EARLY EXPERIENCE AND EARLY INTERVENTION FOR CHILDREN “AT RISK” FOR DEVELOPMENTAL DELAY AND MENTAL RETARDATION

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THE ORIGINS OF EARLY INTERVENTION RESEARCH FOR “AT RISK” INFANTS AND CHILDREN

In 1801, a French surgeon, Itard, began an educational intervention with an 11 year old boy that has since become classic [Itard, 1932]. From his work with the child he found running naked and wild in a forest (“the savage of Aveyron”) emerged hope, as well as understanding, about the role of early experience and the benefits of systematic instruction. Over the course of five years, the boy showed progress, even after the extreme conditions of his early life. In modern neurobiological terms, this case study indicated some cortical neuroplasticity well into middle childhood. Yet there remained many severe deficits and gaps in behavioral functioning that could not be overcome in the areas of language, social–emotional regulation, and reasoning. These observations were consistent with the view that certain types of early experience were essential for the emergence of higher order intellectual functioning. That is, later provision of comparable experiences or even highly individualized, intensive education could not adequately compensate for the developmental toll associated with extreme neglect and lack of early human stimulation and interaction.

A series of landmark studies of infants and young children in orphanages and institutions, begun in the 1930s and 1940s, raised grave concern about the serious and lasting harm caused by the loss of a mother and subsequent care in a group setting. The work of Bowlby, Dennis, Goldfarb, Skeels, Skodak, and Spitz, among others, revealed that the conditions children faced in these institutions were horribly inadequate compared to the love, stimulation, and stability of a good family [see review by S. Ramey and Sackett, in press]. This research set the stage for vigorous scientific inquiry that sought to identify precisely what young children need—early in life—to ensure healthy growth and development.

The efforts included carefully controlled experiments using animal models which systematically varied the type and timing of early experiences, as reviewed by Sackett et al. [1999]. At first, these experiments concentrated on documenting the effects of social and sensory deprivation, although the paradigm subsequently was extended to study the consequences of early environmental enrichment. Collectively, the results provide compelling evidence that early experience matters, a lot; and in the extreme, deprivation can produce functional mental retardation and aberrant social and emotional behavior in animals born healthy and with good genetic endowment.

A second line of research focused on understanding variation in young children’s responses to non-optimal settings and the extent to which environmental “habilitation” could reverse or minimize the negative effects of institutionalization or other forms of early deprivation [cf. Landesman-Dwyer and Butterfield, 1983; Landesman and Butterfield, 1987]. This work clearly confirmed a fundamental principle of social ecology, known as Person X Environment interaction: that not all individuals respond similarly to the same environment [e.g., Bronfenbrenner, 1979; Landesman and Ramey, 1989]. Based on this principle, the role of actual experience at the individual level, rather than mere exposure to environmental conditions, was directly implicated in mediating the effects of early deprivation. The factors hypothesized to contribute to the observed differences in children’s responses to similar environments (e.g., orphanages and institutions) were biological and genetic differences (including gender), age when deprivation occurred, life history prior to deprivation, duration of exposure, and the child’s own behavioral repertoire, which often serves to elicit different degrees of positive caregiving and social interactions from others.

A third and independent line of inquiry, also grounded in the landmark studies of orphanages and institutions, was a pro-active effort begun in the 1960s to prevent the developmental toll observed all too frequently among children from extremely poor families. These efforts to provide early educational enrichment to infants and young children from low resource families were also fueled by scientific findings from the fields of child development, mental retardation, and the new...
field of infant development, as well as a poignant national awareness of devastating conditions of poverty in the United States and tremendous inequality of educational opportunity [C. Ramey and Ramey, 1998a]. Key findings included:

1. Evidence that rates of mental retardation—especially mild mental retardation with no documented biomedical cause—were markedly elevated among very poor families (for an excellent review of the early epidemiological findings, see Garber, 1988). Further, this form of mental retardation displayed a time distributed onset reflecting a “curve of cumulative deficits” or “progressive mental retardation” [e.g., Deutsch, 1967; Klaus and Gray, 1968] and showed a strong familial pattern [Zigler, 1967].

