# Lessons Learned:
# A Review of Early Childhood Development Studies

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**Executive Summary**

Research shows that the economic returns from investments in early childhood development programs are substantial due to productivity gains in the workforce and cost savings to society. The quality of life an adult enjoys and the contributions he or she makes to society can be traced, in part, back to his or her first few years of life. From birth through age five, if a child receives support for development in cognition, language, motor skills, adaptive skills, and social emotional functioning, he or she is more likely to succeed in school and in the workplace. However, if a child doesn't have support for healthy development at an early age, the child is more at risk for dropping out of school, committing crime, and receiving welfare payments as an adult.

Several early childhood development studies demonstrate the gains young children can make in measures of cognition and educational performance when they participate in a high quality early childhood development program. Some of these studies measure the impact of these programs well into adulthood. For example, children from low-income families who attended the Perry Preschool program in Ypsilanti, Mich., were more likely to graduate from high school, were less likely to commit crime and earned more income in the workforce as adults than a control group of children who did not attend. The Perry Preschool program and other longitudinal studies estimate the economic benefits to the participant and society relative to the cost of the program.

Study Results

A review of several methodologically sound early childhood studies shows that high quality early childhood development programs have generally led to the following:

- Improvement in child educational performance, including higher test scores, reductions in special education, grade retention, and school drop-outs.
- Increases in child high school graduation rates and college enrollment rates.
- At least short-term gains in child IQ scores.
- Reductions in child juvenile delinquency and criminal activity later in life.
- Higher earnings and tax payments by child and parent.
- Reductions in welfare use.
- Reductions in child abuse.
- Larger, more qualified workforce for employers. In the short term, parents who have access to high quality early child care and education programs exhibit lower absenteeism rates from work. In the long term, children attending quality early childhood development programs are more likely to become adults who participate in the workforce with relatively higher rates of productivity.

Benefit-Cost Analysis

Thorough benefit-cost analyses were conducted on four of these programs, including the Perry Preschool. A benefit-cost analysis assigns monetary values to benefits and costs over time, discounting the future value of benefits and costs at a given interest rate. A benefit-cost ratio over $1 indicates that the benefits of the program are larger than the program's costs. Benefit-cost ratios of early childhood development programs ranged from $3 to $17 for every dollar invested. The benefits accrue not only to program participants, but also the non-participating public.

The internal rate of return, that is the interest rate received for an investment consisting of payments and revenue that occur at regular periods, can be used to compare returns among different investments. To calculate the internal rate of return for these programs, we estimated the time periods in which costs and benefits in constant dollars were paid or received by program participants and the public. Total internal rates of return, adjusted for inflation, ranged from approximately 7 percent to as high as 20 percent. These relatively high returns show that quality ECD programs are wise investments.

Study Conclusions

- Aspects of proven model programs can be brought to scale in larger settings and achieve positive outcomes.
- Insuring high quality care in early childhood development programs, such as low child-to-teacher ratios and high levels of teacher education, is key to success.
- Benefit-cost ratios are highest when interventions are conducted with at-risk children.
- Child-based programs that include parent education and involvement are more successful than programs that only provide parent education.
- Benefits of early childhood programs accrue over the long term; several benefits do not appear until 15 to 20 years later.

Although no one study is conclusive, the results of these studies collectively suggest that communities could accrue significant benefits by ensuring the availability of high quality early childhood development programs, particularly for at-risk children.

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## Introduction

In *Early Childhood Development: Economic Development with a High Public Return*, Rolnick and Grunewald (2003) argue that compared with conventional notions of economic development, such as subsidies and preferential tax treatment for private businesses, investments in early childhood development provide a much higher return on the dollar. Subsidies to lure companies into local areas only move jobs from one location to another; from a national perspective the net result on job growth is at best zero and is more likely negative.

In contrast, well-focused and funded investments in early childhood development programs produce substantial returns. The quality of life and the contributions a young child makes to society as an adult can be traced back to the first few years of life. From birth through age five, if a child receives support for development in cognition, language, motor skills, adaptive skills, and social emotional functioning, he or she is more likely to succeed in school and in the workplace (Erickson & Kurz-Riemer, 1999; Ramey et al., 2000). However, if a child doesn't have support for healthy development at an early age, the child is more at risk for negative outcomes, including dropping out of school, committing crime, and receiving welfare payments as an adult.

Several early childhood development studies demonstrate the gains young children can make in measures of cognition and educational performance when they participate in a high

quality early childhood development program. Some studies measure the impact of these programs many years into the future. For example, children from low-income families who attended the Perry Preschool program in Ypsilanti, Mich., were more likely to graduate from high school and to earn more income in the workforce by age 40 and were less likely to commit crime than a control group of children who did not attend.

In this paper we will discuss the relative merits of several early childhood development program evaluations, including the quality of their research design and significance of results. We then discuss the lessons learned from the studies, specifically what aspects of these programs may have led to positive outcomes. While there is no guarantee that results from studies of small model programs or programs brought to scale can be replicated in another place, research reveals the ingredients that strongly correlate with desired effects.

Strategic investments in early childhood development can yield substantial results. However, poorly focused, modestly funded programs do little to improve the well-being and school readiness of young children (Shonkoff & Phillips, 2000). Learning from existing early childhood studies, policymakers can understand how best to employ incentives to improve the quality of and expand access to early childhood development programs.

**Background**

The United States and its government have long been concerned with the welfare of its youngest citizens. In 1909, the first White House Conference on Children was called to address government planning relative to the protection of the nation's children (Beck, 1996). Although "nurseries" for young children were in operation as early as the 1850s, the initiative to educate young children took shape in the first half of the 18$^{th}$ century with pioneers like Maria

Montessori advocating the importance of the early years for later development (Spodek, Saracho, & Davis, 1987). The early 20th century also saw the rise of behaviorism. John Watson (1919), a prominent behaviorist, argued that not only was an individual's future behavior predictable from his or her previous experiences, but that human behavior could be molded and changed by the surrounding environment. By the 1960s, few developmental psychologists maintained strict adherence to behaviorism. However, Watson added fuel to an ongoing debate about the relative contributions that genetic heritage (nature) and environmental experiences (nurture) make to an individual's behavior and traits.

Armed with the belief that high-quality early experiences could at least partially ameliorate negative outcomes for children from at-risk backgrounds, the programs discussed in the following review all set out to provide young children and their families with beneficial early experiences, with the hope of preventing negative outcomes later in life. In doing so, the evaluations of these programs have themselves contributed significant evidence about the importance of both genetics and environment to later behavior (e.g., The Milwaukee Project; Weinberg, 1991), as well as an understanding of some of the ways in which poverty causes deleterious effects on children and families (e.g., Farnworth, et al., 1985; McLoyd, 1998).

