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2

Child Development

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2.1 Introduction

The best way to reduce poverty in America is to make people more productive. In this chapter, we review the available evidence about the ability of early childhood interventions to improve children's lifetime earnings prospects and, in turn, reduce their poverty over the long term. Early childhood appears to represent a particularly promising period for human capital investments, based on accumulated evidence regarding the lifelong implications of early brain development as well as the efficacy of early childhood interventions (Nelson 2000; Shonkoff and Phillips 2000; Karoly 2002; Carniero and Heckman 2003; Knudsen et al. 2006).

Most early childhood interventions seek to improve the quality of the learning and social interactions that children experience. We first review programs that attempt to enhance the skills of *parents* in hopes that parents will better teach, nurture, or in other ways provide for their children and in

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so doing enhance their children's well-being. We then discuss *child*-based interventions that seek to provide enriching experiences to children directly, as with intensive preschool education programs. Some early interventions target both the child and the parent at the same time, but most programs fit into either child- or parent-based categories.

Early childhood interventions also differ in the *types* of children's skills and behavior they ultimately seek to influence. Some programs aim to improve children's early cognitive, literacy, or numeracy skills. By building these skills and learning capacity more generally, these programs hope to promote later school success. Other programs focus on developing children's socioemotional behaviors by, for example, reducing antisocial and disruptive problem behaviors. If these behaviors develop in early childhood and persist into the later years, they may limit education and career prospects and result in costly delinquent and adult crime. Some programs attempt to promote both cognitive skills and positive behavior on the premise that they are interrelated and that improving multiple rather than single domains of development is most effective.

Our review of parenting intervention research suggests that it has proven difficult to change parenting practices in ways that lead to improvements in children's academic outcomes. A notable exception is the nurse home-visitation program developed by David Olds, in which high-risk, first-time mothers are visited repeatedly in their homes by nurses.

The evidence supporting the efficacy of high-quality, center-based early childhood education is stronger. Model demonstration programs such as Perry Preschool and Abecedarian have been shown to improve long-term school attainment and earnings; the Perry program appears to reduce crime and the risk of adult poverty as well.

An emerging body of rigorous research suggests that the larger-scale and less-expensive federal Head Start program may also generate long-term improvements in the life chances of participants, but the estimated effect sizes are smaller than those of the model programs. Rigorous evaluations of state pre-Kindergarten (pre-K) programs are also encouraging, although only very short-term program impacts are known at this point. Focusing solely on the magnitude of program effects, however, is misguided. For policy purposes, the goal is not to find the program that produces the biggest benefits but rather to find programs that generate the largest benefits relative to their costs. Programs that generate large benefits, but even larger costs, are unwise public expenditures. The corollary is also true—programs that produce only modest gains in children's outcomes can be worthwhile if their costs are sufficiently low.

All in all, we conclude that investing in selected early childhood interventions appears likely to be a very cost-effective way to reduce poverty over the long term and that current public investments in such programs appear to have helped in this regard. Prior research provides little guidance regarding

what form *incremental* investments should take—for example, whether additional funding should be focused on expanding Head Start, pre-K programs, or intensive home visitation programs. But we are confident that additional investments in well-implemented and proven program designs are likely to do a great deal of good, and compare quite favorably on a cost-effectiveness basis with alternative strategies for reducing poverty in America.

The remainder of this essay is organized as follows. In section 2.2, we describe how socioeconomic disadvantages in early childhood outcomes can increase long-term risks of poverty in adulthood. Section 2.3 describes the existing major federal early childhood programs, Head Start, as well as the universal state pre-K programs that have developed in recent years. Evaluation evidence on parenting programs is reviewed in section 2.4. In section 2.5, we discuss what is known about the ability of early childhood interventions to improve children's cognitive outcomes. Section 2.6 reviews the literature linking early childhood cognitive (and, to a lesser extent, socioemotional skills and behavior) outcomes to long-term earnings and adult poverty rates. Section 2.7 discusses other benefits to society that may result from these kinds of interventions, while section 2.8 summarizes our thoughts about the cost-effectiveness of additional investments in early childhood interventions.

2.2 Description of the Problem

Children cannot choose their parents. Although people disagree about how social policy should treat adults who have been unlucky or unwise, most would agree that there is something fundamentally unfair about holding children's life chances hostage to the circumstances of their parents. The reality, though, is that family background has a powerful influence on how U.S. children develop, beginning very early in their lives. Much of the early disparities in children's development can be traced back to their family experiences before they enter school.

