The Effectiveness of Early Intervention Services

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Approximately one-fifth of all infants born annually are at risk for developmental disabilities (Haber, 1991). Of these, approximately one-fourth will manifest significant delays by age 5. An additional 20-30% of each birth cohort will require special education services due to social or familial factors such as unresponsive or unstimulating environments. “Early intervention” is a term commonly used to encompass a system of services delivered to children with, or at risk for, developmental delays, before their third birthday. These services include physical, occupational, psychological and speech therapy, family support, counseling and education, and case management (care coordination). They are provided at no cost to families through a federal entitlement (the Individuals with Disabilities Education Act – IDEA). Benefits of early intervention have been repeatedly demonstrated through quality research studies.

RATIONALE FOR EARLY INTERVENTION

Neurobiological research shows that early experiences and stimulation are critical for optimal brain development, suggesting the considerable capacity of early intervention to effect the child. The brain develops by an "experience-dependent" process, where experience activates certain pathways in the brain and not others. Experiences early in life are especially crucial in organizing the brain's basic structures, as they create the neural foundation for all subsequent development and behavior (Greenough, Black, & Wallace, 1987; Siegel, 1999). Lack of stimulation or experience leads to cell death in a process called "pruning" whereby pathways that are not used are eliminated (Siegel, 1999).

The primary source of a child's early life experience is interpersonal relationships. Furthermore, advancing neurobiological research shows that a child's readiness for school, and potential for the development of intelligence, emotional regulation, and social skills are highly dependent on the quality and quantity of interaction with the most important people in their lives Shonkoff, (2003). For children who are not learning expected behaviors as fast as their peers, extra care in designing early experiences through interpersonal relationships can provide the stimulation which maintains/expands brain capacity (Siegel, 1999).

RESEARCH ON CHILDREN AT BIOLOGICAL RISK

Leib, Benfield, and Guidubaldi (1980) compared the effects of traditional care with those of a multimodal sensory enrichment program delivered during pre-term infants' stay in an NICU. The Bayley Scales of Infant Development (BSID) were administered 6 months after the expected date of confinement (mean age, 7 months, 3 days, range 1.8 months). Infants in the enrichment intervention group ($n_{EI} = 14$) scored significantly higher than infants in the traditional care control group ($n_{CNTRL} = 14$) on both mental and physical scales of the BSID ($p < .001$ for both).[1] Controlling for initial differences between enrichment and control groups on a measure of interactive processes, the differences remained significant ($p < .01$ for mental scale; $p < .02$ for

[1] Mental scale Δ = 22.43, F = 14.98; motor scale Δ = 19, F = 16.46, degrees of freedom not reported.

motor scale; Leib, et al., 1980).[2] These short-term benefits provide evidence that early intervention can enhance pre-term children's development during the first year of life.

Changes in cognition and behavior for pre-term, low birth-weight infants over the first three years of life were examined in a larger study (N=985; Infant Health and Development Program, 1990). In a randomized clinical trial, the researchers tested the effect of intervention in addition to high-quality pediatric follow-up in the first 3 years of life on the incidence of developmental delays. The intervention group received home visits for family support and education on health, development, activities to facilitate development, and self-identified problem-management, center-based services in an Infant Development Program (IDP), and pediatric follow-up; the control group received pediatric follow-up only ($n_{IDP} = 377$, $n_{CNTRL} = 608$). Significant increases for children in the IDP group as compared to those in the control group were observed in cognitive scores on the BSID at 24 months and the Stanford-Binet at 36 months of age ($P = .001$; Brooks-Gunn, Klebanov, Liaw, and Spiker, 1993).[3] Controlling for sociodemographic and health variables, the difference was still significant ($p < .001$), although the intervention was more effective for infants weighing 2001-2005 grams at birth as compared to infants lighter than 2001 grams ($P = .014$; Infant Health and Development Program, 1990). Heavier low birth weight (2,000-2,500 grams) infants benefited approximately twice as much compared to comparable weight controls as

[2] Mental scale $F = 7.93$, motor scale $F = 6.20$.
[3] Δ between groups = 9.53, effect size, $ES = .59$.