**Scope of Review**

The following is a general overview of several of the most methodologically sound evaluations of early childhood education programs. These evaluations fall into several distinct categories, model programs, large-scale, public programs, and home visitation programs. We have included examples for each category to give readers a better understanding of what each type of program involves. We discuss key methodological strengths and weaknesses of each study, followed by

information on existing cost-benefit analyses. Several of these interventions have extended into the school years; however, we have limited our review to the preschool aspects of the evaluated programs.

**Methodology**

Early child intervention evaluations vary along several dimensions. An understanding of these features of the studies is key to evaluating their relative merits and implications for future policies. One important feature that distinguishes studies from one another is the type and scope of implementation. Some evaluations represent large-scale, public programs that involve many participants and are implemented on a wide scale within existing structures (e.g., local public school districts). In comparison to large-scale, public programs, model programs tend to be of higher quality, provide more funding per child, and feature closer supervision of staff by experts, (Barnett, 1995).

Given this information, it might seem best to base policy on studies of large-scale public programs. Unfortunately, many of the evaluations of these larger-scale programs lack the strong methodological control that is available in the smaller model programs. There are several methodological issues that are particularly relevant for consideration by policymakers.

Internal validity assesses the degree to which an evaluation is accurately measuring the effects of the program. Random assignment of participants into program and control groups is essential for measuring program effects. When participants are not randomly assigned, it is difficult to establish that gains demonstrated by the program group are, in fact, caused by the program itself. For example, if the program group consists of children whose parents elect to enroll them, and the comparison group is made up of children whose parents did not elect to

enroll them, these two groups are likely to differ in several ways. For example, parents who choose to enroll their children in programs may differ from other parents in terms of their involvement with their children, educational values, or socioeconomic status. These differences are likely to impact children's growth outside their participation in the program. Program and no-program groups may appear different because of these underlying family dimensions, rather than participation in the program. Instead of using random assignment, some studies attempt to control for differences between groups statistically; however, true random assignment is the only way to insure that the program itself caused the differences in outcomes. However, it should be noted that children in control groups may have varied experiences; some may attend other early care and education programs. On one hand, this may threaten the internal validity of the evaluation, but, on the other hand, this type of "control" group may represent a fair comparison.

An additional component of internal validity is participant attrition. Over time, children and their families may drop out of research evaluations. This occurs for a variety of reasons. For example, the family may decide that they no longer wish to participate, may move away, or lose access to reliable transportation that would allow them to bring their child in for assessments. Ideally, all participants should be retained over time to evaluate the true effects of a program. Typically, the participants who drop out of the evaluation vary in systematic ways from the participants who remain. For example, families who live in poverty tend to be more transient and therefore more difficult to retain in studies than families who are more financially self-sufficient. If participants who are facing some of the most difficult outcomes are not included in long-term follow-ups, the researchers may overestimate the positive effects of the intervention. On the whole, the evaluations of model programs tend to be stronger in internal validity than the evaluations of large-scale, public programs.

External validity assesses the degree to which the results of a particular evaluation apply to other groups of individuals. A large sample size can help contribute to increased external validity – conclusions based on 1,000 children are more likely to be representative than conclusions based on 100 children. In most cases, study results are not expected to generalize to all populations. For example, many early child interventions are conducted with at-risk children living in poverty. There are many reasons to suspect that the same results may not occur if the same intervention were conducted with affluent children. By the same token, results of interventions for children in urban areas may not generalize to children living in rural areas. Results of evaluations that include multiple cohorts (or groups) of children who receive the intervention from a variety of sites are more likely to generalize to other populations than are the results of a study with a single group of children who all received the intervention at the same site. Generally, the large scale, public program evaluations tend to have higher external validity than the model programs.

Statistical power. Another important methodological consideration is statistical power, or in other words, the potential ability of the researchers to find differences between groups by using various statistical techniques. Statistical power can be achieved in several ways; the two most relevant include having a large number of participants and completing long-term follow-ups of participants. Studies must include a large enough group of participants to be able to detect differences between the intervention and comparison groups using statistical techniques. By following the same participants over long periods of time, not only can researchers examine long-term effects of programs, it also assures that their results are valid. When the same individuals are compared with themselves over time, nearly perfect control is achieved of other extraneous factors (e.g., ethnicity, gender, and family dynamics). Particularly combined with

random assignment, a long-term follow-up provides researchers with particularly compelling evidence for the effectiveness of these programs and can, in many cases, "make up for" a smaller sample size. At this point in time, the model programs are more likely to have long-term follow-up of participants (cf. Chicago Child-Parent Centers).

Benefit-Cost and Internal Rate of Return Analysis. Thorough benefit-cost analyses were conducted on four of these programs, including the Perry Preschool. A benefit-cost analysis assigns monetary values to benefits and costs over time, discounting the future value of benefits and costs at a given interest rate. A benefit-cost ratio over $1 indicates that the benefits of the program are larger than the program's costs. Benefit-cost ratios of early childhood development programs ranged from $3 to almost $17 for every dollar invested. The benefits accrue not only to program participants, but also the non-participating public.

The internal rate of return, that is the interest rate received for an investment consisting of payments and revenue that occur at regular periods, can be used to compare the return to different investments. To calculate the internal rate of return for these projects, we estimated the time periods in which benefits and costs in constant dollars were paid or received by program participants and the public. Total internal rates of return, adjusted for inflation, ranged from approximately 7 percent to as high as 20 percent.

Internal rate of return estimates are helpful when comparing the returns to early childhood development programs with other public expenditure and private sector investments. For example, returns to early childhood development programs compare favorably with the stock market, which earned between 5 percent and 7 percent, adjusted for inflation, over the past few decades. However, in making internal rate of return calculations, much depends on the timing of when the benefits occur. For example, if the stream of benefits accrues quickly for Project A

relative to Project B, but decays more rapidly; whereas benefits for Project B begin late and then persist, it is possible for Project A to have a higher internal rate of return, while Project B has a higher present value (Carneiro & Heckman, 2003). The internal rate of return estimates in this paper assume that benefits occur evenly across relevant age ranges. If the benefits actually occurred earlier, our estimates are too low; if they occurred later, our estimates are too high. When policymakers decide which public programs to fund, it is important that they consider factors besides the internal rate of return, such as when spending and benefits occur, the scale of the project and total net discounted benefits (Summers, 2003).