The human brain grows and changes at an astonishingly rapid rate during the first few years of life (Shonkoff and Phillips 2000; Knudsen et al. 2006). The brain's unusual "plasticity" appears to make young children unusually responsive to environmental influences. Psychologists often refer to these early years as "sensitive" or even "critical" periods for a child's cognitive and socioemotional development (Nelson 2000). Neuroscience research has documented how complex cognitive and socioemotional capacities are built on earlier foundational skills, and such development is strongly shaped by interactions with the environment (Knudsen et al. 2006; Nelson 2000; National Scientific Council on the Developing Child 2007). Moreover, cognitive skills and socioemotional behaviors are closely connected with brain development, as early experiences literally become embedded in the architecture of infants' brains (LeDoux 2000).

The environments that children experience during their early years differ dramatically across socioeconomic lines. More highly educated parents are more likely to provide their children home learning environments that support academic success, for example, by providing rich language and literacy environments and engaging children in learning activities (Davis-Kean 2005; Raviv, Kessenich, and Morrison 2004). They also tend to use teaching strategies with their children that mimic formal instructional techniques, such as asking questions and offering feedback rather than issuing directives (Laosa 1983). Parents with more money are able to buy a larger range of goods and services for their families, such as prenatal health care, nutrition, and learning opportunities, both in the home and outside the home (Duncan and Brooks-Gunn 1997).

The inability to meet household and other basic expenses may cause some poor parents to feel frustrated, helpless, and depressed (Conger et al. 2002; McLoyd 1998). This distress may, in turn, lead to less-responsive and more harsh and punitive parenting. Taken together, the multiple disadvantages poor children face are considerable (Evans 2004; Magnuson and Votruba-Drzal 2009). Compared with kindergarteners from families in the bottom fifth of the socioeconomic distribution (measured by a combination of parental education, occupation, and income), children from the most advantaged fifth of all families are four times more likely to have a computer in the home, have three times as many books, are read to more often, watch far less television, and are more likely to visit museums or libraries (Lee and Burkham 2002).

These differences in early environments contribute to large gaps in children's early academic skills. Numerous studies have compared the outcomes of young children from different socioeconomic backgrounds and find large differences in cognitive skills even as young as three or four years old (Duncan and Brooks-Gunn 1997; Lee and Burkham 2002). For example, one study found that three-year-olds in families of low socioeconomic status had half the vocabulary of their more affluent peers, which, in turn, could be linked to the lower quality and quantity of parental speech (Hart and Risley 1995). Research has also documented a number of differences in the socioemotional skills of poor and nonpoor children—as young as seventeen months in the case of physical aggression (Cunha et al. 2005; Tremblay et al. 2004).

These early gaps in cognitive skills and behaviors tend to persist through the school years and into later life, in part because of the possibility that "learning begets learning"—that mastery by young children of a range of cognitive and behavioral competencies may improve their ability to learn when they are older (Carniero and Heckman 2003; Cunha et al. 2005). Researchers have learned that rudimentary reading and, especially, mathematics skills at kindergarten entry strongly predict later school achievement (Duncan et al. 2007). Although the correspondence is far from perfect, chil-

dren scoring poorly on academic assessments before entering kindergarten are more likely to become teen parents, engage in crime, and be unemployed as adults (Rouse, Brooks-Gunn, and McLanahan, forthcoming). Moreover, preschool problem behaviors like physical aggression are predictive of criminal behavior later in life (Reiss and Roth 2003).

2.3 Background on Existing Early Childhood Programs

Nationwide, about 57 percent of three- and four-year-old children attend some form of early education program. Rates of participation are higher among older children and more advantaged children. About 69 percent of four-year-olds are in such programs, compared with just 43 percent of three-year-olds. Preschool attendance is 13 percentage points lower among poor children than nonpoor children. Finally, preschool attendance also differs by racial and ethnic group. Preschool attendance is higher among black (66 percent) than among white (59 percent) or Hispanic children (43 percent) (U.S. Department of Education, National Center for Education Statistics 2007).