VLBW infants did compared to their controls (P = .014; Infant Health and Development Program, 1990).[4]

There was also a slight but significant decrease in problem behavior for IDP children as compared to control children at 2 and 3 years of age (P = .001).[5] Again, controlling for sociodemographic and health variables, the difference remained significant (P = .003), while secondary analyses indicated a differential effect for children of mothers with less education as compared to children of mothers with more education. For the latter group, there was little difference between IDP and control-group children. For the former group, mothers of children in the IDP reported fewer behavior problems than mothers of children in the control group, and the intervention was more efficacious for children with more severe behavior problems (Brooks-Gunn, et al., 1993; Infant Health and Development Program, 1990). This evidence supports the benefit of early intervention on cognitive and behavioral domains and also indicates that child behavior and health and family risk factors can influence the degree of benefit.

Resnick, Eyler, Nelson, Eitzman, and Bucciarelli (1987) also studied the effects of a multidisciplinary infant development program (IDP) on the physical and mental development of pre-term, low birth-weight infants (500 – 1,800 grams). Two hundred and fifty-five infants from a neonatal intensive care unit were randomly assigned to either the IDP (n_{IDP} = 124) or to a control group (n_{CNTRL} =131). The infants assigned to the IDP received intervention services through two years of age. Parents also received counseling and education. In a blinded evaluation, infants in the IDP scored much

[4] Δ_{LBW} = 13.2 IQ points, Δ_{VLBW} = 6.6.

higher on the BSID than the control group on both mental and motor indices at 12 and 24 months of age (t Test, $p < .05$).[6] Chi-square (χ^2) statistical analyses revealed that the IDP group had a significantly lower incidence of developmental delay ($p < .05$). The IDP group had 4% prevalence of developmental delay at one year and 4% prevalence at two years, whereas the control group had 18% prevalence of delay at one year and 26% prevalence at two years (Resnick, et al, 1987).

Together these studies support the power of early intervention in enhancing the development of children at biological risk for developmental delay. Replication of results, longitudinal studies of the effects on skills into adulthood, and more investigations of development in behavioral and socio-emotional skills are needed to fortify this conclusion.

RESEARCH ON CHILDREN WITH DEVELOPMENTAL DELAYS

Research on specific conditions or delays also presents a strong case for the effectiveness of early intervention.

> "Early identification of children with developmental disabilities leads to an effective therapy of conditions for which definitive treatment is available. However, even in those instances in which the condition cannot be fully reversed, early intervention improves children's outcomes and enables families to develop the strategies and obtain the resources for successful family functioning" (Committee on Children with Disabilities, 1994, page 863).

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[5] Δ between groups = 3.5, effect size <= -.18.

[6] Mental Δ between groups = 10.6, motor Δ between groups = 8.75.

A 1990 evaluation of specific motor training for children with Down Syndrome by Bjornhage, Lagerwall, Ericsson-Sagsjo, and Waldenstrom (as cited in Spiker and Hopmann, 1997) involved 20 children. The treatment group (n_{TX} = 14) received intervention from 3 months of age until they could walk. The treated children performed better than control children (n_{CNTRL} = 6) on four areas: gross motor, fine motor, kinesthetic perception, and tactile perception. Muscle tone was not affected. The benefit of early intervention seen in this study indicates the need for research using larger numbers of children. Another interesting question for future investigation is whether earlier acquisition of motor skills facilitates cognitive and social development (Spiker and Hopmann, 1997).

The effects of two types of therapy on motor and cognitive development were examined for children with spastic diplegia cerebral palsy (Palmer, et al., 1988). Children aged 12-19 months were enrolled in a treatment program consisting of 12 months of neurodevelopmental physical therapy (NDT, n_{NDT} = 25), or 6 months of infant stimulation followed by 6 months of NDT (n_{IS} = 23). Evaluation after the first 6 months of the programs indicated children receiving infant stimulation performed better on motor and mental quotients derived from the BSID (P = .02, P = .05, respectively).[7] The mental quotients for children in both groups improved over enrollment scores, with infants in the stimulation group improving more than NDT infants.[8] Children receiving infant stimulation also improved over their motor quotients at enrollment, while children

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[7] Motor, M_{IS} = 58.1, M_{NDT} = 49.1; Mental, M_{IS} = 75.5, M_{NDT} = 65.6.

[8] Δ_{IS} = 9.4, Δ_{NDT} = 3.6.

in the NDT group had lower scores than at enrollment.[9] This difference persisted at twelve months and in the same direction on the motor quotient ($p < .01$),[10] but there was no longer a difference on the mental quotient. The difference for motor scores persisted even after controlling for any base-line motor, cognitive, and demographic differences (Palmer, et al., 1988). The best predictor of 6- and 12-month performance for both mental and motor indices was the mental and motor scores at enrollment, which limits the interpretability of this study, given the absence of a control group. However, the authors propose that infant stimulation may benefit motor performance for children with cerebral palsy, but this benefit declines with withdrawal of stimulation (Palmer, et al., 1982).

