness
Target population ranged from high risk to severe/multiply handicapped (birth to 6 years); average IQ 75; no other information available	Pre-post with no controls	Cattell Infant Intelligence Scale, Stanford-Binet Intelligence Test, Alpern-Boll Developmental Profile	Average child gained 13 months on developmental tests in the 8-month period; statistically significant gains were obtained on the Alpern-Boll (mean gain = 13.5); on the Stanford-Binet mean gain was 18.3 IQ points, also statistically significant

Analysis of Effectiveness

The difficulties in conducting meaningful evaluations that meet established scientific standards, discussed earlier in the section on children with Down syndrome, apply equally to early intervention programs for children with other biologically based delays. In fact, the group of studies that met the criteria for review in this section appeared to be much less sophisticated and less credible from a scientific perspective than those studies reviewed that focused exclusively on children with Down syndrome. With minor exceptions (e.g., Moxley-Haegert & Serbin, 1983) no effort was made to utilize independent observers or evaluators who were unaware of the intervention status of the children or families. Similarly, interrater reliability was rarely established, and many of the assessment instruments selected did not seem to have the capacity to be sufficiently sensitive to the range and complexity of delays exhibited by these children. Finally, as will be discussed, despite some creative efforts to establish control or

contrast groups, the overwhelming majority of studies relied on the least sophisticated experimental designs in order to evaluate the impact of their program.

Certainly, as described in Chapter 1 of this volume, these problems are part of the larger methodological and ethical problems faced by investigators seeking to conduct intervention research for handicapped populations. However, difficulties in experimental design for this particular group of studies may also be a reflection of the added burden of providing intervention services and developing instrumentation for such a heterogeneous group of children. This drain on already scarce resources was likely to have left limited support available for research and evaluation. Moreover, it is important to note that, in contrast to the programs for children with Down syndrome, very few studies were available that had systematically traced the general course of development for this diverse group of children in a manner useful for evaluation. As described in the first sections of this chapter, documentation of changes in measured cognitive skills with increasing chronological age obtained for children with Down syndrome were simply not available for children with other biologically based delays to serve as a framework for interpreting the outcomes of early intervention programs. In particular, the absence of these developmental expectations makes any appeal for effectiveness based primarily on changes in rates of development subsequent to program services less compelling.

These difficulties are reflected in the finding that a substantial number of studies compared changes from pre- to post-intervention without the benefit of a control group (Barna et al., 1980; Bricker & Dow, 1980; Bricker & Sheehan, 1981; Nielsen et al., 1975; Safford, Gregg, Schneider, & Sewell, 1976; Shapiro et al., 1977; Shearer & Shearer, 1976). In essence, these programs had no other alternative but to appeal to changes in the rate of development (such as number of months in mental age gained per unit of time as reflected in proportion measures or more directly in IQ scores) that coincided with the provision of early intervention services. The outcomes of these studies ranged widely, with one (Barna et al., 1980) not reporting any statistical analyses of their data at all and one claiming rates of development for children in the program to be nearly twice that prior to entry (Shearer & Shearer, 1976). Findings of the remaining programs were more modest (see Table 2) but nevertheless did indicate an increase in the rate of development sufficient in many instances not only to prevent any further disparities with normally developing children but also to be capable of reducing the differences to some small extent. An interesting variation of this pre-post design was a study reported by Revill and Blunden (1979) in which a geographically matched group postponed entry into the program for 2 months. Rate changes in the number of curricular skills gained did coincide with entry into the program, but gains for both groups on a standardized intelligence test were minor.

Four studies did attempt to form contrast or control groups in some manner to

enable them to make certain comparisons but random assignment was not possible. Goodman, Cecil, and Barker (1984) matched their treatment group retrospectively with children in community programs; Sandow et al. (1981) employed a distal control group presumably not receiving services; Brassell and Dunst (1978) compared the performance of experimental-group children to those not recommended for a specific form of intervention; and Barrera et al. (1976) used subjects as their own controls in a variation of a multiple-baseline design. Again, modifications in development as a result of early intervention were relatively modest, although Goodman et al. (1984) did report a mean gain of approximately 7 points on standardized intelligence tests above that of their contrast group. As noted earlier, each of these design strategies is fallible and their conclusions must be viewed accordingly.

The remaining prospective study was primarily concerned with evaluating the effectiveness of a particular type of parent education program utilizing both parent and child change measures (Moxley-Haegert & Serbin, 1983). This very well designed and executed study included a randomly assigned control group not receiving any intervention services. Comparisons on the Bayley Scales of Infant Development revealed reliable differences in favor of the treatment group on the motor but not on the mental scale after 1 month (average increase over control group was approximately 6% above pretest level), which was maintained at a 1-year follow-up.