The importance of children's preschool years is not reflected well in federal government budget priorities. The United States currently spends around $7,900 on elementary and secondary public schooling for each school-aged child (five to seventeen) in the United States, around $588 billion in total (see U.S. Department of Education 2005).[1] Most of this funding is collected and disbursed by states and localities. (All dollar figures reported in the paper, unless otherwise noted, are in 2007 dollars.) But disparities in family background generate large differences in children's development well before school and even before children are old enough to participate in the federal government's preschool program for disadvantaged children, Head Start. Per-student spending by the federal government on Head Start is similar to that in public elementary and secondary schools, but the program's annual budget of nearly $8 billion is enough to serve only about 900,000 children, not even half of all income-eligible three- and four-year-olds (U.S. Department of Health and Human Services 2005). Although the federal and state government spending on child care subsidies exceeds its spending on Head Start, the subsidies are designed to support parental employment rather than improve children's development (Magnuson and Shager, forthcoming).

Head Start began in 1965, amidst the War on Poverty, as a summer program for children around age three to five; by 1970, a majority of participants attended year-round. Widely perceived as a schooling program, early childhood education is only one of Head Start's six service components

1. The U.S. Statistical Abstract (2007) reports average per-pupil spending for children in elementary and secondary schooling of around $8,200 in 2004. These data also suggest that around 89 percent of all school-aged children are enrolled in public schools. So public school spending per school-aged child equals ($.89 \times \$8{,}200$) $\approx$ $7,200. The figure reported in the text converts this from 2004 to 2007 dollars.

and accounts for less than half (about 40 percent) of the program's budget (Currie and Neidell 2007). Other program elements include parent involvement, social services, nutrition, and children's physical and mental health screening and services.

Head Start involves relatively low pupil-teacher ratios of around 6.5 to 1 (see table 2.1) although only around one-third of teachers hold a college degree, and average salaries for teachers in the program tend to be around one-half those found among teachers in the public K-12 system. This bundle of Head Start services might affect schooling outcomes in several ways. In addition to the direct effects on cognitive academic skills from early childhood education, nutrition, and health services, Head Start may indirectly affect children's schooling by influencing parents' life course or parenting practices.

More recently, states and local school districts have initiated their own pre-Kindergarten programs. Pre-K is usually (but not always) a part-day educational program located within public schools. Typically, some additional services are offered, including meals and transportation, but few programs provide a full array of comprehensive services such as health screenings (Ripple et al. 1999; Schulman, Blank, and Ewen 1999). States also directly fund, and school districts may subcontract with, other programs to provide early education services. In 2007, thirty-eight states funded prekindergarten programs, and spending reached $3.9 billion. Despite large increases in funding in recent years, these programs serve just a fraction of children—22 percent of four-year-olds in 2007.

Table 2.1 summarizes the characteristics of a selected set of prekindergarten programs operating in five states (Michigan, New Jersey, Oklahoma, South Carolina, and West Virginia) that have been subject to evaluation (described in further detail in the following). The average spending level per child across these five state programs is about $6,100. (All costs reported in table 2.1 and in the paper are in 2007 dollars and have been discounted back to age zero using a 3 percent discount rate to facilitate comparison of costs that target children of different ages.) It should be noted, however, that spending levels vary considerably across the states and are difficult to estimate precisely.[2]

2.4 Parenting Interventions

It is useful to distinguish two types of parenting programs—parenting education and parenting management training. Parenting education programs seek to boost parents' general knowledge about parenting and child

2. Because these state pre-K programs tend to operate within the public school system, there may be some question about whether the accounting of fixed costs is comparable with these state programs compared to either the model programs or Head Start.

Table 2.1 **Alternative early childhood education programs—program characteristics**