Thus, for children with Down Syndrome and cerebral palsy, there is support for the benefit of specific types of early intervention on motor skills, but less evidence that it also enhances cognitive skills. Rigorous examination is needed to determine how parental characteristics are influenced by the child and/or family's participation in intervention, and how these characteristics influence the child's development.

A tangible component of early intervention is the provision of adaptive devices to children with special needs to enable them to engage in specific behaviors. Hulme, Shaver, Acher, Mullette, and Eggert (1987) empirically examined the effect of adaptive seating devices (ADS) on eating and drinking for 11 children with multiple disabilities, 18 – 45 months old, 9 of whom had cerebral palsy. Subjects served as their own quasi-control, as behavioral measurements on the first 3 visits before the ASD was introduced

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[9] $\Delta_{IS} = 5.1$, $\Delta_{NDT} = -.38$.

were compared to behavioral observations with ASD use. Children's sitting posture improved during ASD use (p <= .01).[11] Skills involved in eating and drinking also improved; subjects were better able to maintain their heads in alignment (p <= .01, p <= .03, respectively),[12] and retain food and drink in their mouths (p <= .01, p <= .01, respectively).[13] Four subjects were able to change from eating pureed food to chopped food (p <= .01),[14] and 3 subjects switched from bottle feeding to cup drinking (p <= .01, no other statistics reported). Although eating time increased with ASD use, this resulted from switching from pureed to chopped food and being included with the family at meal-time. Being included in the social interaction and dinner conversation provided the children with stimulation to develop language and social skills (Hulme, et al., 1987). Given the small N and lack of a true control, a cautious interpretation is in order of the benefit of using ASDs on drinking and eating, but these results suggest the merit of further and more rigorous investigations.

Whitehurst, Fischel, Caulfield, DeBaryshe, and Valdez-Menchaca (1989) investigated the use of social interactions between the parent and child as an intervention medium to improve expressive language development. The study examined the effect of a 4-month, home-based language intervention administered by parents on the expressive language development of 25 children diagnosed with expressive language delay (ELD) at 24 – 40 months of age. Compared to 26 age-matched children with ELD who did not receive treatment, categorical post-test scores

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[10] $M_{IS} = 63.3$, $M_{NDT} = 47.9$.
[11] $F(1,20) = 48.2$.
[12] Eating, $F(1,20) = 10.6$, p <= .01; drinking $F(1,29) = 5.8$, p <= .03.
[13] Eating $F(1,20) = 17.0$; drinking $F(1,2) = 13.0$.

[no improvement = score <70, mild improvement = score 70 - 85, complete improvement (normal) = score >85] on the One Word Expressive Picture Vocabulary Test of the children in the treatment group were significantly better ($p < .001$). For children in the treatment group, 72% were in the normal range and 8% were in the no improvement range, as compared to 31% and 28% for the control group, respectively. Children who received treatment also improved more than the controls on the Illinois Test of Psycholinguistic Abilities (ITPA; $P = .001$; Whitehurst, et al., 1989).

The researchers monitored parent compliance with the treatment through audio-tapes of each "session," and found parents were following the prescribed instructions which involved learning to use child-centered speech patterns (e.g. following a child's attempt at words with praise and/or an expansion on the topic). This finding, that parents can be trained to implement a language treatment, is important, as parents are a primary source of linguistic stimulation for children. Research has shown that language stimulation affects cognitive development as well (McCartney, 1985, as cited in Whitehurst, et al., 1989). Although this study has not yet examined long-term effects of the treatment, other correlational research indicates that children with ELD are more likely to have difficulty in school and problems with peer relations and behavior, and continued deficits in speech and language into adulthood (Whitehurst, et al., 1989).

The study by Whitehurst and colleagues (1989) had methodological limitations, such as small sample-size and a 68% retention of children in the treatment group, but

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[14] $F(1,20) = 9.7$.

it provides promising evidence for the short-term benefits of early language intervention on language development. McLean and Cripe (1997) reviewed this study along with 55 others on the effect of early intervention on language development and concluded that:

> "Early intervention for a broad spectrum of communication disorders affecting young children can be very effective in eliminating those disorders or at least mitigating their impact on a child's later speech and language development" (p. 403).