Although most of the early intervention programs served children with widely varying degrees of severity of developmental delay, it was not generally possible due to insufficient numbers of children to distinguish whether proportional gains were made by subgroups classified by level of severity. Data from Bricker and Sheehan (1981) did, however, suggest that where developmental gains did occur, groups of severely, moderately, and mildly delayed children all showed relative increments in development. Proportionally small gains were reported for programs specifically devoted to severely delayed and multihandicapped groups (Barrera et al., 1976; Bricker & Dow, 1980; Safford et al., 1976; Sandow et al., 1981; Shapiro et al., 1977). Moreover, Bricker and Dow (1980) found that for a group of predominantly severely and profoundly delayed children pretest scores were the best predictors of posttest scores. Similar correlations for a much more heterogeneous group were also high between pre- and posttests, but pretest scores were not correlated with change scores (Goodman et al., 1984). In addition, in this latter study greater improvement occurred for children who were in highly stressed home environments.

It should be noted that substantial gains in curriculum related skill areas as measured by corresponding criterion-referenced type instruments were reported by many programs—gains that seemed reliable and correlated with entry into the program (Bricker & Dow, 1980; Bricker & Sheehan, 1981; Moxley-Haegert & Serbin, 1983; Revill & Blunden, 1979; Shearer & Shearer, 1976). These changes

should be considered important as they stand. At the same time, however, it is unclear whether the curriculum-based skills taught by prescribed instructional procedures produced generalized sets of skills and abilities. If standardized tests of general cognitive functioning reflect aspects of these generalized skills, then generalized gains must be considered modest. In fact, two studies found limited relationships between skill-related improvements and gains in general cognitive development (Moxley-Haegert & Serbin, 1983; Revill & Blunden, 1979).

It is certainly possible that the absence of these relationships and the modest gains found in the studies reviewed in this section in terms of standardized tests of general development may reflect an insensitivity of the instruments to detect important changes, as most of the tests were not designed for children with significant delays. In fact, the development of meaningful and appropriate evaluation instruments for many groups of handicapped children remains a major task for the future. It is also possible that important changes were occurring in domains not measured in the early intervention program evaluations. Improvements in social competence, emotional stability, motivational characteristics, parent-child relationships, and overall family functioning—all important potential outcomes of early intervention—were not systematically assessed (see Outcome Measures column in Table 2). Similarly, little is known about the longer term impact of early intervention. A retrospective analysis of children now of elementary school age comparing groups with varying degrees of preschool experience did yield positive relationships in support of the value of early intervention, but methodological problems make it very difficult to weigh this outcome strongly (Moore, Fredericks, & Baldwin, 1981). A 1-year reevaluation following termination of specific services did, however, indicate that gains could be maintained (Moxley-Haegert & Serbin, 1983).

Summary for Children with Other Biologically Based Delays

In the studies meeting the criteria for inclusion in this section of the review, reports of successful efforts to teach curriculum specific skills were widely noted, and parents were relied upon to provide vital, direct intervention services in most instances. However, reported gains in more general areas of development, especially cognitive domains, were more modest and the studies yielded little information as to the specific characteristics of either programs or children that might produce the most substantial benefits. As noted earlier, the heterogeneity of developmental delays and accompanying disabilities for this group of children may well have been responsible for the unusual experimental design and curriculum development problems experienced by this group of early intervention programs. Although some investigators were extremely clever in developing

designs that strengthened the link between programmatic efforts and developmental changes, a substantial proportion of programs were forced to rely on less sophisticated approaches. There were numerous signs from this literature that early intervention programs were having an impact but the difficulties noted earlier, the narrow focus of most outcome measures, the lack of follow-up, and the considerable instrumentation problems prevent us from going beyond these most tentative of statements.

Finally, the inclusion of a substantial number of children with severe and profound delays raises the issue as to what constitutes meaningful change for this subgroup of children. To some extent, of course, value judgments enter into all of our decision making in this field, but the impact and ultimate value of short-term changes in the development of severely and profoundly delayed young children occurring as a result of early intervention has been questioned in many quarters. Although it is beyond the scope of this chapter to discuss this issue in detail, it is important to note that a number of studies have reported benefits to these children that appear to have potentially important developmental and functional significance (Barrera et al., 1976; Bricker & Dow, 1980; Safford et al., 1976; Sandow et al., 1981). Follow-up studies of the long-term effects of early intervention efforts in relation to the impact of these programs on later life activities will be necessary to help evaluate this complex issue.

CONCLUSIONS AND RECOMMENDATIONS

Early intervention programs for children with general developmental delays are prominent features of contemporary service systems for young handicapped children. As we have seen (see Chapter 1 of this volume), there appears to be a logical and developmentally sound rationale for providing such services, but, of course, it is essential to examine empirically the extent to which the goals of early intervention programs have been accomplished. No attempt will be made in this section to summarize in any detail the numerous studies reviewed in this chapter, as summary statements have been presented at many points as part of the preceding analyses. However, we do feel that, despite the many problems associated with the evaluation of early intervention programs for developmentally delayed children, this review has many implications for the practitioner as well as for program and policy designers, researchers, parents, and evaluators.