	Abecedarian	Perry Preschool	Head Start	State universal pre-K
Ages covered	0–5	3 and 4	3–4	4
Quantity (coverage) per year	7:30–5:30 each day, five days a week, fifty weeks a year	2.5 hours a day, five days a week, October–May	Half day or full day, academic year	Half day (MI, SC), full day (NJ), varied (OK, WV)
Teacher qualifications	Mostly high school for teachers of young children, mostly BA for teachers of 3- to five-year-olds[a]	≥BA plus education certificate	31% BA, 27% AA, 27% early-education teaching certificate	BA (MI), BA with training in early education (NJ, OK, SC), BA or AA with training in early education (WV)
Teacher salaries	Comparable to public schools	Comparable to public schools (plus 10%)	~1/2 public school	
Pupil–teacher ratios	3:1 infants and toddlers, 6:1 older children	5 or 6:1	6.5:1 (5.4:1 including volunteers)	8:1 (MI), 15:2 (NJ), 10:1 (OK, SC, WV)
Number of students served	112 in model program	45	905,000	24,729 (MI), 21,286 (NJ), 30,180 (OK), 17,821 (SC), 6,541 (WV)
Program population	Low-income African American (Chapel Hill, NC)	Low-income, low-IQ African American (Ypsilanti, MI)	Mostly low-income (national)	
Curricular emphasis	Communication skills plus other motor, social, cognitive skills	Logic, math, literacy, creativity, social	Varied	
Nonacademic services	Medical and nutrition	Weekly home visits with parents	Dental, other health, nutrition	
Total cost per year	$19,080	$8,700	$9,000[c]	$5,031 (MI), $10,361 (NJ), $6,167 (OK), $3,219 (SC), $6,829 (WV)
Total cost per student (present value at age 0, 3% discount rate)[b]	$90,000	$15,700	$8,000	$6,100

Notes: For Head Start, we assume one year of program participation per child as in Garces, Thomas, and Currie (2002). Abecedarian program description and impacts from Ramey and Campbell (1984), Campbell and Ramey (1994), and Campbell et al. (2002); test score impacts for reading and math achievement reported for ages four and five in our table were actually measured for Abecedarian at forty-two and fifty-four months. For Perry Preschool, the age-three results are actually for "end of first preschool year" and age-four test results are for "end of second preschool year," which should roughly correspond to ages three and four (Schweinhart et al. 2005). Results from Head Start from Hart and Schumacher (2005), Zill et al. (2003), and Puma et al. (2005). Results for the study of five state pre-K programs are from Wong et al. (2008), who report a cost of $6,300 per year, which we discount back to age 0 using a 3% discount rate.

[a]From personal communication September 16, 2005, between Stephen Robblee and Frances Campbell, based on her recollections rather than actual program records on teacher qualifications.

[b]Present value of total cost per student at age 0, calculated using a 3% discount rate.

[c]This figure includes federal, state, and local grants and subsidies, as calculated by Ludwig and Phillips (2007).

development. Often, information is provided in conjunction with instrumental and emotional support and can take a variety of formats including, but not limited to, short instructional workshops provided by educators or community centers, parent discussion groups, and home visitation programs. Home visitation programs for new mothers and parent-teacher programs are perhaps the most widespread and familiar.

Management training programs are designed for parents of children with problem behavior, usually conduct disorders. Clinical therapists teach parents concrete behavioral strategies designed to improve their children's behavior. Typically, parents are taught how to reinforce their child's positive behavior and punish negative behavior appropriately.

Two theoretical assertions undergird most parenting interventions. First, parental behavior has a strong influence on children's healthy development. Second, positive parenting can be learned. Both of these assertions are controversial. That parents influence children is beyond debate; however, the relative contribution of environmental influences (including parental) and genetic influences to development remains a point of contention (Collins et al. 2000; Scarr 1992).

Even if pathways of parental influence are identified correctly, and children benefit from changes in parent-child interaction patterns, or in the quality of their home learning environments, the success of parent-based interventions is premised on the ability of interventions to improve parents' behavior in cost-effective ways. The research reviewed here suggests that affecting change in parents through parenting programs is indeed possible although more difficult than often thought.

Parenting education and training programs make demands on the time and effort of parents—demands that, for some parents, appear too high. Work conflicts, stress, and lack of motivation result in nonparticipation rates as high as 50 percent in some programs (Prinz and Miller 1994; Webster-Stratton and Spitzer 1996). In addition, parental engagement appears to be a function of parents' perceptions of how well their needs are met by a particular program (Brooks-Gunn, Berlin, and Fuligni 2000). Furthermore, even when parents do participate in the program, they are not all equally engaged or capable of implementing and maintaining the strategies they are taught. Unfortunately, parents of children most at risk of academic or behavior problems—single and low-income parents—appear least able to participate in programs and maintain changes in parenting behavior (Prinz and Miller 1994; Webster-Stratton and Hammond 1990).

Parenting education for new parents is increasingly being provided through home visitation. Most families adapt successfully to the challenges of preparing for a newborn's birth and caring for a young baby. Nevertheless, this transition can be a difficult time, particularly for first-time parents who may be socially isolated or experiencing severe adversity. Under such circumstances, some home visiting has proven to be an effective way of

providing families with support and education, resulting in positive impacts on a variety of outcomes.