Longitudinal studies using more rigorous methodology will provide answers to the question of long-term impact of early intervention and which kind of interventions are most effective for which kinds of language delays, but there is a growing empirical base which supports the positive effect of early intervention on young children's language skills.

Children with visual impairments benefited from a year-long, individualized program focusing on visual and general development and implemented by their parents during the first and second years of life (Sonksen, Petrie, and Drew, 1991). Fifty-eight children were semi-randomly assigned to treatment and control groups, where the former group received a program for visual development and a program for general development, and the latter group received only the program for general development (n_{VGD} = 35, n_{GD} = 23, respectively). Initial scores of progress on 9 visual skill areas indicated no difference between the two groups. By the 4th measurement 12 months after beginning the programs, mean scores of children in the treatment group increased above their baseline scores and were higher than those for the control group in all 9 areas, taking prognostic variables such as initial visual level into consideration (multiple regression analysis, 4 scales, $p < .0001$;[15] for 3 scales, $p < .01$;[16] for 2 scales, $p < .05$; Sonksen, et al., 1991).

Of the 13 different types of visual impairments children presented, all children benefited except those who had disorders associated with Norrie's disease and Leber's amaurosis (Sonksen, et al, 1991). Since vision subserves cognitive and motor skills, Sonksen and colleagues (1991) contend that cognitive and motor skills are likely to be affected in children with visual impairments. Early treatment of visual impairments may not only enhance a child's visual skills, but also remove risk factors countering optimal development in other developmental domains.

Home-based programming for children with hearing impairments was examined in an impressively large research study by Strong, Clark, Barringer, Walden, and Williams in 1992 (N = 5,178; as cited in Calderon and Greenberg, 1997). Unfortunately, no control group was studied, but predictive models were used to control for maturation when examining change from pre- to post-test scores on receptive and expressive language on the Language Development Scale (LDS). Parents were instructed by parent-trainers in various techniques to develop auditory, cognitive, language, and communication skills (duration of treatment not cited). Mean differences between the actual and predicted scores were statistically significant; the actual post-test scores were higher than predicted scores due to maturation, and the developmental rate of children during intervention was 1.8 times their developmental rate before beginning the intervention (no statistics or means cited, Calderon and

[15] Averaged for 3 of these scales, group Δ = 4.3 3, Δ_{VGD} = 4.7, Δ_{GD} = 0.7.

Greenberg, 1997). The lack of an experimental design requires caution in interpreting these findings, and other potentially interactive variables were not considered. Nonetheless, the significant improvement of a very large number of children is a strong indication that early intervention for children with hearing impairments can facilitate their language development.

Experimental studies on the effect of early intervention on children with autism are few in number, especially studies involving children under age three. Promising results have been obtained in a quasi-experimental, longitudinal study of 59 children who were 40 to 46 months old at enrollment (Lovaas, 1987). Nineteen children received more than 40 hours of one-to-one behavioral modification treatment per week, for 2 or more years. There were 2 control groups, 19 in the first, who received only 10 hours of treatment per week, and 21 in the second, who did not receive any treatment. Although group assignment was not random, there were no statistically significant differences between groups. When the children were between 6 and 7 years old, the experimental group had a higher level of educational placement and higher IQs than the control groups, who did not differ from one another (placement, all group comparisons, $p < .001$; IQ, experimental vs. control 1, $p < .001$; IQ, experimental vs. control 2, $p < .01$).[17] Nine children in the experimental group (47%) were in regular education classes and had IQs at or above average. Eight children in this group (42%) were receiving some special education and had IQs in the mildly mentally retarded range, while only 2 (10%) were profoundly mentally retarded and in specialized classes

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[16] Reported for one scale, Δ = 3, Δ_{VGD} = 3, Δ_{GD} = 0.

for autistic and retarded children. Combining both control groups, only 1 child (2%) was in regular education with at or above average IQ, 18 (45%) were mildly mentally retarded and receiving some special education, and 21 (53%) were profoundly mentally retarded and in specialized classes (Lovaas, 1987).