## Model Programs

### Perry Preschool Project

Summary. One of the largest, most renowned and empirically sound early childhood programs, the Perry Preschool Project was conducted in the early 1960s. A total of 123 young, African-American children living in poverty participated in the city of Ypsilanti, Michigan. Approximately half of the children were from single-parent families. Less than half of the parents of participating children were gainfully employed at the start of the study; the majority of these parents did not graduate from high school. Half of participating children were randomly selected to attend a high-quality preschool for 2 1/2 hours a day. The preschool curriculum grew out of a Piagetian tradition; teachers encouraged children to be active learners by focusing on key experiences, asking children open-ended questions, and setting a daily routine that encouraged reflection. Additionally, each child's preschool teacher came to the child's home once a week and visited with the child's parent for 1 1/2 hours. Assessments in several rounds occurred while the children were in preschool and during many subsequent years up until

participants were 40 years old. Assessments addressed children's academic performance, delinquency and crime, economic status, family structure, health, and social relationships.

Results. The age 40 follow-up documents the overwhelming success of the Perry Program. Generally, program participants fared better in a variety of different domains relative to their no-program group counterparts. Program participants demonstrated a greater lifetime of educational performance, completed more schooling, were more likely, on average, to graduate from high school, spent significantly fewer years in special education programs, had higher grade point averages, and higher achievement test scores. The program participants also demonstrated decreased levels of delinquency and crime (marked by fewer arrests across their lifespan and less self- and teacher-reported misconduct) relative to the no-program group. Economically, program participants had higher monthly earnings as adults, were more likely to own their own home, and were more likely to be self-supported and gainfully employed than their no-program counterparts. Additionally, program participants were more likely to be married, less likely to have births out of wedlock, were closer with their families, and had more goals for the years ahead, relative to no-program participants.

Strengths. This study has many strong features. The first of these is the study design. Participants were randomly assigned to the program or no-program group at the start of the study. Another strength is the long-term follow-up of the participants. Preschool participants were measured in a variety of domains, at many time points, until age 40. A third strength is the low attrition of the sample. For example, at the age 40 follow-up, over 95 percent of original participants were located and interviewed, giving researchers confidence that their follow-up is representative of nearly all study participants.

Weaknesses. The weaknesses of the Perry study are few. Some of the results seem to suggest that the program was more effective in several respects for girls than it was for their male peers. However there were substantial gender differences in rates of arrest, where boys were more likely to be arrested and were thus more likely to experience a reduction in arrests as a result of participating in the program. The sample was fairly large, but pales in comparison to some of the large-scale evaluations. However, relative to the majority of other programs, the weaknesses of the Perry Project are fairly negligible.

Benefit-cost Analysis. Overall, benefit-cost analyses conducted on the Perry Preschool Project confirm that the program yielded a high benefit-cost ratio. The average amount spent on each child in 2004 dollars[1] was $17,362.[2] The main financial benefits to both the participant and his/her family include decreased spending on child care and increased earnings later in life. The financial benefits to the non-participating public include decreased spending on K-12 education (due to reductions in special education and grade retention), decreased use of the criminal justice system, and dramatic decreases in financial ramifications for crime victims. These benefits total $283,995 per participant, discounted at 3 percent, yielding a net benefit of $266,633 per participant. About 88 percent of the benefits were measured through age 40, the rest were projected based on trends in crime rates, earnings and welfare payments. For every dollar invested in the preschool program the total return was $17.07.

Most of the benefits from the Perry Preschool program were attributed to the non-participating public, including reductions in the cost of crime to the justice system and victims, savings to public schools, and increased tax revenue. The public portion of the benefit is

[1] All dollar figures in the present review were converted to 2004 dollars using the Consumer Price Index.
[2] The program was designed for children to attend for two years; on average children spent 1.6 years in the program.

estimated at $12.90 for every dollar invested in the preschool program. The total internal rate of return, adjusted for inflation, is estimated at 18.4 percent; the public internal rate of return is estimated at 16.9 percent.

### Carolina Abecedarian Project

Summary. Another renowned and empirically sound model early childhood program is the Carolina Abecedarian Project, which enrolled children from 1972 to 1977. Participants included 111 young, at-risk, predominately African-American children living in poverty in a university city in North Carolina. Approximately half of the children were born to teenage mothers. The median income level for participating children's families was zero. The majority of these parents did not have a high school diploma. Half of participating children were randomly selected to attend a high-quality, full-time preschool program. The preschool curriculum emphasized cognitive, language, perceptual-motor, social, and pre-literacy skills. Families were encouraged to become involved with their children's educational experiences.

Assessments in several rounds occurred while the children were in preschool and during many subsequent years up until participants were 21 years old. Assessments addressed children's intellectual level, academic skills, degree of self-sufficiency, and social adjustment. Social adjustment was indexed by participants' self-reports of negative outcomes; other outcomes were determined with standardized testing procedures.

Results. The age 21 follow-up documents the largely positive effects of the Abecedarian program. Generally, relative to the control group, program participants fared better in a variety of different domains. Preschool program participants demonstrated slightly higher IQ scores, but greatly improved math and reading scores, than the control group. Program participants

completed more years of schooling, were significantly more likely to be enrolled in a four-year college or university, and were more likely to hold skilled jobs. There were no significant differences between the groups on economic self-sufficiency. Generally, there were no significant differences in parenthood, although there was a trend for program participants to delay having children until later in life, relative to the control group. The program participants were also less likely to self-report the use of marijuana, relative to the control group. There were no other significant differences between the groups for drug and alcohol use, violent behavior, misdemeanors, and felonies. It should also be noted that subsequent analyses have demonstrated important positive effects for teenage parents of program children including increased high school graduation rates, greater likelihood of being self-sufficient, less likelihood of bearing additional children, and more likelihood of being employed in "skilled" or "semi-skilled" positions.

Strengths. This study has many strong features. The first of these is the study design. Participants were randomly assigned to the preschool program or no-program group. Another strength is the long-term follow-up of the participants. Preschool participants were measured in a variety of domains, at many time points, up until early adulthood, age 21. A third strength is the low attrition of the sample. At the age 21 follow-up, over 93 percent of original participants were located and interviewed, giving researchers confidence that the follow-up is representative of nearly all study participants. Additionally, participants were recruited during infancy and were all provided with free formula and diapers to reduce any early nutritional differences between the control and experimental groups.

Weaknesses. The empirical weaknesses of the Abecedarian study are few. The main concern is the representativeness of the sample. Although the children enrolled were at risk and

living in poverty, due to the existence of a large university, the public school districts that the participants (program and control) funneled into were of very high quality. Unfortunately, it is unlikely that the majority of at-risk children have this opportunity in other parts of the country. This high-quality school experience may have either diluted or enhanced the effects of the early intervention relative to lower-quality school environments. Also, crime rates in the area were lower than several other parts of the United States, which would have diluted potential differences in crime rates, such as those found in the Perry study. Given these issues, compared to other model programs, the benefit-cost analysis demonstrates a lower ratio of benefits-to-costs than some of the other programs that have been investigated.