The successes of a few intensive parenting intervention programs are noteworthy. Most famously, the experimental evaluation of an intensive nurse home visitation program by Olds et al. (1999) in Elmira, New York, found that the program had lasting effects on important indicators of disadvantaged children's well-being. In particular, a fifteen-year follow-up study found that unmarried mothers assigned to the program group had fewer verified reports of child abuse and neglect than mothers assigned to the control group (table 2.2). Furthermore, their children had fewer emergency health-related visits and reported arrests. It is worth noting that the program had early effects on children's cognitive development, but these effects faded over time (table 2.2).

Olds and colleagues have undertaken replication studies in two sites—Denver and Memphis. Results from the Denver trial indicated that nurse home visitors were more effective than paraprofessionals who did not have any postsecondary education in a helping profession. One explanation for this finding is that mothers are more likely to perceive nurses as having legitimacy and authority when it comes to issues related to their infants' health and development than visitors with other backgrounds (Olds, Sadler, and Kitzman 2007). Results from a nine-year follow-up study of the Memphis program indicate positive, but more limited, impacts on parenting and child outcomes (Olds, Sadler, and Kitzman 2007). Evidence from additional follow-up studies in Memphis and Denver will provide important information about the likelihood of replicating the success of the Elmira program.

Involving an average of nine visits by registered nurses during the pregnancy and twenty-three visits during the first two years of the child's life, and costing approximately $10,300, Olds's program was clearly at the intensive end of parenting programs.[3] Yet its benefits exceed its costs. Aos et al. (2004) estimate the total value of gross benefits to be nearly $30,000, most of which comes from reduced crime on the part of the child together with reductions in child abuse on the part of the parent.

It is crucial to ask whether the positive child impacts from intensive programs such as Olds's would carry over to more-practical, less-intensive programs. As suggested by Gomby, Culross, and Behrman (1999), the answer appears to be no. Evaluations of other home visiting models have shown less consistent positive impacts. One example is Healthy Families America (HFA), a program to prevent child maltreatment that was modeled after the Hawaii Healthy Start Program, which was developed in the early 1990s and implemented statewide in several states. The core of this program involved

3. This figure represents the cost of the Denver nurses program, as reported by Aos et al. (2004). The Elmira program, as reported by Olds and Kitzman (1993), reported somewhat lower costs of $8,200.

Table 2.2 **Parenting intervention programs—program description and impacts**

	Nurse family partnership, full sample (Elmira)	Nurse family partnership, at risk sample (Elmira)	Early Head Start home visiting	Incredible Years parent training
	Prenatal home visiting program	Prenatal home visiting program	Home visiting program	Parent management training
		Program description		
Year of enrollment in program	1978–1980	1978–1980	1996–1998	1995–1997
Child age	Prenatal to age two	Prenatal to age two	Prenatal to age three	Four–eight years old
Program length	Prenatal to age two	Prenatal to age two	Prenatal to age three	Twenty-two–twenty-four weeks
Average dosage	Eight prenatal visits, twenty-three postnatal visits	Eight prenatal visits, twenty-three postnatal visits	90% received one visit; 30% received weekly visits throughout the program	On average, twenty-one two-hour weekly sessions of ten–twelve parents and two therapists
Inclusion criteria	All mothers in Elmira, NY	Low SES, teen mothers	Low-income, poor, pregnant women and mothers	Clinical levels of behavior problems lasting for six months
Providers	Nurses	Nurses	58% had a college degree; 12% had a two-year degree; training was "extensive"	Trained therapists, masters or PhD, and at least five years of clinical experience
No. of families assigned to receive services[a]	116	38	448	31
Evaluation method	Experimental	Experimental	Experimental	Experimental
		Impacts at program completion		
IQ (Cattell Developmental Quotient)	0.19 SD	0.52 SD		
Avoidance of restriction and punishment	0.25 SD	0.58 SD		
CPS abuse	0.14 SD (ns)	0.35 SD		
No. of emergency room visits	0.29 SD	0.26 SD (ns)		
Parenting stress			0.14 SD	
Mother negative parenting			HOME hostility scale: 0.06 SD (ns)	0.81 SD

