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Early Childhood Interventions

Proven Results, Future Promise

Lynn A. Karoly

M. Rebecca Kilburn, Jill S. Cannon

Prepared for

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1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516

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Summary

Parents, policymakers, business leaders, and the general public increasingly recognize the importance of the first few years in the life of a child for promoting healthy physical, emotional, social, and intellectual development. Nonetheless, many children face deficiencies between ages 0 and 5 in terms of emotional support, intellectual stimulation, or access to resources—due to low income or lack of health care, among other factors—that can impede their ability to develop to their fullest potential. While intervention programs in early childhood are of natural interest to the public sector, the private sector is increasingly playing a role in advocating and effecting increased investments in early childhood.

The *PNC Grow Up Great* initiative is an example of the involvement of the business sector in early childhood investments. This initiative, launched in September 2003 by The PNC Financial Services Group, Inc., is a ten-year, \$100-million program to improve school readiness for children from birth to age 5. The PNC initiative encompasses several components, including investing in direct services to disadvantaged children, developing and disseminating information about child development and school readiness through television and print media, promoting employee volunteerism in programs serving children ages 0 to 5, supporting objective research on the costs and benefits of early childhood programs, and advocating for increased access to quality early childhood programs. PNC has partnered with Sesame Workshop, the producers of *Sesame Street*, and Family Communications, Inc., the producers of *Mister Rogers' Neigh-*

borhood, to develop content for the initiative, and the entire effort is guided by a 12-member advisory council of experts in the early childhood field. In the first year of the *PNC Grow Up Great* program, \$950,000 in grants has been provided to selected early childhood programs, including Head Start centers and other early childhood education organizations, in PNC's service area (namely Delaware, Indiana, Kentucky, New Jersey, Ohio, and Pennsylvania).

As part of the *PNC Grow Up Great* initiative, PNC asked the RAND Corporation to prepare a thorough, objective review and synthesis of current research that addresses the potential for interventions of various forms in early childhood to improve outcomes for participating children and their families. In particular, as part of this study, we consider

- the potential consequences of not investing additional resources in the lives of children—particularly disadvantaged children—prior to school entry
- the range of early intervention programs, focusing on those that have been rigorously evaluated
- the demonstrated benefits of interventions with high-quality evaluations and the features associated with successful programs
- the returns to society associated with investing early in the lives of disadvantaged children.

Our approach to addressing these questions was to survey the relevant literature, identify the evidence that is scientifically sound, and provide an unbiased perspective on early childhood interventions that can inform decisionmaking on the part of the private and public sectors. Our analysis considers a broad range of interventions implemented throughout the United States, even beyond the types of programs currently supported by the *PNC Grow Up Great* initiative. We here summarize our conclusions.

The period from birth to age 5 is one of opportunity and vulnerability for healthy physical, emotional, social, and cognitive development.

Human development is the result of a complex interplay between genetic endowments and environmental conditions. Both nature and nurture—alone, and in interaction with one another—play key roles throughout the life course. Notably, the first few years of life are a particularly sensitive period in the process of development, laying a foundation for cognitive functioning; behavioral, social, and self-regulatory capacities; and physical health in childhood and beyond. During these early years, a variety of factors are critical to healthy development. They include the nature of early relationships with caregivers, the extent of cognitive stimulation, and access to adequate nutrition and health care. Some children will be resilient in the face of various stressors in early childhood, while healthy development will be compromised for others, with temporary or long-lasting effects.

A sizable fraction of children face risks that may limit their development in the years before school entry.

Risks of developmental delay accrue from living in poverty, having a single parent, and having a mother with less than a high school education, among other factors. Nearly half of a recent cohort of kindergarten children in the United States examined as part of the U.S. Department of Education's Early Childhood Longitudinal Study of the Kindergarten Class of 1998–1999 (ECLS-K) faced at least one of four such risk factors. Nearly one in six was subject to more than one. Exposure to such risks does not necessarily lead to developmental problems. Some children are resilient, but for others, the consequences can be considerable.

Variations in early childhood experiences are manifested in disparities in school readiness, and these gaps often persist.