Benefit-cost Analysis. Overall, the benefit–cost analysis conducted on the Carolina Abecedarian Project confirms that the program yielded a moderately high benefit-to-cost ratio. The main financial benefits to both the participant and his/her family include decreased spending on child care and increased benefits to teenage mothers of participating children, including higher graduation rates, fewer later births, and increased likelihood of self-sufficiency. The financial benefits to society, as a whole, include decreased spending on K-12 education and potential future tax revenues based on a greater likelihood of enrollment in four-year colleges. At a discount rate of 3 percent, the cost of the program was $37,658 per child in 2004 dollars. The benefit-to-cost ratio for this program was about $3.50 returned for every dollar invested. However, it should be noted that this analysis included a projected estimate of return to society based on reductions in smoking among program participants. This outcome measure is not included in any of the other benefit-cost ratios reported here, and exclusion of this element reduces the benefit-to-cost ratio to about $3.00. The study authors indicated that if the nutritional support was provided only to program participants (and not to all families, both

participants and non-participants), this would likely increase the benefit-cost ratio of the program.

The authors of the benefit-cost analysis estimate that the internal rate of return is slightly greater than 7 percent. Benefits to the non-participating public include savings to the school system and some public health benefits that add up to about half the cost of the program. Therefore, the 7 percent internal rate of return largely reflects increased maternal earnings and future participant earnings likely due to higher productivity in the workforce.

**Syracuse University Family Development Research Program**

Summary. The Syracuse program involved an intensive combination of weekly home visits and five years of center-based care for children aged 6 months to 5 years. By intervening with parents, the project authors hoped to foster and improve parent interactions with and interest in their children. The center-based care allowed children to interact with one another and explore their surroundings in a teacher-supervised classroom setting. The curriculum used by teachers aimed to bolster cognitive and social skills and encourage children to accept challenges. Participants were African-American, from single-parent, low-income families. The majority of mothers were teenagers with little or no work experience. The research design included an original 108 program families. Matched controls (on age, sex, race, and socioeconomic status) were established during kindergarten. Forty-five program families and 39 control families participated in the follow-up, which included parent interviews, child interviews, and teacher and school reports.

Results. The results of the 10-year follow-up reveal that there were no significant differences between the control and program groups on family structure. School reports

indicated significant differences between control and program group girls during early adolescence; program girls were less likely to be failing school, were rated by teachers as being higher on academic achievement, had better attendance records, and were rated by teachers as having more positive attitudes toward themselves and others. Similar differences did not emerge for boys during early adolescence, and no significant differences were found for academic measures during the elementary school years. Interviews with parents revealed that parents of program children were more likely to endorse prosocial goals for their children and reported that they would be more likely to encourage "young people" to learn more about themselves. Child interviews revealed that program children were more likely to report feeling good about themselves, view education as a long-term part of their lives, and offer that they would use a more active approach to solving problems. Court records were collected to determine the effects of the program on juvenile delinquency. Relative to no-program controls, program participants were less likely to have been processed by the probation system and had committed fewer violent offenses.

Strengths. The strength of this investigation is the long-term follow up, combined with the intensity of the early intervention. The long-term follow-up enabled researchers to see that many of the results for academic achievement did not appear until early adolescence.

Weaknesses. There are several weaknesses of this study. The 10-year follow up received consent from only 79 percent of program families and 73 percent of control families. Additionally, of those families who provided consent, nearly 25 percent of them did not complete the follow-up assessments. Further, the families who did not participate tended to have the least amount of stability. Therefore, there is good reason to suspect that the results of the

report are not representative of all study participants. Another concern is the failure of the evaluation to use a randomly assigned comparison group.

Benefit-cost analysis. A benefit-cost analysis was conducted in 1997 to estimate the program's effect on the costs of crime. The average cost of the program, per participant was $21,229 in 2004 dollars. The savings based on criminal justice costs avoided was $4,652 and for victim costs avoided $4,522. Therefore, the program's cost was higher than savings from crime reductions. Without inclusion of potential unmeasured benefits (e.g., educational benefits and income effects), it is not clear whether this program's costs are higher than its total benefits.

**Milwaukee Project**

Summary. The Milwaukee Project set out to use an early childhood educational intervention to demonstrate that early experience could help reduce mental retardation in children at risk. Participants included 35 predominately African-American infants recruited from well-baby clinics between 1966 and 1968. All children had no serious pathology and were born to mothers who were classified as mentally retarded, based on an IQ score of less than 75. Seventeen of these children participated in the intervention, the other 18 served as randomized controls, matched for maternal IQ. A group of nine contrast children, who were born to mothers with IQ scores equal to or greater than the national average (100+), were also included for comparison purposes. All children were recruited from similar neighborhoods in inner-city Milwaukee, Wis.

A project staff member visited children in the intervention group in their home on average three days per week for 3-5 hours per visit up until children reached 6 months of age. Staff members provided basic information on child care, medical care, nutrition, and financial

planning. An additional purpose of these visits was to build rapport with families and aid with the transition of the infant into full-time care at the child center. After age 6 months, program children attended the child center five days per week, seven hours a day. Although child center caregivers had no professional degrees, they received in-service training and turnover rates were low. Low child-to-caregiver ratios were maintained. The curriculum focused on meeting children's needs at different ages and included socio-emotional, perceptual-motor, and cognitive-language components. Children participated in the center until age 6, having completed kindergarten at the center. Parents of participating children were provided with rehabilitation training during the duration of the project, which focused on education and job training in the service of increasing family income.

Assessments of program participants, control children, and contrast children occurred frequently throughout the infancy and early childhood periods. Children were examined at age 6, and then a long-term follow up was conducted when the children reached ages 12 to 14. Assessments addressed children's IQ, interactions with parents, academic performance, intellectual development, educational assistance required, grade repetitions, and conduct.

Results. The adolescent follow-up (ages 12-14) details the success of the Milwaukee project in preventing mental retardation in its participants. Generally, relative to their no-program counterparts, program participants fared better in a variety of different domains. In the short term, program participants demonstrated increased success with early developmental milestones (e.g., learning to read, get along with other children, and catch a ball), greater intellectual development, greater problem-solving behavior, more advanced language skills, and more informative exchanges with their mothers, relative to control children. In the long term, program participants maintained their intellectual advantage in terms of IQ and achievement

tests; although this advantage did not necessarily translate to higher school grades. Over the course of their elementary school years, program participants had less grade retention and required fewer educational special services than children in the no-program group. Overall, across a variety of measures, children who participated in the program were more similar to the contrast group (not at risk for retardation based on maternal IQ) than to children in the control group.

Strengths. This study has several strong features. The first of these is the use of random assignment to form the treatment and control groups. A second strength is the intensity of early assessments and the later long-term follow-up of the participants. Children were measured extensively in a variety of domains during their first few years of life and then again at ages 12 to 14.