On average, children who received 40+ hours of treatment per week gained 30 IQ points over children who received only 10 hours, or no treatment (Lovaas, 1987). More impressively, these gains were preserved in a follow-up examination of the children at a mean age of 11.5 years (McEachin, Smith, and Lovaas, 1993). Eight of the 9 children in the experimental group who had attained at or above average IQs and regular education placement at 7 years were still in regular education and were indistinguishable from their typically developing peers in intelligence and adaptive behavior. Furthermore, 1 child in the experimental group who was mildly mentally retarded and receiving some special education at 7 years had moved into regular education. In contrast, none of the children in the control group were in regular education at follow-up (one child was in regular education at 7 years).[18] Together, these studies provide strong experimental evidence for the long-term benefit of this kind of intervention for some children with autism. Despite the intervention intensity, a diverse group of families was able to meet the extensive family participation requirement of this type of therapy (McEachin, et al., 1993). Although most of the children began treatment after age 3, Lovaas (1987) comments that successful mainstreaming of autistic children is much easier for a 2 to 4 year-old than it is for a

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[17] Comparing placement for experimental and control 1, $F(1,56) = 23.6$; experimental vs. control 2, $F(1,56) = 17.6$. Comparing IQ, experimental vs. control 1, $F(1,56) = 14.4$; experimental vs. control 2, $F(1,56) = 10.4$

child in the primary grades, and McEachin and colleagues (1993) suggest that an earlier start might allow most children to achieve typical levels of functioning. Future research that replicates these findings using complete randomization of subjects and decreases the age at entry is indicated by the success in these studies.

BENEFITS TO THE FAMILY AND CHILD, AND TO THE CHILD THROUGH THE FAMILY

The benefits of early intervention on parent interaction styles and family functioning have been empirically established. These benefits to the family, in turn, provide benefits to the child through enhanced interaction styles and experiential opportunities.

The relationship between maternal interaction styles, home environment, and child behavioral competence: According to research in neurobiology, a child's experiences stimulate the development of connections in the brain which will later subserve skills in all developmental domains (e.g. Bedi, 1989; Chugani, 1998; Greenough, et al., 1987; Huttenlocher, 1994; Porter, Grunau, and Anand, 1999; Sengpiel, Stawinski, and Bonhoeffer, 1999; Siegel, 1999). As discussed previously, a child's interpersonal relationships are the primary source of experience (Siegel, 1999, Shonkoff, 2003), both in providing the child access to experiences and in promoting the child's comfort with seeking out his/her own experiences, for example through exploration. MacTurk, Meadow-Orlans, Koester, and Spencer (1993) cite several studies which show a link between a child's exploratory behavior and later competence by affecting mastery motivation in the child. Mothers who interact with their infants in

[18] χ^2 (1, N = 38) = 19.05, $p < .05$.

sensitive and appropriately responsive manners and are emotionally available to their infants provide a secure emotional base which enables infants to leave the mother and explore the world around them (Siegel, 1999, Meins, et al., 2001, Raval et al., 2001).

Infants that are not securely attached have been found to present with emotional, social, and cognitive impairments later in life. For example, patterns of interpersonal relationships and emotional communication early in life, especially those that cause acute and chronic stress in the infant, may directly influence the development of explicit memory, which is integral for a child's mental construction of reality, which in turn effects later health and behavior (Perry and Azad, 1999; Siegel, 1999; Yim, 1998). Neurological research confirms the deleterious effects of stress on the hippocampus and amygdala, structures in the brain involved in memory and emotional regulation (Gunnar, 1996; Kupfermann, 1991; Siegel, 1999).

Other research documents the connection between the level of stimulation in a child's home environment and IQ (Martin, Ramey, and Ramey, 1990). A randomly allocated, logitudinal study of 86 families with low maternal IQ and education level revealed that the level of stimulation in the home is an independent predictor, along with maternal IQ and education level, of children's IQ. Forty-one of these children were classified as having a more stimulating home environment. By 54 months, these children scored an average of 7.9 points higher on the McCarthy Scales of Children's Ability than children from less stimulating homes, controlling for maternal IQ and participation in educational day care ($p < .05$, no other statistics reported; Martin, et al., 1990).

Interaction styles were related to child development in a study of 102 mothers and their developmentally delayed or at risk infants (Dunst and Trivette, 1986, as cited in Dunst and Trivette, 1988). Children's developmental quotients [DQ = (mental age – mental age one year prior to study)/(chronological age – chronological age one year prior to study)] were significantly related to passive, responsive, and imposing interaction styles. [19] Structural coefficients indicated moderately high relation with passive styles (.67), a moderate relation with responsive styles (.42), and a moderate negative relation with imposing styles (-.24; Dunst and Trivette, 1988).