2. Numerous studies detecting a strong association between the quality of a child’s home environment—indexed by dimensions such as responsibility and sensitivity of the mother to her child, the amount and level of language stimulation, direct teaching, and parenting styles—and children’s intellectual and problem solving competencies [e.g., H. Hunt, 1961; Vygotsky, 1962; Hess and Shipman, 1965; Bee et al., 1969]. Over the next four decades, literally hundreds of additional studies have affirmed this strong association [e.g., see reviews by Maccoby and Martin, 1983; H. Huston et al., 1994; Cowan et al., 1994]; and

3. The new demonstrations that very young infants, even newborns, could “learn,” which challenged the then-dominant view that babies were essentially passive, unresponsive, and incapable (cf. Osofsky’s 1979 first edition of The Handbook on Infant Development for a summary of these remarkable discoveries). Especially impressive were the experimental findings about the many different ways infants could learn, and how these learning experiences directly affected infants’ responses to subsequent learning opportunities [cf. C. Ramey and Ramey, 1999].

Collectively, the scientific and social Zeitgeist favored the launching of enrichment programs “as antidote for cultural deprivation” [Hunt, 1964]. Great optimism accompanied these efforts [e.g., Clarke, 1973], with a broad base of theoretical underpinnings and empirical findings to inform the experimental human research on early educational interventions [C. Ramey and Ramey, 1998a].

**THE FIRST SET OF EXPERIMENTS: BENEFITS AND LIMITS**

The first set of studies systematically designed to test the effects of providing enriched experiences to children from impoverished homes included many university-based preschool centers as the site of program delivery. These programs varied considerably in their intensity, as indexed by the amount of time children spent in the program, and their timing (age of onset, total duration). All were enacted with great care and concern for the well-being of the children and their families. Before reviewing the key findings, however, we want to acknowledge that much of the original writing about these early educational efforts would be subject to criticism today for endorsing a “deficit model” of extremely poor, often marginalized or oppressed families. Similarly, the approaches could be characterized as largely “compensatory” in that they sought to ensure that children had the seeming early “advantages” of middle class families—interesting toys, books, music, and games; responsive, educated caregivers; a safe environment, nutritious meals, regular rest, and vigorous activity; and a cognitively rich environment where language and thinking skills were actively encouraged. Without doubt, there have been unfair and destructive negative stereotypes of those at the lowest socioeconomic levels, as well as bias in assuming that middle class families are “optimal” in everything they do. Today, these programs of the 1960s and early 1970s would be described using different terms (less pejorative of families, less paternalistic of programs). Nonetheless, as best we can tell, the substantive content of what was offered to participating children and families was sound, conscientiously provided, well received by participants, and—as reviewed below—often successful.

**The Consortium for Longitudinal Studies**

The Consortium for Longitudinal Studies represented a collaborative effort to conduct pooled analyses of findings reported from 11 studies that used experimental or quasi-experimental designs to test the efficacy of early intervention for children who were “at risk” based on sociodemographic characteristics [Darlington et al., 1980; Lazar et al., 1982]. Two major results emerged. The first was a re-affirmation that these programs did produce significant gains in the intellectual and cognitive performance of participating children. The second was that the magnitude of these gains, as indexed by IQ scores, was strongest at the end of the intervention, was maintained for three or four years thereafter, and then declined over time as children progressed with their formal schooling. Interestingly, the authors concluded that early education programs for children from low-income families resulted in long-lasting effects in four areas: school competence, developed abilities, children’s attitudes and values, and impact on the family. However these rarely are mentioned, in contrast to the findings about the IQ decline. In the early 1980s, the Consortium for Longitudinal Studies represented the authoritative word about early intervention effects, lending support for the value of early educational enrichment and what became widely known as the “fade-out effect” with respect to IQ.