Weaknesses. The main weakness of the Milwaukee Project is the small sample size. Although 55 children were initially identified who met the criteria for participating; only 35 participated in the evaluation – resulting in 17 children who served as the experimental group. Thirty-six percent of initially recruited participants dropped out of the evaluation, leading to concerns about the generalizability of the sample. Several of the results presented in the evaluation do not include statistical comparisons, presumably because the statistical power was so weak due to the sample size. A second weakness of this study is the applicability to other populations. Participants were recruited who were at genetic risk for mental retardation; therefore, the effects reported may not generalize to other children who do not have this same risk. Additionally, some of the project investigators were convicted of embezzlement of federal funds (Weinberg, 1991), leaving lingering questions about the validity of the intervention.

Benefit-Cost Analysis. To date, no benefit-cost analysis has been completed for the Milwaukee Project. Results are generally positive for program participants, although no data

were reported on the cost of the intervention. Given six years of full-time care for children with low child-to-teacher ratios and continued intervention with the parents, it is likely that this program is cost-intensive relative to others reviewed here.

## Large-Scale Public Programs

### Chicago Child-Parent Centers

Summary. One of the largest and empirically sound program evaluations, the Chicago Longitudinal Study has followed children (as well as matched controls) who began participating in Chicago Child-Parent Centers (CPC) during 1985 and 1986. Participants were predominately African-American children, born in 1970, living in poverty in various neighborhoods of Chicago. Nearly 1,000 children participated in the CPC during preschool. These children were matched on demographic variables (e.g., income and family structure) to a second group of 550 study participants who did not participate in the CPC (primarily because it was not available in their neighborhood) but who completed an alternative full-day Kindergarten program.

CPC preschools offered half-time programs for children, 3 and 4 years of age, with many opportunities for parent involvement. The curriculum provided relatively structured, but diverse experiences focusing on the acquisition of basic skills in language arts and math. Parents of participating children were provided opportunities for interaction with other parents and school staff. Parents were encouraged to attend educational workshops, reading groups, volunteer in their child's classroom, attend school events, and work on completing their own high school education. The program also included home visitation, health and nutrition services, and low child-teacher ratios.

Assessments occurred annually while children were in preschool and elementary school. The most recent assessment was conducted when participants reached age 20. Assessments addressed children's academic performance, delinquency and crime, and general well-being. Parents also provided information at each assessment about their own goals for and involvement with their children.

Results. The age 20 follow-up documents the overwhelming success of the Chicago Parent-Child Centers. Generally, relative to their no-preschool program counterparts, preschool program participants fared better in a variety of different domains. Program participants demonstrated a greater lifetime educational performance, on average; they completed more schooling, were more likely to have graduated from high school (particularly boys), spent fewer years in special education placement, and had lower rates of grade retention. The program participants also demonstrated decreased levels of delinquency and crime (marked by fewer arrests across their lifespan) relative to the no-program group. In other domains, preschool CPC participants had higher levels of consumer skills and parents who were more involved in their education and less likely to maltreat them.

Strengths. This study has many strong features. The first of these is the use of existing publicly funded preschool programs. Unlike the model programs that are frequently conducted in a single school, the Chicago Longitudinal Study follows children enrolled in 20 different school sites. These centers were established under the Federal Title 1 of the Elementary and Secondary Education Act of 1965 and remained publicly funded throughout the duration of this study. Another strength is the long-term follow-up of the participants. Participants were measured in a variety of domains, at many time points, up until age 20.

Weaknesses. The weaknesses of the Chicago Longitudinal Study are few. The main weakness is that for logistical and ethical reasons, participants were not randomly assigned to the CPC program group. The authors note that the non-CPC comparison group was eligible for CPC; however, the intervention was simply not offered in their neighborhood. Therefore, selection bias may exist on a neighborhood level; that is, neighborhoods with a CPC may be different from neighborhoods without a CPC (Barnett, 1995). However, the program versus no-program groups were comparable on economic and psychological factors. An additional weakness for this study is the attrition level. At the age 20 follow-up, only 75 percent of participants had information recorded on school progress. Additionally, the 25 percent of missing participants differed from the available participants in terms of gender, early academic success, and parent involvement during preschool. Consequently, the age 20 follow-up results may not be representative of all original study participants.

Benefit-Cost Analysis. Overall, benefit-cost analyses conducted on the Chicago Child-Parent Center programs reveal that the actual cost of the program per participating child is well outweighed by the benefits that accrue later. The cost per child, was $7,799 in 2004 dollars over one and a half years. The benefit-cost analysis was restricted to only the preschool portion of the study. The main financial benefit to the participant was increased earnings later in life. The financial benefits to society, as a whole, include decreased spending on K-12 education, decreased use of the justice system, reductions in spending for child welfare services, greater tax revenue from these increased earnings, and dramatic decreases in financial ramifications for crime victims. Total discounted benefits equaled $55,348 per participant. For every dollar invested in the preschool program, the total return was $7.14, 21 years later. The benefit-cost ratio for the nonparticipating public was $3.85 for every dollar invested.

Internal rates of return for the Chicago Child-Parent Center were somewhat similar to the Perry Preschool program. The savings due to child care benefits and reductions in juvenile crime that accrued relatively early after preschool helped boost the total internal rate of return to about 18 percent; the public internal rate of return is estimated at 12 percent.

**Michigan School Readiness Program**

Summary. A more recent investigation of a state-funded program is the Michigan School Readiness Program. This program has served 26,000 children annually, since 1985. The recent evaluation focuses on the 1995-1996 class of children and reports on their outcomes on various school-related measures from kindergarten through grade 4. The program group consisted of 338 children; 258 children served as the no-program comparison group. Children qualified for the program group by demonstrating several risk factors, including low family income and single-parent status. The groups were not randomly assigned to the program/no-program conditions, but the groups were similar in terms of age and socioeconomic background. No-program children did not attend preschool of any kind. The program group received nine months of either part-time or full-time educational experience beginning at age 4. Curriculum was designed to promote intellectual and social growth through developmentally appropriate activities. The program also encouraged parents to become involved with their children's education. Assessments occurred annually on all participants up through grade 4.

Results. The results of the evaluation show that the Michigan School Readiness Program participants were ahead of their no-program peers on a variety of measures. Program participants scored significantly higher in overall development at kindergarten than the no-program controls, as rated by independent observers. Similarly, teachers rated program

participants higher in school readiness from grades K through 4 than the no-program controls; this was particularly due to program children's "readiness to learn." Program participants were rated as being more interested in school, more likely to have good attendance, more likely to take initiative, had stronger backgrounds in reading, math, thinking, and problem-solving, and were better at working with others. Relative to controls, program participants were also less likely to be held back a grade. By grade 4, program participants also had higher percentages of satisfactory ratings on standardized achievement tests in reading and mathematics relative to no-program controls. Parents of program participants were significantly more involved with class activities and in more communication with teachers, relative to parents of no-program children. There were no significant differences between program and no-program children on the amount of services received in special education, reading specialist use or diagnosis of learning disabilities over the duration of the study.