Perhaps the most important implication these findings may have for health professionals, educators, parents, child development specialists, other practitioners, and policymakers, is the perspective they provide on early intervention issues. Specifically, this review has clearly not been an effort to arrive at a consensus opinion, as it would certainly result in oversimplifications and overex-

tensions, given the nature of existing research. Nor has it been an effort to present a devastating critique of published work—a task all too easy to accomplish. Rather, this review may be of special value in providing a sense of what to expect realistically in terms of developmental gains from intensive and extensive involvement in early intervention programs.

In particular, claims of utter failure of early intervention as well as claims of incredible success for the group of children described in this chapter can now be more critically appraised. Neither is accurate. There is, however, reason to project confidence that the decline in measured intelligence with increasing chronological age common to children with Down syndrome can be prevented and to some extent reversed. As we have seen, this was a generally consistent finding, holding across many different types of experimental designs and programs. It was the convergence of different sources of information that was perhaps most convincing. Unfortunately, for children whose delays could be attributed to a biological basis other than Down syndrome, the evidence was less satisfactory. As noted, the heterogeneity of the population and other factors resulted in less sophisticated designs overall, raising important questions about both the internal and the external validity of the findings. Nevertheless, the consistency of the results, even for the better controlled investigations, suggests that early intervention programs for these children may well have an effect of about the same order of magnitude as those directed toward children with Down syndrome, but with much more variability in the possible outcomes.

To some readers of this review the range and magnitude of outcomes that can be realistically expected to occur due to systematic early intervention will be disappointing, as no evidence can be found to support expectations for radical and dramatic changes. To others, these results will suggest that promising but yet tentative optimism with regard to achieving a meaningful impact on the lives of young developmentally delayed children through early intervention programs is the most reasonable position to maintain. Still others perhaps may see these outcomes as a confirmation of the power of biological determinism or the ineffectiveness of intervention procedures that are experiential in nature.

In our view, the second position—that early intervention is indeed a promising strategy, one that has in fact demonstrated its ability to produce consistent positive changes in the development of young delayed children—is most compatible with the facts. Aligning ourselves with this position seems especially appropriate when the entire early intervention enterprise is placed in perspective. In essence, the evaluation of impact was based upon a series of “first generation” early intervention programs. Curricula were being written and tested, administrative procedures were being developed, techniques for incorporating the input from many disciplines were being refined, and team-process strategies were being explored; often while services were being delivered. Moreover,

personnel preparation programs providing specialists to work with these children were limited, and many staffs were faced with a difficult on-the-job training experience. Finally, the measurement strategies were often questionable and restricted primarily to direct child change measures.

Whether better trained and experienced personnel, refined and well-tested curricula, as well as other strategies and resources designed to improve the quality of early intervention services will yield corresponding improvements in outcomes is a vital question for the future. Initial results suggest that this task should be actively encouraged. A fair appraisal for purposes of public policy as well as for individual decision making by professionals and parents regarding early intervention for developmentally delayed children must await the outcomes of a next generation of programs. In this next phase, researchers, evaluators, and program designers should seek to achieve a more enlightened family partnership and recognize more completely the implications of a broader ecological approach to intervention (Bronfenbrenner, 1977). It appears to be especially important to consider dimensions such as social support networks (Friedrich & Friedrich, 1981; O'Connor, 1983). Moreover, it may be helpful in subsequent programs to take a somewhat less directive and perhaps less artificial approach to intervention than that described in existing studies, relying more on the integration of intervention activities within the natural flow of family and school events. In addition, we recommend that measurement systems be expanded beyond primarily cognitive measures to assess potentially important outcomes of early intervention that have been generally excluded to date. Of particular importance are measures of social competence, motivation, family functioning, and problem-solving skills.

Of course, these recommendations do not resolve the basic difficulties inherent in conducting early intervention research for developmentally delayed children. The experimental design issues and strategies for extending evaluation beyond the short-term focus, characteristic of almost all the prospective studies reviewed, remain major barriers. Some suggestions for improving our experimental designs and establishing a meaningful data base for developmentally delayed and other groups of young handicapped children are described in the final chapter of this volume. Perhaps as these procedures are applied and additional studies are forthcoming more specific issues such as the relative value of early versus later intervention, the optimal intensity of programming, and determinations of which children are likely to benefit from specific early intervention approaches can be meaningfully addressed. Despite the fact that even tentative answers to these more detailed questions are not possible at this time, we are encouraged by the initial efforts of the studies analyzed in this review and look forward to the design and analysis of subsequent generations of early intervention programs for children with general developmental delays.

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