**SUBSEQUENT LONGITUDINAL RESEARCH TARGETED TO PREVENT MENTAL RETARDATION**

Continued longitudinal inquiry and new intervention studies have provided valuable data that allow for a better understanding of the course of development in children who receive different types and amounts of early intervention. Five studies—only one of which was included in the earlier Consortium for Longitudinal Studies—specifically focused on groups of children at high risk for mental retardation are particularly informative. These are the Perry Preschool Project [Weikart et al., 1978; Schweinhart et al., 1985; Schweinhart et al., 1993], the Milwaukee Project [Garber, 1988], the Abecedarian Project [Ramey and Campbell, 1984; Campbell and Ramey, 1994], Project CARE [Ramey et al., 1985; Wask et al., 1990; Burchinal et al., 1997], and the Infant Health and Development Program [Infant Health and Development Program, 1990; Ramey et al., 1992]. All studies involved random assignment to intervention groups and were intensive, multi-pronged programs involving a minimum of one full year of intervention prior to five years of age.
When comparing effects across studies, there are several key issues to consider. The first concerns the comparability of the participants in terms of their risk factors. For example, the Milwaukee Project enrolled only children whose mothers were mentally retarded (IQs below 75), in contrast to the Perry Preschool Project which enrolled children at age three or four who already showed developmental delay (IQs between 70–85). Both the Abecedarian Project and Project CARE enrolled all poverty families with additional social risk factors (e.g., low maternal education, unmarried parent, teen mother, mother with IQ below 90, absence of maternal relatives). In contrast, the Infant Health and Development Program enrolled infants based on both low birth weight (below 2,500 grams) and premature (less than 37 weeks gestational age)—although this sample of 985 infants included a disproportionate number of low income, socially at risk, and minority families, which is characteristic of premature, low birth weight infants in general.

Theoretically, these differences in participants may be related to how much they need and how much they benefit from the intervention. Further, different types and amounts of intervention may be indicated for particularly vulnerable children, although this has not been rigorously tested.

Another important factor to consider is both the amount and nature of the intervention itself. In theory, interventions that provide the most intensive and direct, individualized services to children are the most likely to alter the children's early experiences and, in turn, to result in the greatest benefits. The Perry Preschool Project provided one or two years of a 2 ½ hr day educational preschool experience, supplemented by home visits to promote more positive parenting skills. The Abecedarian Project afforded a minimum of five years of full day early childhood education, health care, infant nutrition, and parenting and family supports; plus half of the participants received three years of additional intervention in the form of a "home and school resource program" after they entered public school. The Milwaukee Project also provided a full day educational program throughout the preschool years and continued through the kindergarten year. Special training for the low IQ mothers for parenting and employment also were components of the Milwaukee Project. Project CARE systematically compared two forms of intervention, a center-based curriculum identical to that in the Abecedarian Project and a home-based program of weekly home visits for the first three years, followed by biweekly visits for the next two years. The home-based intervention used the same educational curriculum as the center-based treatment, with special instruction and materials to assist parents in promoting their children's development. The Abecedarian Project, the Milwaukee Project, and Project CARE also included a very strong emphasis on language development. Finally, the Infant Health and Development Program concentrated intervention efforts on the first three years of life only, adapting key components of the Abecedarian Project and Project CARE, both of which had demonstrated efficacy at the time the project for premature, low birth weight infants was initiated.

Another powerful factor that potentially influences the results of different studies, as well as the children's direct experiences, is the general ecological context. These projects were launched over a wide span of history and geography. The Perry Preschool Project was the first, launched in industrial Ypsilanti, Michigan in the early 1960s, whereas the Infant Health and Development Program, an eight-city randomized controlled trial, was the last in the mid-1980s. The Milwaukee Project, begun in the late 1960s, was located in a concentrated inner city area, in contrast to the Abecedarian Project and Project CARE which were carried out in the university town of Chapel Hill, North Carolina, enrolling families from the early to the late 1970s.

When comparing findings across studies, the performance of the control children—those who did not receive the intensive intervention—provides valuable information about the cumulative impact of the children's ecology on intellectual development. For instance, in the Infant Health and Development Program, children selected based on the same biological risk conditions at the same time in history, showed markedly different courses of development across the eight sites. For example, in Boston, the average performance of the control children at age three was essentially at national average and dramatically higher than that of children in Miami, whose average performance placed them in the mentally retarded range. It is noteworthy that in Boston there were early intervention supports readily available to the control children as part of a statewide program of early intervention, whereas these were not provided to control children in Miami. Further, there were many other ecological conditions that varied across the cities from differences in substance abuse, crime and parental literacy to community supports of families with young children. We note further that ecological differences can influence development after intervention.
Major Findings at the End of the Intervention

For all five of these studies, significant main effects of the early intervention on children's intelligence were detected at the time the program ended. Figure 1 presents findings from the Abecedarian Project, one of the more intensive interventions, from infancy through school entry. In this study, group differences began to appear in the second year of life and continued thereafter, averaging about a 10-IQ point difference between the intervention and control group. The control group was not, however, untreated, since they received free nutritional supplements, medical care, and social supports to the family. These results were essentially replicated with the center-based educational treatment group in Project CARE. Quite disappointing, however, was the Project CARE finding that five years of home visiting, although well received and valued by the families, did not produce any detectable benefits for children.