Strengths. This study has several strengths. It relies on a large sample size, including children attending a variety of sites across the state of Michigan. The study also has a multi-method assessment including ratings from observers, teacher ratings, school records review, and statewide testing. Another strength is the curriculum, based on the High/Scope program, which was evaluated by outside observers from the High/Scope Educational Research Foundation and was found to create a high-quality preschool environment.

Weaknesses. The main weakness of this study is the lack of random assignment. Although the authors work to insure that the program and no-program group are similar in terms of age and socioeconomic status, they acknowledge that they have insufficient data to compare the program and no-program group in terms of ethnicity and the number of risk factors children were facing. This is particularly problematic as the no-program group may consist of children

who entered the study with a greater number of risk factors. Therefore, observed differences between the groups may be due to these underlying prior differences, rather than to the intervention, and no statistical controls are available to control for these factors.

Benefit-cost Analysis. At present, no benefit-cost analysis has been conducted of this study. However, the authors propose that, based on these study results, the program annually prevents some 1,700 Michigan children from repeating a grade. This alone saves the state approximately $11 million to $12 million per year.

**Oklahoma Pre-K**

Summary. The Oklahoma pre-K program is somewhat unique from the other interventions reviewed here. First, all children are eligible to participate, not just children who are living in poverty or those who have several risk factors. In addition, the children participating in the evaluation are racially and somewhat socio-economically diverse. The one-year intervention is given to 4-years-olds through existing local preschool centers and the public school districts. The pre-K program has no set curriculum, but offers both full and half-day programs that meet strict quality guidelines. The site for the evaluation is the city of Tulsa, where about 66 percent of all 4-year-olds participate in the program. The researchers administered a nationally-normed test to 1,567 pre-K students and 3,149 kindergarten students during the fall of September 2003. Nearly half of the kindergarten students had participated in the pre-K program during the previous school year. The test measured age appropriate skills in pre-reading, writing and numeracy.

In order to correct for selection bias, the researchers compared kindergarten students who had just completed Tulsa pre-K (program group) to students who were about to begin pre-K (no-

program group). Because Tulsa uses a strict birthday cut-off for eligibility, the researchers compared "old" pre-K children to "young" kindergarten children who were in pre-K the previous school year. Researchers included statistical controls for gender, race/ethnicity, socio-economic status, mother's education and date of birth. The observable characteristics of the two groups were similar, including that participants of both groups chose to enroll in pre-K.

Results. Overall, children who attended Tulsa pre-K showed a 52 percent gain in letter-word identification test, a 27 percent gain in the spelling test, and a 21 percent gain on a pre-numeracy test compared with the no-program group. All racial and ethnic groups benefited from the pre-K program. Black and Hispanic students had statistically significant gains on all three tests, while Native American and White students had statistically significant gains on two of the three tests. Hispanic students showed the strongest gains on all three tests. While all socio-economic groups benefited from the pre-K program, children that qualified for free or reduced lunch showed stronger gains compared with full-price lunch children.

Strengths. The researchers were able to reduce risk of selection bias without random assignment by comparing children with birthdays slightly after the pre-K cut-off date with children with birthdays just before the date. Therefore, the gains found in the test scores are likely attributed to the effect of the program. Another strength of this investigation is the inclusion of a diverse group of participants – not just those who are at risk. Furthermore, programs had consistent quality across all participating centers and schools.

Weaknesses. Using the cut-off date to divide children into comparable groups accounts for selection bias, but only for one year. The cut-off date limits researchers to identify effects of pre-K to one year since after that time the no-program children start the pre-K program. After the no-program group children finish their year of pre-K, both groups will have experienced the

effects of the intervention; differences between the two groups can no longer be used to show the effects of pre-K during their school years or beyond.

Benefit-cost Analysis. No formal benefit-cost analysis has been conducted on this study.

**New Jersey's Abbott Districts**

Summary and Results. Assessments of kindergarten children in New Jersey's highest poverty school districts, the Abbott districts, showed marked improvement in the 2003-2004 school year compared with previous years. Since 1999 these districts were mandated by the state's Supreme Court to provide preschool for 3- and 4-year-old children. Kindergarten language scores were significantly higher in the 2003-2004 school year compared with scores from four years earlier, and the percentage of children scoring "very strong" in early reading skills increased to 47 percent from 42 percent a year earlier. No formal benefit-cost analysis has been conducted on this program.

**Head Start.**

Summary and Results. One of the most widespread, publicly funded interventions is the Head Start program. Open to all children, ages 3 to 5, who meet low-income requirements, Head Start programs are operated at a local level but are required to meet federal quality standards. All programs must also provide nutritious food to children and monitor the use of preventative health care services. Numerous investigations have been conducted to examine the effects of Head Start programs on children's readiness for kindergarten and later school success. A common finding among these studies is that there are short-term achievement gains for participants, such as higher IQ and test scores for reading and mathematics, relative to non-

participants. However, there is evidence that these effects may "wash-out" after several years in the public school districts. There are also some indications that the effects of the program may be different for children of various ethnic backgrounds.

The existing evaluations of Head Start are generally plagued by a variety of methodological problems and do not supply long-term follow-up of participants. An additional challenge is that given the local operation, individual Head Start programs vary in terms of their curriculum, quality, and correspondence with the federal quality guidelines. Economically speaking, the average cost of keeping a child enrolled in a part-time Head Start program for 34 weeks a year is about $7,200. However, given the existing research, it is likely that there is high variability in both the cost and long-term benefits of Head Start programs across different geographical areas.

At present a randomized controlled study is underway investigating the impact of Head Start programs on children's development. Beginning in 2002 about 5,000 3- and 4-year-old children applying for Head Start were randomly assigned to either a program group or to a no-program group. Children in the program group enrolled in Head Start through one of 84 nationally representative agencies, while children in the no-program group had access to non-Head Start community services. Researchers will collect data on the children through the spring of their first grade year.

Results after one year of data collection show small to moderate gains in a number of areas for children who attended Head Start relative to non-Head Start children, but there were also a number of areas where there were no statistical differences between the two groups. Researchers found positive impacts for 3- and 4-year-old children across four of six cognitive areas, a small but significant impact for 3-year-olds in problem behavior, small to moderate

impacts on some health measures for 3- and 4-year-olds, and some small impacts on parenting practices. Future reports from the study will examine areas of possible impact, explore possible variation in impact by program and community characteristics, and report on child outcomes and parenting practices through the end of first grade.