Maternal stress level affects interaction style and child behavior: Dunst and Trivette (1986, as cited in Dunst and Trivette, 1988) also examined the relation of maternal psychological well-being, emotional/physical health, and maternal role accumulation with 5 styles of interaction in the study reported just above. Psychological well-being had a significant, moderate, negative relation with imposing interaction styles; emotional/physical health was significantly, moderately related positively to responsive styles and negatively to imposing styles; and maternal role accumulation was moderately and negatively related to all interaction styles, suggesting that the more a mother has to do (e.g. household chores and childcare) the less opportunity the mother has to interact with the child and exhibit any of these styles.

In a study of 52 mothers and their preterm, VLBW infants, maternal stress level at 1 month was related to interaction styles at 8 and 12 months (Crnic, Greenberg, and Slough, 1986). Higher stress was associated with more negative maternal affect (8

[19] Canonical correlation analysis results: 1) A significant relation for elaboration and passive interaction styles, Multiple Rs = ..48 and .51, respectively, $p < .05$; 2) A significant relation to imposing style, Multiple R = .53, p <

months, $p < .05$; 12 months, $p < .01$) and decreased dyadic synchrony at 8 months ($p < .05$; not measured at 12 months).[20] Also correlated were intense infant temperament at 8 months ($p < .01$), and infant compliance and attachment at 12 months ($p < .05$, $p < .01$, respectively),[21] with higher maternal stress associated with more intense temperament, less compliance, and less optimal attachment (Crnic, et al., 1986).

In a longitudinal study beginning when children were 1 month old, the effects of maternal stress on child behavior were evident at 5 years of age (Crnic and Greenberg, 1990). Thirty-four children born prematurely and their mothers were compared to 40 full-term children – mother pairs. Mothers' life stress was related negatively to child social competence ($p < .05$),[22] mothers' ratings of the child's level of challenging behavior were related positively to behavior problems measured on the Child Behavioral Checklist ($p < .0001$)[23] and negatively to child social competence ($p < .01$; i.e. mothers' ratings agreed with behavioral measures),[24] and parenting tasks were positively related to child behavior problems ($p < .05$; i.e. more tasks were associated with more problems; Crnic and Greenberg, 1990).[25]

Family Support influences maternal stress level and interaction style:

Guralnick (1989) reports research which establishes a tendency of parents of children with delays to be more directive and controlling in interactions as compared to parents

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.01; 3) A highly significant relation with responsive style, Multiple $R = .57$, $p < .001$.

[20] Correlations between stress and 1) maternal affect, -.27 at 8 months, -.37 at 12; 2) dyadic synchrony, -.29.

[21] Correlations for stress and 1) 8 mo. temperament, .37; 2) 12 mo. compliance, -.30; 3) 12 mo. attachment, -.40.

[22] $F = 4.00$, overall $F = 4.10$, degrees of freedom not reported.

[23] $F = 30.10$, overall $F = 13.82$, degrees of freedom not reported.

[24] $F = 6.19$, overall $F = 4.10$, degrees of freedom not reported.

[25] $F = 5.81$, overall $F = 13.82$, degrees of freedom not reported.

of typically developing children. Additional research on the effect of providing different kinds of support to mothers indicates a positive influence on maternal interaction styles.

Considering deaf infants and their mothers, MacTurk and colleagues (1993) compared interactions of 20 hearing mothers and their deaf children and 20 hearing mothers with hearing children when the children were between 3 and 18 months old. Maternal responsiveness at 9 months was found to differentiate the groups, with mothers of hearing children exhibiting more responsive interaction styles than mothers of deaf children ($p < .05$).[26] At 18 months, global ratings of the dyadic interaction were also higher for the hearing infant dyads than the deaf infant dyads ($p < .05$), [27] indicating higher levels of dysynchronous interaction between mothers and infants who are deaf as compared to mothers and hearing infants (MacTurk, 1993). Meadow-Orlans and Steinberg (1993) also studied the interactions of mothers and 20 hearing infants compared to 20 deaf infants at 18 months. Data indicated that mothers of deaf infants were significantly less likely to use positive and frequent touch, show sensitivity to the infants' cues, exhibit flexibility, show positive affect, and display consistency throughout the interaction ($p < .05$).[28] Again, dysychronous interactions were more common in hearing-deaf dyads than in hearing-hearing dyads.