The study that produced the largest group differences on IQ scores was the Milwaukee Project, which served children who (1) were at the highest risk for mental retardation (i.e., their own mothers had very low IQs) and (2) had the greatest contrast between the treated and control groups in terms of the children’s direct experiences and the supports provided to the families. At the end of the treatment period, the groups differed by 30 IQ points, with the treated children performing well above national average and the untreated controls somewhat below national average. Similar to the two North Carolina studies, the treated and control groups diverged in their development starting at 18 months of age. In addition, the children in the Milwaukee Project as well as the two North Carolina studies showed significant differences favoring the treated group in terms of many dimensions of language development and the quality of mother-child interactions. Garber provided a thoughtful summary of the extensive mother-child dyadic interactions systematically coded from the Milwaukee Study where all the mothers had low IQs and low verbal skills:

In summary, then, we found that the experimental dyads transmitted more information during structured mother-child interaction sessions than did the control dyads, and this was seen as a function of the quality of the experimental child’s verbal behavior. The experimental children supplied more information verbally and initiated more verbal communication than did children in the control dyads. The children in the experimental dyads took responsibility for guiding the flow of information and providing most of the verbal information and direction. The mothers in both dyads indicated little differences in their teaching abilities during the testing session. However, in the experimental dyads the children structured the interaction session either by their questioning or by teaching the mother. As a result, a developmentally more sophisticated reciprocal feedback system seemed to have developed between the experimental children and their mothers, which contributed to faster and more successful problem completion. Thus, the intensive stimulation program undergone by the experimental children has benefited both the experimental child and the experimental mother by broadening their verbal and expressive behavioral repertoire. [Garber, 1988, p. 223]

The Infant Health and Development Program also reported significant group differences in each of the eight sites, although the magnitude of these differences varied considerably. Further, the children’s birth weight category was

ends as well as before and during intervention.

Fig. 2. Children’s intellectual performance as a function of treatment group and site in the Infant Health and Development Program. Scores at 12 and 24 months are based on Bayley Scales of Infant Development, Mental Development Index (M = 100, SD = 15); at 36 months, the scores reflect Stanford-Binet IQ scores (M = 100, SD = 15). All group comparisons at 36 months are for corrected age and are significant at p < .05 for all eight sites in the 2,001–2,500 gram group (A), and for seven of the sites in the <2,100 gram group (the group differences were not statistically significant for Boston in this lighter birth weight group) (B). Data from C. Ramey & Ramey [1998].
a significant factor associated with the magnitude of group differences. For infants in the heavier birth weight group (2,001–2,500 grams), the IQ difference was 13 points at 36 months corrected age, whereas the group difference was half this much (6.5 points) for the lighter low birth infants (less than 2,000 grams). This differential effect may reflect contributing, although not precisely specified, biological conditions that were more prevalent in the smaller premature children and in turn affected central nervous system integrity. Figure 2A,B presents these results for the two different birth weight groups. It is also noteworthy that the family characteristics of the heavier low birth weight infants more closely resembled those of children in the other intervention studies (i.e., low income, minority status, low maternal education, and other demographic risk conditions). In terms of preventing mental retardation in this heavier low birth weight group, 23 percent of the control children had IQ scores of 70 or below at three years of age, compared to eight percent of the children who received early educational intervention. In this study, as in both the Milwaukee Project and the Abecedarian Project, direct benefits on the mother-child dyad were documented via quantitative observations of videotaped interactions [Spiker et al., 1993].

Long-Term Benefits

The most frequently asked question about early intervention is “How long do the benefits last?” This question reflects an implicit assumption that high quality early experiences should be sufficient to ensure that a child will do well throughout later years. In early intervention circles, this is often referred to as “the inoculation hypothesis.” What this question ignores is that the subsequent experiences a child has will also affect his or her rate of development and academic achievement. The quality of children’s schooling, the nature of their peer groups, and the degree to which parents provide ongoing supports for learning (e.g., parent involvement with schools, quality after-school programs, opportunities for learning during the summer, home literacy activities) all have been associated with differences in children’s performance during the school years [cf., S. Ramey and Ramey, 1998, in press]. Before presenting the results from the long-term follow-up of participants in the above studies, we want to underscore that one of the greatest scientific challenges is to understand the causal mechanisms that are involved in the maintenance, or the loss, of the early gains associated with participating in early intervention.