## Home Visitation Programs

### Elmira Prenatal/Early Infancy Project

Summary. The Elmira project focused on intervening with economically disadvantaged first-time mothers and their children from 1978 to 1982. Four hundred families participated in the evaluation. Participants were broken into several sub-groups equated on several risk factors. The two groups of interest are a program group of 116 mothers who received home visits during pregnancy and the first two years of their child's life and a control group of 184 who received no intervention. Registered nurses visited mothers in the intervention group in their homes approximately nine times during the pregnancy for a little over an hour each time, and then an additional 23 times, on average, prior to the child's second birthday. During these visits, nurses promoted maternal functioning, health-related behaviors, appropriate caregiving, and maternal self-development (e.g., family planning, education, and employment).

Mothers and children were assessed at 4 to 6 month intervals during the first four years of the child's life, and again when the child reached age 15. Most results for the Elmira Project focus on parent outcomes. However, several child-focused measures were examined. IQ was measured at ages 3 and 4. Arrests and convictions were also examined through age 15. Additionally, child health was assessed via the number of visits to the emergency room and days spent in the hospital during preschool, ages 2 to 4.

Results. Overall, there were few effects of the Elmira Prenatal/Early Infancy Project on child outcomes. Participation in the home-visits did not relate to child IQ at ages 3 or 4. The authors isolated a subset of participants (N = 38 treatment, N = 62 controls) who were particularly at risk for negative outcomes. Among these children, program participation was associated with fewer child arrests and several positive maternal outcomes. Generally, program participants experienced less child abuse than non-participant controls.

Strengths. A strength of this investigation is the relatively large sample size, random assignment to treatment groups, and the long-term follow-up of participants. Additionally, registered nurses knowledgeable about early child development conducted home visits.

Weaknesses. By design, the Elmira project set out to examine the impact of early home visits on first-time mothers. Consequently, the greatest weakness of this investigation is a lack of focus on the child and the child's outcomes. Other than IQ as a measure of early intellectual development, there are no measures of children's experiences in school.

Benefit-costs Analysis. A benefit-cost analysis of the Elmira Project revealed that the average cost of the program per child was $7,324 in 2004 dollars. The only child outcome measures included in the analysis were reductions in criminal justice costs and reductions in health services use (based on decreased child abuse). Looking at child outcomes on these two factors alone, the program's benefits, measured as savings to government, do not outweigh its costs. For the higher-risk children the total benefit discounted at 4 percent was $5,189, yielding a benefit-cost ratio of $0.71. The benefit for lower-risk children was $1,505, yielding a benefit-cost ratio of $0.20, that is, for every dollar invested in the program, only 20 cents were regained. However, this calculation does not include savings due to decreased grade repetition and use of special education services, or projected higher tax revenue from increased earnings.

A full benefit-cost examination was conducted on the maternal variables. When benefits to the mother (e.g., deferment of future pregnancies, improved entry into the workforce, and increased economic self-sufficiency) as well as the child are summed, the benefit-cost ratio for high-risk families jumps to $ 4.06 ($29,730 savings to government), although the ratio for low-risk families is only $0.62 ($4,545 savings to government). After including tangible losses to crime victims and increased maternal earnings and calculating the net welfare payments (tax revenue used to make welfare payment minus welfare payments), the total benefit-cost ratio is closer to $5 to $1 (about $36,000 in total benefits) for the high-risk families and close to cost recovery (about $1 to $1) for low-risk families.

Internal rates of return are tricky to measure for the Elmira program because the benefits accrue more quickly than in the other early childhood development programs evaluated with benefit-cost analysis. Assumptions about when the benefits occur change the internal rate of return, especially during the first few years. Nevertheless, the internal rates of return for high-risk families, including government and crime victim cost savings and increased maternal earnings, are likely to be between 20 percent and 25 percent.

**Child Care Studies**

A separate, but related field of research examining the effects of child care on young children's development may also help to highlight the importance of early experience. A full review of this literature is beyond the scope of the present review, although two recent investigations are of particular note. The first of these examines child care in poor communities (Loeb, Fuller, Kagan, & Carrol, 2004); the second includes a more diverse sample (NICHD, 1999; 2000; 2004). Both studies found that enrollment in center-based care was associated with

positive cognitive outcomes for young children, particularly when child care providers had high levels of skill and education and child-teacher ratios were low. These positive effects were significant in both poor communities and more diverse communities even after other relevant factors such as family background and maternal education were controlled. An additional finding from these studies is an increase in children's physically aggressive behavior after participating in center-based care, particularly for children who spend large amounts of time in these care arrangements. These same cognitive and language benefits do not appear to extend to children who spend a majority of time in non-maternal care that occurs outside of a center (e.g., neighborhood care provided in another's home). Future work will need to examine the implications of these findings for the transition to kindergarten.

**Washington State Meta-Analysis**

A recent meta-analysis conducted by the Washington State Institute for Public Policy (Aos, Lieb, Mayfield, Miller, & Pennucci, 2004) examined the benefits and costs for a variety of early intervention programs. Overall, early child education programs for low-income 3- and 4-year-olds performed well relative to many of the other programs reviewed. To establish the ratio for early education programs, the authors created an average composite of 53 early education programs, some model, others publicly funded. Their analysis resulted in an estimated benefit-cost ratio of $2.36 in 2004 dollars for early child education for low income 3- and 4- year olds. This value scored high among intervention program types reviewed by the authors, including several parole supervision programs for juvenile offenders and smoking prevention programs.

**Study Conclusions**

Overall, there is much to be learned from the early childhood education interventions reviewed here. The model programs demonstrate that when random assignment is present, program participation leads to better outcomes for children, including increased educational success during the early school years. Long-term follow-ups reveal reduced use of the juvenile justice system, increased adult wages, more stable family situations, and more positive goal-setting. The large-scale programs demonstrate that, in some cases, successful interventions can be implemented at scale and can produce positive outcomes. Several key themes emerge from our review of the literature.

Quality. Early childhood development programs are successful when the care and instruction provided to children is of high quality. Generally, as long as the quality is high (as measured by high levels of teacher education and training and low child-to-teacher ratios), the specific curriculum employed is less important in terms of prediction of both short- and long-term child outcome measures. Furthermore, while the site in which the program occurs needs to meet safety standards and other basic requirements, the layout of the building and grounds seem to play a small role in overall impact relative to teacher education and child-to-teacher ratios.

Participants. Benefit-cost ratios are highest when interventions are conducted with at-risk children. In most cases, when they are included as participants, children who do not fall into risk categories (e.g., having a young, single parent or low income) do benefit from these programs; however, at-risk children seem to benefit more dramatically.

Child-based intervention. Child-based programs that include parent education and involvement are more successful than programs that only provide parent education. Several of the programs reviewed assumed that by primarily influencing the child's parents, the effects would be passed on to influence the child. Although the studies reviewed here are in no position

to support or refute this hypothesis, a number of studies do find that direct interventions with children that also include parent education and involvement are largely more effective than only home visits with parents.