Disadvantages in early childhood have implications for how prepared children are when they enter school. School readiness includes not only cognitive skills but also those associated with socialization, self-regulatory behavior, and learning approaches. Assessments for the

ECLS-K cohort indicate that children with more-disadvantaged backgrounds enter school with lower levels of the knowledge and social competencies that are important for subsequent school success. While these readiness measures indicate that children from more-enriched environments enter school better prepared, longitudinal data demonstrate that these early gaps persist and even widen as children progress through school. Thus, because disadvantaged children do not advance at the same rate as their more advantaged peers, achievement gaps tend to widen over time. Children from disadvantaged backgrounds also experience higher rates of special education use, grade repetition, and dropping out of high school. Lower rates of school achievement are in turn associated with unfavorable trajectories in later years. The latter include such outcomes as low rates of employment, welfare dependency, and delinquency and crime. Even if only a portion of these detrimental outcomes in childhood and adulthood can be averted, the benefits may be substantial.

Early childhood interventions are designed to counteract various stressors in early childhood and promote healthy development.

Early childhood interventions are designed to provide a protective influence to compensate for the various risk factors that potentially compromise healthy child development in the years before school entry. While they share a common objective, early childhood interventions are highly varied in their methods; there is no uniform model. Programs vary in the outcomes they aim to improve and in the risk factors they consider for eligibility to participate, e.g., low socioeconomic status, single parenthood. They differ in whether they target the child, the parent, or both, and in the extent of individualized attention they provide. Different programs target children of different ages and vary in what kind of services they provide, where they provide them, and for how many hours per week.

Rigorous evaluations of early childhood interventions can help us understand what outcomes they may improve.

Although we may expect early childhood programs to produce beneficial effects, a scientifically sound evaluation is required to know

whether they fulfill their promise. The variation in early childhood intervention approaches suggests that such evaluations are needed for the full range of program models, ideally with the ability to ascertain the effects of varying key program features.

The best evaluation designs are those that provide the highest confidence that effects attributed to the program are indeed the result of the intervention, rather than some other influential factor or factors. Randomized experiments are ideal, but such designs are not always feasible, so carefully designed and implemented quasi-experimental methods may suffice as an alternative.

While many early childhood interventions have been implemented, and a subset of those have been evaluated in some fashion, only a relatively small subset have been evaluated using scientifically sound methods. After reviewing the literature on studies of early childhood interventions that met our criteria for rigorous evaluation, we identified published evaluations for 20 early childhood programs with well-implemented experimental designs or strong quasi-experimental designs (see Table S.1 for a list of the programs grouped according to the types of services provided). In selecting these 20, we excluded some programs because their evaluations did not meet minimum standards for scientific rigor (e.g., a large enough sample size). Sixteen programs had the strongest evidence base in that they measure outcomes at the time of kindergarten entry or beyond. The remaining four programs are labeled as having a promising evidence base because, as of the last follow-up, many or all of the children were as young as age 2 or 3, so there is less information as to the effect of the program on outcomes when the children are closer to the age of school entry or once the children have entered school.

Scientific research has demonstrated that early childhood interventions can improve the lives of participating children and families.

We examined the following benefit domains: cognition and academic achievement, behavioral and emotional competencies, educational progression and attainment, child maltreatment, health, delinquency and crime, social welfare program use, and labor market success. For

Table S.1
Early Childhood Intervention Programs Included in Study

Home Visiting or Parent Education
Nurse-Family Partnership (NFP)
Developmentally Supportive Care: Newborn Individualized Developmental Care and Assessment Program (DSC/NIDCAP)*
Parents as Teachers*
Project CARE (Carolina Approach to Responsive Education)—no early childhood education
HIPPY (Home Instruction Program for Preschool Youngsters) USA
Reach Out and Read*
DARE to be You
Incredible Years

Home Visiting or Parent Education Combined with Early Childhood Education
Early Head Start*
Syracuse Family Development Research Program (FDRP)
Comprehensive Child Development Program (CCDP)
Infant Health and Development Program (IHDP)
Project CARE (Carolina Approach to Responsive Education)—with early childhood education
Carolina Abecedarian Project
Houston Parent-Child Development Center (PCDC)
Early Training Project (ETP)
High/Scope Perry Preschool Project
Chicago Child-Parent Centers (CPC)
Head Start

Early Childhood Education Only
Oklahoma Pre-K

NOTES: Programs marked with an asterisk are designated as having a *promising* evidence base because a substantial number of children were as young as age 2 or 3 at the time of the last follow-up. All other programs are designated as having a *strong* evidence base.

each of these domains (with the exception of social welfare program use), statistically significant benefits were found in at least two-thirds of the programs we reviewed that measured outcomes in that domain (see Tables S.2 and S.3). In some cases, the improved outcomes in these domains were demonstrated soon after the program ended, while in other cases the favorable effects were observed through adolescence and in the transition to adulthood. In one case, lasting benefits were measured 35 years after the intervention ended. Even though there is evidence that early benefits in terms of cognition or school achievement may eventually fade, the evidence indicates that there can be longer-lasting gains in educational progress and attainment, labor market outcomes, dependency, and pro-social behaviors. A few studies also indicate that the parents of participating children can also benefit from early intervention programs, particularly when they are specifically targeted by the intervention.