The study that has received the greatest amount of attention is the one with results through the age of 27, the Perry Preschool Project. At age 15, the treated children showed significantly greater academic achievement in school, although their IQs were similar to those of controls, in the low 80s. Recall that these children were initially enrolled based on their low IQs in the preschool years. Thus, it appears that the IQ boost detected at age five was not sustained. R review of the longitudinal data indicates that the treated children showed a slight decline in tested IQ during the school years, whereas the control children showed a modest boost [Schweinhart et al., 1985]. The latter is consistent with Ceci’s [1991] conclusion about the general benefits of schooling on IQ.

What is so widely cited, however, are the “real world” benefits during the adolescent and adult years, including decreased school dropout and unemployment, increased college attendance, reduced teen pregnancy, and decreased criminal activity at 27 years [Schweinhart et al., 1993]. For example, rates of special education placement and grade retention were 37 percent for the control children versus 17 percent for the treated children in the Perry Preschool Project. In fact, a cost–benefit analysis estimates that the
Perry Preschool Project resulted in a long-term savings of approximately $7 for every dollar invested in early intervention [Barnett, 1985].

School-age results from the Abecedarian Project and Project CARE indicate long-term group differences in terms of a number of indicators, including reading and math achievement scores at ages 8, 12, and 15 [Campbell and Ramey, 1995; C. Ramey and Ramey, 1998b; C. Ramey et al., in press]. Figure 3 summarizes the results, comparing those who received the five years of preschool enrichment to those who received no systematic educational intervention during either the preschool or the school years. More detailed analyses indicate that children who received the additional three years of the home and school resource program tended to perform at the highest levels at most age periods, while the children who received the home and school resource program only, showed only slight benefits [C. Ramey et al., in press]. Thus, there is an orderly stepwise function for academic achievement—but not for IQ scores—for children who received eight, five, three, or no years of educational intervention. Other long-term benefits include large reductions in the rates of special education placement and grade retention, as Figure 4 shows. Unlike the Perry Preschool Program, significant IQ differences continued to be detected at 8, 12, and 15 years, although the magnitude of the group differences declined considerably during the school years (e.g., a five-point difference at age 15, effect size of .31). Currently, the age 21 year follow-up is being completed for the Abecedarian Project, and includes many of the same “real world” indicators measured by the Perry Preschool Project.

The Milwaukee Project published results of follow-up until the children were 10 years old. Significant IQ score differences persisted, although the differences at the end of fourth grade were slightly less than at the end of treatment: 104 for the treated children versus 86 for the control children. Somewhat surprising was the finding that the school achievement of the groups did not differ. Garber [1998] describes the poor quality inner-city schools these children attended and other complex educational policies and practices that may have affected children’s school performance. Rates of placement in special education and referral for special services did differ significantly for the two groups, as did the referral of children into “extended” primary grades (during the years when grade retention was a prohibited practice in the Milwaukee schools).

The Infant Health and Development Program was the only early intervention that ended several years before the children entered kindergarten. Many of these children’s parents, regardless of original treatment group, were assisted in obtaining subsequent quality child care and other early intervention supports. By ages five and eight, the IQ differences had decreased considerably between the groups, such that an overall main effect of treatment was no longer present [McCaffrey et al., 1997; Brooks-Gunn et al., 1994]. The heavier low birth weight children, however, continued to manifest significantly higher IQs as a function of early intervention. Specifically, by age eight, this early intervention group scored an average of 4.4 points higher than did the comparison children who received pediatric follow-up and social service referrals. In addition, other small magnitude but significant differences were detected in this group for mathematics achievement and receptive vocabulary scores. The consortium of investigators concluded that additional intervention strategies are needed for low birth weight, premature infants to sustain the earlier benefits detected after the birth to age three educational enrichment.
Summary of Results

The five major studies reviewed here all demonstrated benefits in terms of significant and clinically meaningful IQ increases and corresponding reduced rates of mental retardation during the preschool years. For four of the studies, multiple benefits persisted until middle childhood or later, although the IQ differences between groups declined and, in the case of the Perry Preschool Project, ceased to exist by adolescence. In contrast, more substantial benefits appeared in terms of everyday performance indicators, such as decreased rates of grade retention, special education placement, and improved school achievement (except for the Milwaukee Project on the latter measure). For the one study that has followed children into adulthood, these benefits included more positive adult roles regarding economic self-sufficiency, greater educational attainment, and decreased criminal activity [Schweinhart and Weikart, 1993].