Looking at the relationship between maternal support, interaction styles, and child behavior, Mac Turk and associates (1993) reported that the amount of support mothers received from professionals, friends, and family significantly increased the

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[26] $F(1,39) = 5.67$, mean for mothers of hearing infants is 12.60 and 9.80 for mothers of deaf infants.
[27] $F(1,39) = 5.10$, mean for mothers of hearing infants is 3.78 and 3.04 for mothers of deaf infants.
[28] $F(1,38) = 5.11$; for touch, $M_{DEAF} = 2.8$, $M_{HEAR} = 3.7$; sensitivity, $M_{DEAF} = 3.3$, $M_{HEAR} = 4.4$; flexibility, $M_{DEAF} = 3.0$, $M_{HEAR} = 3.9$; overall affect $M_{DEAF} = 3.2$, $M_{HEAR} = 4.0$; and consistency, $M_{DEAF} = 3.7$, $M_{HEAR} = 4.4$.

quality of interaction with both groups of infants at 18 months. Multiple, step-wise regression results indicated that support, maternal responsiveness, and infants' tendency to avert gaze and use social smiles to regulate the interaction accounted for 78% of the variance in interactions of mothers and deaf infants, but only 29% of the variance for mothers with hearing infants.[29] Support from family, friends, and professionals was more influential on the interactions of mothers and deaf infants than for mothers and hearing infants (standardized regression coefficients, .59 and .32, respectively; MacTurk, et al., 1993).

Meadow-Orlans and Steinberg (1993) also found differential effects of support on mother-infant interactions. Contrasting families with low vs. high levels of support from family, friends, and/or the community, data indicated that interactions of mothers with hearing children were comparable in both support level groups, and interactions of mothers with deaf children were also comparable for families receiving high levels of support. In fact, the difference reported above between interaction styles of mothers of deaf infants compared to mothers of hearing infants was due entirely to the less-optimal interaction ratings of mothers of deaf infants with low support (Meadow-Orlans and Steinberg, 1993).[30]

Research on the effects of stress and social support on mothers and premature and full-term infants demonstrated that maternal sensitivity to infant cues at 4 months and infant clarity of cues were negatively related to maternal stress ($p < .05$; Crnic,

[29] $F(5,29) = 3.22$, $p < .05$.
[30] For measures of use of touch, sensitivity, flexibility, overall positive affect, consistency, and a summary score of these variables, results of one-way ANOVAs range from $F(3,36) = 3.1$, $p < .05$ for overall positive affect to $F(3,36) = 6.0$, $p < .01$ for sensitivity.

Greenberg, Ragozin, Robinson, and Basham, 1983).[31] For both groups, intimate support had a positive relation to mother's positive affect ($p < .05$).[32] Because intimate and community support were mildly correlated, separate two-way ANCOVAs were performed and revealed that intimate support was still significantly predictive of affect, but additional relations were found between community support and mother's social-emotional-growth fostering and mothers' sensitivity to cues ($p < .05$).[33] Intimate and friendship support also had a buffering effect on infants' responsiveness to parents, and friendship increased children's positive affect ($p < .05$; Crnic, et al., 1983).[34]

Crnic and associates (1986) extended the age of investigation of the influence of support to 12 months for preterm, VLBW infants. Results were similar; when the infants were 8 months old, professional, intimate, and community support indicated a significant, moderate, positive relation to mother's positive affect, and the latter two were also positively related to dyadic synchrony ($p < .05$ for all except mother's affect and community support, where $p < .01$).[35] At 12 months, only intimate support was still moderately and significantly related to mother's positive affect ($p < .05$), and it was also related to the child's non-compliance and attachment. Interestingly, community support was significantly positively related to the child's compliance and attachment, and negatively related to non-compliance. Friendship was predictive of the child's improved language use, decreased noncompliance, and more optimal attachment (p <

[31] $F = 4.7$ for maternal sensitivity to cues and $F = 3.8$ for infant's clarity of cues, degrees of freedom not reported.
[32] $F = 4.1$, degrees of freedom not reported.
[33] $F = 3.7$ for social-emotional-growth fostering and $F = 4.8$ for mothers' sensitivity to infant cues, degrees of freedom not reported.
[34] For responsiveness to parent, $F = 4.2$ for intimate x stress interaction, and $F = 3.7$ for friendship x stress. For infant affect and friendship x stress, $F = 3.8$. Degrees of freedom not reported.
[35] Correlations ranged from .25 for affect and professional support to .38 for affect and community support.