The magnitudes of the favorable effects can often be sizable. The size of the effects tend to be more modest for cognitive and behavioral measures, and, as noted, the favorable gains in these measures often shrink in size over time. The effects are more substantial and long-lasting for outcomes such as special education placement and grade retention, as well as some of the other outcomes in adolescence and adulthood. At the same time, it is important to note that the improved outcomes realized by participants in targeted early intervention programs are typically not large enough to fully compensate for the disadvantages those children face. Thus, while early intervention programs can improve outcomes over what they otherwise would have been, they typically do not fully close the gap between the disadvantaged children they serve and their more advantaged peers.


While the evidence from the programs we review is compelling, it is important to note that these programs do not represent all early childhood programs or even the subset of effective programs. Moreover, evidence of the effectiveness of a given program does not imply that all similar programs will have the same effect or even that


Table S.2
Measured Outcomes and Program Effects for Early Childhood Intervention Evaluations—Child Outcomes


Program	Domain					
	Cognitive/ Achievement	Behavioral/ Emotional	Educational	Child Maltreatment	Health, Accidents, and Injuries	Crime
Home Visiting or Parent Education						
NFP	Achievement test scores	Positive behaviors		Child abuse	Emergency room visits Hospital days	Arrests
DSC/ NIDCAP ^a	Mental indices	Developmental delay			Reflexes Weight gain Hospital stays	
Parents as Teachers ^a	Achievement test scores	Positive behaviors		Child maltreatment	Child health rating Injuries	
Project CARE (no ECE)						
HIPPY USA	Achievement test scores					
Reach Out and Read ^a	Vocabulary					
DARE to be You	Developmental level	Behavior problems				
Incredible Years		Behavior problems Social competence				
Home Visiting or Parent Education Combined with Early Childhood Education						
Early Head Start ^a	Achievement test scores	Positive behaviors			Child health rating	
Syracuse FDRP	IQ	Positive behaviors	Grades (girls) Attendance (girls) Teacher ratings (girls)			
CCDP						
IHDP	IQ Achievement test scores	Behavior problems				
Project CARE (with ECE)	IQ					
Abecedarian	IQ Achievement test scores		Special education Grade retention			

Table S.2—continued

Program	Domain					
	Cognitive/ Achievement	Behavioral/ Emotional	Educational	Child Maltreatment	Health, Accidents, and Injuries	Crime
Home Visiting or Parent Education Combined with Early Childhood Education (continued)						
Houston PCDC	IQ Achievement test scores	Behavior problems				
ETP	IQ Achievement test scores		Special education		Teen pregnancy	
Perry Preschool	IQ Achievement test scores		Special education		Teen pregnancy	Arrests
Chicago CPC	Achievement test scores	Social competence	Special education Grade retention	Child abuse		Delinquency
Head Start	IQ Achievement test scores (mixed)		Grade retention		Immunizations Other positive health behaviors	
Early Childhood Education Only						
Oklahoma Pre-K	Achievement test scores					

 Outcome measured and improvement in the listed indicator was statistically significant at the 0.05 level or better.

 Outcome measured but difference was not statistically significant at the 0.05 level or better.

 Outcome not measured.

SOURCE: Table 3.1.

NOTES: See Table S.1 for full program names and Table 2.3 for program implementation dates and sample sizes.

^aAt the last follow-up, these programs measured outcomes for children as young as age 2 or 3.

Table S.3
Measured Outcomes and Program Effects for Early Childhood Intervention Evaluations—Adult Outcomes

Program	Adult Outcome Domain			
	Educational Attainment	Employment and Earnings	Social Services Use	Crime
Home Visiting or Parent Education Combined with Early Childhood Education				
Abecedarian	Years of completed schooling Ever attended four-year college	Skilled employment		
ETP				
Perry Preschool	High school graduation	Employment Earnings Income	Use of social services	Arrests Arrests for violent crimes Time in prison/jail
Chicago CPC	High school graduation Highest grade completed			Arrests Arrests for violent crimes
Head Start	High school graduation (whites) College attendance (whites)			Booked or charged with crime (blacks)

- Outcome measured and improvement in the listed indicator was statistically significant at the 0.05 level or better.
- Outcome measured but difference was not statistically significant at the 0.05 level or better.
- Outcome not measured.