The one study that did not show long-term benefits for the entire treated group was the Infant Health and Development Program. This program differed in two major ways: (1) children were selected solely on a presumed biologic risk factor of being low birth weight and premature and (2) educational intervention ended by 36 months corrected age, whereas all the other programs continued until the children entered school or beyond (for some of the Abecedarian children and for all the Milwaukee Project children). The four studies with long-term benefits included three that identified children at high risk based on social demographic characteristics, especially maternal characteristics, while one (Perry Preschool Project) selected children who already showed significant delays by 3 years of age. Virtually all of the children in these four studies were African American and came from families that predominately spoke Black Dialect English. What then did the early educational enrichment provide that either “boosted” the children’s performance or, alternatively, prevented the development of the toll consistently observed in control children during the preschool years?

HYPOTHESES: MEDIATING MECHANISMS: HOW EARLY INTERVENTION MIGHT ALTER CHILDREN’S DEVELOPMENTAL TRAJECTORIES

Ramey and colleagues have been refining a complex, social ecological model of development over the past two decades. This incorporates principles of systems theory and social ecology, as well as findings from the literature about risk and protective factors [C. Ramey and R. amey, 1998a]. In this conceptual framework, a child’s individual competence is determined by a multitude of forces, including intergenerational factors, biological factors, parental competencies, and community social and cultural norms and practices. In this model, the important influences on intellectual competency are the direct transactions a child has with the immediate environment. Thus, early intervention programs that provide more intensive educational services, as well as start earlier and last longer, are hypothesized to be the most beneficial. Similarly, programs that directly target the child’s everyday experiences, rather than indirectly seek to change this through increasing parental competency or the quality of the child’s living conditions, are hypothesized to yield more immediate and greater effects.

Although not reviewed here, there are many other early interventions reported for “at risk” poverty children; although many of these studies have serious design problems (e.g., lack of random assignment, retrospective control groups), high rates of attrition (approaching 50% or higher), or relatively low rates of participation in the intervention program itself (for a review of the results of these studies see Bryant and Maxwell, 1997). Typically, programs that have a very narrow focus, do not carefully control the content of the intervention, and do not last for one or more years have not produced changes in children’s intellectual competency or academic achievement [S. Ramey and Ramey, 1992; Bryant and Maxwell, 1997]. In essence, these ineffective early intervention programs are notably lacking in their provision of high quality, developmentally supportive transactions for the children on a daily basis.

In a recent new analysis of the longitudinal findings from both the Abecedarian Project and Project CARE, Burchinal et al. [1997] calculated individual growth curves and related these to both family variables and children’s direct experiences—that is, environmental transactions (including participation in early intervention, day care experiences for those in the control condition). This analysis, more than any other to date, provides findings that support the hypothesis that efficacious early intervention provides developmentally normative learning opportunities for children who otherwise would not receive these to support normal intellectual development. The authors conclude that:
The results indicate that more optimal patterns of cognitive development were associated with intensive early educational child care, responsive stimulating care at home, and higher maternal IQ. In accordance with a general systems model, analyses also suggested that child care experiences were related to better cognitive performance in part through enhancing the infant's responsiveness to his or her environment. Maternal IQ had both a direct effect on cognitive performance during early childhood and, also, an indirect effect through its influence on the family environment.[Burchinal et al., 1997, p. 935].

This interpretation of likely causal mechanisms strongly agrees with the conclusions of Garber [1988] from the Milwaukee Study. The maintenance of school age benefits in the Carolina projects may be attributable to children attending a higher quality school system where children could apply their own competencies in learning and eliciting positive social responses from adults compared to the less resourceful school environments in Milwaukee and Ypsilanti.

A note of caution regarding the positive results from all of the studies is that the children performed, on average, below national norms—with the one exception of the average IQs of the treated children in the Milwaukee Study. Thus, even though early intervention was associated with significantly higher intellectual or academic performance compared to controls, the interventions did not completely eliminate the need for special education, grade repetition, or special services and educational supports. Children from high risk families clearly benefited from compensatory experiences, although these did not entirely eliminate all risks. This is not surprising, since most of the children continued to live with their natural families, attended public schools in their locale, and also may have sustained intergenerational and biological risks that were not clinically detected [e.g., Moser et al. 1990].

WHO BENEFITS THE MOST FROM EARLY INTERVENTION?