Long-term benefits. Benefits of early childhood programs accrue over the long-term; several benefits do not appear until 15 or 20 years later. Many of the studies that include a benefit-cost analysis do not find substantial benefits for society until later in participants' lives, such as decreased use of the criminal justice system for program participants.

**Reflections from Developmental Psychology**

In reflecting on these themes, we turn to supporting evidence from studies of early childhood development. This information may help explain why particular program features produced positive outcomes.

*Why might high quality early childhood development programs lead to positive outcomes for children*? A recent study by the National Institute of Child Health and Human Development Early Child Care Network (2002) examines this question. In an investigation based on child care experiences of young children, the researchers examined how child care structure (as measured by teacher training and child-teacher ratios) and child care process (defined as the classroom environment interactions between caregivers and children) work together to predict child cognitive and social outcomes. Both social-emotional and cognition-language processes interact to foster later benefits. The study demonstrated that structural variables and process variables were associated. Additionally, once process variables were considered, there was no relation of structural variables to child outcomes. The authors speculated that higher levels of caregiver training led to better interactions between children and adults, and lower child-teacher

ratios led to more interactions among children and adults. In turn, these improved interactions between children and caregivers led to more sensitive caregiving and a more positive, non-chaotic classroom environment. These features are considered to be responsible for improved child outcomes in terms of cognitive skills and social competence. Providing teachers and caregivers with training and increasing teacher-student ratios may enable teachers to adjust to the changing conditions in classrooms and create an environment that is ideal for children. Although the present review does not indicate any major differences in effectiveness among different curriculum models employed by early childhood education programs, there is some evidence that curriculum models emphasizing child-initiated learning are the most effective, particularly in the prediction of later delinquency (Schweinhart, Weikart, & Larner, 1986).

Benefit-to-cost ratios are highest when interventions are conducted with at-risk participants. *Why might this be*? As mentioned earlier, close relationships with teachers may help to shelter children who are at risk due to family characteristics for lower achievement (Burchinal et al., 2002). Raising a child in poverty is a particularly stressful experience for parents. As a result, children of poor households are more likely to have diminished home-based cognitive stimulation and to experience inconsistent parenting (McLoyd, 1998). Consequently, having an opportunity to form a close relationship with a teacher and experience a cognitively stimulating environment in the context of an early childhood development program may be most advantageous for at-risk participants.

Many of the financial benefits of early childhood interventions come out of reductions in criminal justice system use. Given that at-risk children are more frequent offenders as juveniles and adults (Chung, Hawkins, Gilchrist, Hill, & Nagin, 2002), the most dramatic reductions in use of the criminal justice system are likely to come from at-risk participants.

It is important to note that in most early childhood development programs, child-based interventions take place in the context of a child center, rather than in the child's own home. *What is it about intervening directly with the child, in a center-based context, that may lead to the positive effects demonstrated in early childhood development programs?* One possibility is that center-based experiences provide children with the opportunity to form a close relationship with a non-parental caregiver or teacher. Teacher-child relationships are frequently measured in terms of three dimensions: closeness, conflict, and dependency (Pianta, Nimetz, & Bennett, 1997). There is some evidence that children's early interactions with parents relate to later interactions with teachers (Pianta et al., 1997). Additionally, there is considerable similarity between children's relationships with their preschool and kindergarten teachers (Howes, Phillipsen, & Peisner-Feinberg, 2000). These researchers suggest that children with center-based preschool experience enter formal school with expectations for teacher-child relationships and knowledge of how to engage with teachers. Additionally, reading and language skills during kindergarten are predictable from children's close relationships with both parents and preschool teachers (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002). In some cases, close relationships with teachers may help to shelter children who are at risk due to family characteristics for lower achievement (Burchinal et al., 2002).

A second possibility for the importance of direct intervention with young children in center-based settings is the role of young children's friendships in predicting kindergarten success. In one study, children who transitioned to kindergarten with several preschool friends reported having more positive perceptions about school early on in the year, perhaps because they found the new environment more comfortable and familiar (Ladd, 1990; Ladd & Price, 1987). Forming new friendships in kindergarten was associated with improved school

performance (Ladd, 1990). Additionally, children who had experience forming friendships during the preschool years were better able to form new friendships during kindergarten and had better adjustment to kindergarten including: improved attendance, less anxious behavior, and more positive school attitudes (Ladd & Price, 1987). However, this is not to say that parents are unimportant – parents are children's first and primary teachers. Not surprising, children's relationships with parents have been demonstrated to be one of the strongest predictors of later cognitive and socio-emotional success in school (NICHD, 2002; Harrist, Pettit, Dodge, & Bates, 1994; Sroufe, 2000). Additionally, parent education levels and child-rearing practices have also been linked with children's academic success (Burchinal et al., 2002).

Many of the studies that include a benefit-cost analysis do not find substantial financial benefits until later in participants' lives. This seems to be primarily due to a decreased use of the criminal justice system for program participants, which is not relevant until adolescence. *How might preschool intervention prevent use of the criminal justice system 15 or 20 years later*? One proposal is that early interventions increase later school success, which itself leads to less delinquency later in life. Additionally, both increased school success and attachment to school are associated with decreased delinquency in adolescents (Farnworth, Schweinhart & Berrueta-Clement, 1985).

**Final Remarks**

This review of early childhood development programs indicates that children, particularly those considered at risk, made notable gains in school performance, increased earnings, and reductions in criminal behavior by participating in a quality early childhood development program. This paper echoes the theme of the importance of early intervention drawn by research in fields such as neuroscience, psychology, education, and economics (e.g., Barnett, 1995; Nelson, 2000; Pianta, Nimetz, & Bennett, 1997). Although no one study is conclusive, the results of these studies collectively suggest that communities could accrue significant benefits by ensuring the availability of high quality early childhood development programs, particularly for at-risk children.

Early childhood research also provides guidance in how to best bring early childhood intervention to children. Qualified teachers create rich interactions with children and have the latest knowledge about childhood development to inform those interactions. Low child-to-teacher ratios allow for more contact between teachers and children. This contact leads to high quality teacher-child relationships that help to buffer at-risk children from academic problems and later delinquency. This environment also allows children to form positive, high-quality friendships that provide support over the transition to kindergarten. In conclusion, investments in early childhood development need to have solid resources in order to create positive results. Investing only part way in a child may lead to little or no improvement in outcomes.

Finally, this paper serves as an example of multidisciplinary collaboration. The psychologist learned to calculate benefit-cost ratios, while the economic analyst learned the stages of child development. Just as a rich mix of cognitive, emotional-social, and physical development occurs during early childhood, as policy moves forward, lessons from a variety of disciplines are needed to find the best ideas to bring about optimal outcomes for children.

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