SOURCE: Table 3.2.

NOTES: See Table S.1 for full program names and Table 2.3 for program implementation dates and sample sizes.

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the same program implemented under different conditions will have the same effects. Ultimately, program effects may vary because of a variety of factors, including program design, the population served, and the local context in which a program is delivered.

A very limited evidence base points to several program features that may be associated with better outcomes for children: better-trained caregivers, smaller child-to-staff ratios, and greater intensity of services.

Based on experimental and quasi-experimental evaluations of program design features, as well as comparisons of effects across model programs, three features appear to be associated with more-effective interventions. First, programs with better-trained caregivers appear to be more effective. In the context of center-based programs, this may take the form of a lead teacher with a college degree as opposed to no degree. In the context of home visiting programs, researchers have found stronger effects when services are provided by a trained nurse as opposed to a paraprofessional or lay professional home visitor. Second, in the context of center-based programs, there is evidence to suggest that programs are more successful when they have smaller child-to-staff ratios. Third, there is some evidence that more-intensive programs are associated with better outcomes, but not enough to indicate the optimal number of program hours and how they might vary with child risk characteristics. One might expect that some minimum level of program hours is required for there to be any benefit but that, as hours increase, returns increase at a diminishing rate. It is noteworthy that the features associated with more-successful programs are costly. Thus, it appears that more money may need to be spent to obtain larger effects—at least up to a point.

The favorable effects of early childhood programs can translate into dollar benefits for the government, participants, and other members of society.

Early childhood interventions may range in cost from modest to a considerable financial investment. It is therefore reasonable to ask whether the costs can be justified in terms of the benefits associated with the programs. Many of those benefits can be translated into dollar figures. For example, if school outcomes improve, fewer resources may be spent on remedial education services in the form of repeated grades or special education classes. If improvements in school performance lead to higher educational attainment and subse-

quent economic success in adulthood, the government may benefit from higher tax revenues and reduced outlays for social welfare programs and the criminal justice system. As a result of improved economic outcomes, participants themselves benefit from higher lifetime incomes, while other members of society gain from reduced levels of delinquency and crime. It should be kept in mind, however, that some of the improved outcomes associated with early childhood interventions cannot be readily translated into dollar benefits. That is the case, for example, for cognitive development and behavioral improvements.

Economic analyses of several early childhood interventions demonstrate that effective programs can repay the initial investment with savings to government and benefits to society down the road.

One or more benefit-cost analyses have been conducted for seven of the 20 programs we studied. In addition, benefit-cost meta-analyses have been conducted for home visiting programs serving at-risk children and for early childhood education programs serving low-income three- and four-year-olds. These studies employ accepted methods for benefit-cost analysis based on the associated rigorous outcome evaluations. The results for these benefit-cost studies are summarized in Table S.4, with columns showing present-value costs and present-value benefits to society per child served, along with net benefits per child, and the benefit-cost ratio. In recognition of the differing follow-up periods (shown in the second column), the results are presented in four panels based on the age of participants at the time of the last follow-up: the elementary school years, the secondary school years, early adulthood, and middle adulthood.

Because of differences in methodology—such as which benefits were measured and monetized, the length of the follow-up period, and the projection of future benefits beyond the last age of follow-up—the benefit-cost results in Table S.4 are not strictly comparable across early childhood interventions. Thus, while these results cannot identify which programs have the “biggest bang for the buck,” they can demonstrate whether, in principle, early childhood intervention programs can generate benefits that outweigh the program costs.

One of the seven individual programs evaluated (the Comprehensive Child Development Program, or CCDP) was not shown to be effective, so it could not generate net economic benefits. A second program (the Infant Health and Development Program, or IHDP) had favorable effects as of the last follow-up at age 8, but the outcomes assessed could not be translated into dollar savings. For the remaining studies (including the meta-analyses), the estimates of net benefits per child served range from about \$1,400 per child to nearly \$240,000 per child (see Table S.4). Viewed another way, the returns to society for each dollar invested extend from \$1.26 to \$17.07. Positive net benefits were found for programs that required a large investment (over \$40,000 per child), as well as those that cost considerably less (under \$2,000 per child). Programs with per-child costs in the middle of this range also generated positive net benefits. The economic returns were favorable for programs that focused on home visiting or parent education, as well as those that combined those services with early childhood education.