.001 for friendship support and non-compliance, $p < .01$ for community support and non-compliance, and $p < .05$ for the rest; Crnic, et al., 1986).[36]

The effect of stress on mother-child interactions continued to be buffered by support when children were 5 years old (Crnic and Greenberg, 1990). The negative effects of daily parenting hassles (PDH) on maternal affect were modulated by intimate, friendship, and community support, the latter of which also buffered stress effects on maternal sensitivity ($p < .05$ for all except friendship and affect, $p < .01$).[37]

Trivette and Dunst (1986, as cited in Dunst and Trivette, 1988) studied the effect of social support on child functioning for 224 families with developmentally delayed or at risk children. Multiple regression analyses indicate that informal support is significantly related to reduced child behavior difficulties reported by the parent ($p < .005$), accounting for 7% of the variance, and formal support was predictive of the child's developmental quotient (described previously; $p < .05$), accounting for 3% of the variance.

Although Dunst and Trivette (1986, as cited in Dunst and Trivette, 1988) found that different measures of support were related to an increase in responsive and elaborative maternal interaction styles ($p < .001$ and $p < .05$, respectively), as well as to a decrease in imposing interaction styles ($p < .01$), they cite another study by Simeonsson (1979), which indicated no relation between support and child outcome. They propose that this evidence, together with evidence that support influences

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[36] Absolute values of 12 mo. correlations ranged from .29 for attachment and community support to .48 for non-compliance and friendship support.
[37] Maternal affect: PDH x friendship, $F = 7.27$; PDH x community, $F = 5.57$; PDH x intimate, $F = 3.63$. Maternal sensitivity: PDH x community, $F = 3.04$. Degrees of freedom not reported.

parents' well-being, interaction styles, and child functioning suggests an indirect effect of support in moderating effects on child behavior. In fact, other studies reviewed above indicated that moderating effects depend upon factors such as child age, child disability or risk condition, the outcome factor of interest, level of support, and source of support (Crnic and Greenberg, 1990; Dunst and Trivette, 1988; Meadow-Orlans and Steinberg, 1993). Additional research indicates that support has a positive effect on families with a high need for support and negative effects on families with a low need of support (Dunst, Trivette, and Jodry, 1999).

Taken together, the empirical evidence indicates an indirect effect of family support on child functioning, mediated through maternal interaction styles, but that this effect depends upon several other factors. Early intervention services, including family support, are tailored to families' individual needs and strengths, which takes into account many of these other factors. The data therefore support the conclusion that the package of services available to families has strong potential for both direct and indirect benefits on children and their families. Several of the authors cited above advanced similar conclusions and emphasized the importance of early intervention for children with or at risk for delays and their families (Crnic, et al., 1986; Dunst and Trivette, 1988; MacTurk, et al., 1993; Meadow-Orlans and Steinberg, 1993).

CONCLUSION

Research reviewed above indicates that early intervention ameliorates or prevents developmental delays and gives support to families of children with delays.

Reason #1: Neurological evidence supports the provision of intervention early in a child's life when the brain is creating connections that will later subserve all behavior and skills.

Reason #2: Research shows that early intervention during the postnatal period, infancy, toddlerhood, and early childhood is effective for preterm, LBW and VLBW children; children with Down Syndrome, cerebral palsy, expressive language delays, and visual and hearing impairments. It enhances short-term and long-term physical, cognitive, behavioral, social, emotional, and language development and reduces the incidence of developmental delays for biologically at risk children.

Reason #3: Early intervention assists the family in obtaining adaptive devices to support the child's participation in everyday activities.

Reason #4: Effective intervention can be carried out by parents of various backgrounds in the home as well as by professionals in a center.

Reason #5: Early intervention provides different sources of social support to the family, which reduces the impact of stress on the family and enhances parent-child interaction and consequently child development.

The research also indicates a great need for additional, experimental research to investigate the complexities that arise from family and child characteristics, type of intervention, and type of delay. More long-term studies that extend the results of the benefits of early intervention in early childhood are urgently needed. But, given the mounting evidence that early intervention can benefit different developmental areas in early childhood, and that developmental domains are very likely interdependent, it seems unwise to wait for the results of such studies.

Early Intervention services are individualized to the specific child's needs and all provided free of charge. Given the benefits demonstrated above, it is imperative that early identification and referral become a regular practice for all professionals who work with young children. Physicians, for example, are one professional in a child's life with considerable resources and ability to help a child with possible developmental delays. It is therefore the responsibility of professionals who serve very young children to not only be knowledgeable of early intervention services, but to also be a prompt and active referrer to such services.

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