A number of analyses on the North Carolina studies and the Infant Health and Development Program have confirmed a strong association between maternal education and/or maternal IQ and the magnitude of IQ benefits in children. In general, the lower the maternal educational level or maternal IQ level, the greater the degree of benefit associated with the early educational intervention [Landesman and Ramey, 1989; Martin, Ramey, and Ramey 1990; Brooks-Gunn et al., 1992]. Garber [1988] also described in detail the micro-environment or the daily experiences of the highest risk children, those with very low IQ mothers who often experienced inadequate parenting and poor schooling themselves. He concludes that the home environment exerted a powerful influence on the development of children. Sub-group analyses, however, were not possible due to the small sample size and the relative homogeneity in the maternal and family characteristics of this sample.

The Infant Health and Development Program also indicates that the premature, low birth weight children who sustained benefits from this form of early educational intervention were those who were biologically closer to normal (i.e., heavier low birth weight) and also from families at greater social and economic risk.

THE IMPLICATIONS OF EARLY INTERVENTION STUDIES FOR SOCIAL POLICY AND THE PREVENTION OF MENTAL RETARDATION

The findings from carefully controlled, randomized trials of early intervention have been the basis for implementing many large scale, Congressionally-authorized programs to improve the outcomes for poverty children, such as Head Start [Zigler and Munchow, 1992; Zigler and Styfco, 1994] and many programs labeled “two-generation programs,” including New Chance, the Comprehensive Child Development Program, the JOBS program [cf. Smith, 1995], and the recently enacted Early Head Start. To date, none of these large scale programs has demonstrated the same types or magnitude of benefits that have been documented in the smaller scale studies. The smaller scale, carefully controlled studies reviewed here were designed to adhere to high scientific standards, and further provided far more intensive educational supports to a greater proportion of enrolled children than have the large scale, federally administered programs. For example, most children enrolled in Head Start receive only seven months of a half day program for four days a week, starting when they are four years old—far less than any of the studies that produced significant intellectual benefits. A recently adopted set of higher standards for the Head Start program, which now serves approximately one million children, is intended to ensure that in the future these programs will be of more uniform high quality nationwide. Another notable difference is that most of these federal programs, including Head Start, have enrolled families solely based on poverty income. Accordingly many of the participating children are not at comparably high levels of developmental risk for mental retardation or special education placement as were the multi-risk children in the smaller scale studies.

The research findings clearly support the conclusion that rates of mental retardation and special education placement among children at sociodemographic risk can be reduced by 50 percent or more. This means that the most prevalent form of mental retardation—namely, mild mental retardation associated with family conditions and not attributable to any known biological cause—could be drastically reduced if early intervention could be successfully targeted to those at greatest risk.

The question for policy and decision makers then becomes two-fold: What would be the estimated cost of such preventive interventions? and Is it feasible to identify the highest risk families and provide the types of high quality, intensive, multi-year, multi-pronged programs needed? Based on the costs of the early educational programs reviewed in this paper, the estimated annual cost of such preventive educational interventions would range from approximately $6,000 to $10,000 per year, with differences attributed primarily to variation in staff child ratios, wages, and hours per day. In 1995, the nationwide average cost for special education was $6,335 above and beyond the cost of regular education, which averages between $6,000 to $7,000 in most local school districts. Thus, the investment would appear to be a sound one in terms of cost savings, as well as the intangible benefits associated with a better educated citizenry. To place this in perspective, the cost of early intervention—especially if targeted to the highest risk groups rather than to all poverty families—is quite reasonable compared to the costs of many medical interventions, such as extended stays in Neonatal Intensive Care Units or to the cost of high quality child care. There is, however, no third party insurance to pay for such educational interventions, and these children have no strong parent advocacy or obvious professional group with national clout to lobby on their behalf. Worse yet, there are many home visiting programs and local programs [Roberts et al., 1991] that would be jeopardized if a more intensive form of early intervention were adopted as the standard for high risk
children and their families. As with most prevention efforts, complex political, economic, and social factors are at play.

Given the increasing evidence that brain development is profoundly affected by early and cumulative life experiences [cf, Shore, 1997], and the positive results of the research-based early interventions for truly high risk children, there is ample theoretical and empirical support to justify launching systematic prevention efforts. Children from very low income families whose parents have limited educational and intellectual resources need not be doomed to a life of incompetency. Yet without timely and highly intensive supports starting very early in life and probably extending into the school years, these children are likely to continue to fulfill the intergenerational prognosis of sub-average intellectual performance and marginal social and economic existence.

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