The largest benefit-cost ratios were associated with programs with longer-term follow-up (i.e., moving farther down Table S.4), because they allowed measurement at older ages of outcomes such as educational attainment, delinquency and crime, earnings, and other outcomes that most readily translate into dollar benefits. Not only do the studies with measured improvements based on long-term follow-up demonstrate that the benefits from early interventions can be long-lasting, they also give more confidence that the savings the programs generate can be substantial. Programs with evaluations that have followed children only until school entry or a few years beyond typically do not measure those outcomes that are likely to be associated with the largest dollar benefits, although they may eventually generate large savings as well.

Because not all benefits from the interventions could be translated into dollar values, our benefit-cost estimates for effective programs are likely to be conservative. Moreover, such analyses do not incorporate some of the other benefits from effective early interventions. These could include improved labor market performance for

Table S.4
Benefit-Cost Results for Selected Early Childhood Intervention Programs

Program	Type	Age at Last Follow-Up	Program Costs per Child (\$)	Total Benefits to Society per Child (\$)	Net Benefits to Society per Child (\$)	Benefit-Cost Ratio
Follow-Up During Elementary School Years						
CCDP	Combo	5	37,388	-9	-37,397	—
HIPPY USA	HV/PE	6	1,681	3,032	1,351	1.80
IHDP	Combo	8	49,021	0	-49,021	—
Follow-Up During Secondary School Years						
NFP—higher-risk sample	HV/PE	15	7,271	41,419	34,148	5.70
NFP—lower-risk sample	HV/PE	15	7,271	9,151	1,880	1.26
NFP—full sample	HV/PE	15	9,118	26,298	17,180	2.88
HV for at-risk mothers and children (meta-analysis)	HV/PE	Varies	4,892	10,969	6,077	2.24

Table S.4—continued

Program	Type	Age at Last Follow-Up	Program Costs per Child (\$)	Total Benefits to Society per Child (\$)	Net Benefits to Society per Child (\$)	Benefit-Cost Ratio
Follow-Up to Early Adulthood						
Abecedarian	Combo	21	42,871	138,635	95,764	3.23
Chicago CPC	Combo	21	6,913	49,337	42,424	7.14
Perry Preschool (excluding intangible crime costs)	Combo	27	14,830	76,426	61,595	5.15
Perry Preschool (including intangible crime costs)	Combo	27	14,830	129,622	114,792	8.74
ECE for low-income three- and four-year-olds (meta-analysis)	Combo	Varies	6,681	15,742	9,061	2.36
Follow-Up to Middle Adulthood						
Perry Preschool	Combo	40	14,830	253,154	238,324	17.07

SOURCE: Table 4.4.

NOTES: See Table S.2 for full program names and Table 2.3 for program implementation dates and sample sizes. All dollar values are 2003 dollars per child and are the present value of amounts over time where future values are discounted to age 0 of the participating child, using a 3 percent annual real discount rate. Numbers may not sum due to rounding; n.a. = not available; Combo = HV/parent education combined with ECE; ECE = early childhood education; HV = home visiting; PE = parent education.

the parents of participating children, as well as stronger national economic competitiveness as a result of improvements in educational attainment of the future workforce.

The economic benefits of early childhood interventions are likely to be greater for programs that effectively serve targeted, disadvantaged children than for programs that serve lower-risk children.

There is some evidence that the economic returns from investing in early intervention programs are larger when programs are effectively targeted. In the Nurse-Family Partnership home visiting program, the effects were larger for a higher-risk sample of mothers (see Table S.4). Consequently, the return for each dollar invested was \$5.70 for the higher-risk population served but only \$1.26 for the lower-risk population. This finding indicates that it is not reasonable to expect the returns we report for specific programs serving specific disadvantaged populations to apply when the same program serves a different population. In particular, we would not expect to see the same returns in a universal program, e.g., a state-run preschool program open to all, although net benefits from such universal programs may still be positive and the associated benefit-cost ratios may still exceed 1.

It is important to acknowledge that our conclusions rest on a solid, but still limited, evidence base. And that evidence base can always be strengthened by further research and evaluation of early childhood intervention programs. Nevertheless, for decisionmakers considering investments in early childhood interventions, our findings indicate that a body of sound research exists that can guide resource allocation decisions. This evidence base sheds light on the types of programs that have been demonstrated to be effective, the features associated with effective programs, and the potential for returns to society that exceed the resources invested in program delivery. These proven results signal the future promise of investing early in the lives of disadvantaged children.