Mother positive parenting			HOME warmth scale: –0.01 SD (ns)	0.51 SD
Receptive vocabulary			PPVT: 0.09 SD (ns)	
Problem behavior, age three			Aggression: 0.08 sd	Conduct problems: 0.63 SD (father report), 0.66 SD (mother report), 0.35 SD (teacher report)
		Long-term follow-up		
Child IQ (Stanford Binet), age four	0.19 SD (ns)	0.21 SD (ns)		
HOME Inventory Total Scale, age four	0.00 SD (ns)	0.33 SD (ns)		
HOME Stimulation of Language Skills, age four	0.12 SD (ns)	0.65 SD		
Avoidance of punishment, age four	–0.38 SD	–0.28 SD (ns)		
Log incidence of the no. of emergency room visits, age twenty-five–fifty months	0.36 SD	0.43 SD		
Log incidence of substantiated abuse and neglect, age fifteen	0.34 SD	0.54 SD		
Log incidence of child arrest, age fifteen	0.37 SD	0.45 SD		
Log incidence of alcohol and drug impairment, age fifteen (parent report)	0.05 SD (ns)	0.36 SD		

Notes: ns = not statistically significant (results otherwise are all statistically significant at conventional 5% cutoff). SD = standard deviation. CPS = Child Protective Services; PPVT = Peabody Picture Vocabulary Test. All effects are presented so that positive effects represent better outcomes. All estimates reflect intent to treat calculations based on experimental data, with the exception of Early Head Start, in which estimates are provided for those who received at least one home visit (see footnote 4 for more details). Effects sizes for the nurse family partnership program for continuous variables have been calculated by dividing the program treatment impact by the control group standard deviation, which were generously provided by David Olds (see also Olds et al. 1986; Olds, Henderson, and Kitzman 1994). Effect sizes for log incidence variables are the authors' calculation of data provided in Olds et al. (1997) and Olds et al. (1998). These are calculated based on *p*-value for statistical significance of a covariated adjusted analysis, and are likely to be conservative. Effect sizes for Early Head Start are taken from Love et al. (2005); effect sizes for the Incredible Years parent training are taken from Webster-Stratton, Reid, and Hammond (2004).

[a]The number of families receiving services in Early Head Start is the number who received services and who participated in the follow-up parent interview.

identifying parents at high risk of abusing or neglecting their children through broad-based screening and then offering voluntary home visiting services delivered by paraprofessionals for a period of three to five years. Home visitors were expected to provide a range of services including service referrals, modeling problem-solving skills, and parent education.

Randomized trials have yielded mixed findings. One study conducted in Hawaii yielded disappointing results, with as many negative impacts as positive effects on key family process outcomes (Duggan et al. 2004). A study in New York showed some promising reductions in harsh parenting and maltreatment during the first year of the program, but these effects had faded by the second year of the program (DuMont et al. 2008).

The Early Head Start evaluation study also provides some recent evidence on the effectiveness of home-visiting programs for low-income families with children (Love et al. 2002; see table 2.2). Early Head Start is designed to provide educational and other health and social services to disadvantaged children between birth and age three. The program includes several modes of program delivery including both center-based early education programs as well as home visiting programs. Seven sites in the larger evaluation provided programming primarily through weekly home visits and biweekly parent-child socialization activities. The programs also provided case management and health screenings. The evaluation assessed the program's effects on several aspects of children's development and family life when the children were aged two and three. Of the families enrolled in home-visiting programs, 90 percent participated for at least one visit, and although most of these had more than one visit, only 30 percent of families participated in weekly home visits for all three years (table 2.2). Rates of home-visiting in the control group were significantly lower, but not insubstantial, with close to one-third reporting that they received a home visit during the first three years of their child's life.[4]

The evaluation study found a few small effects of the program on measures of participants' parenting. For example, mothers reported lower levels of parenting stress (table 2.2), with an effect size of around 0.14 of a standard deviation.[5] With a few exceptions, experimental-control differences in parents' mental health, children's home learning environments, and harsh parenting favored the experimental group, but almost none of these differences was statistically significant at conventional levels (table 2.2).

With so few detectable effects on parenting, one might not expect large

4. The evaluation study reports the effects of home-visiting programs for those families who participated in Early Head Start Services, rather than the effect of the program on those who were offered the services (Love et al. 2002). Assuming that the programs would not benefit or harm the nonparticipating families, with 10 percent of families not participating, the program's impacts are likely to be 10 percent lower than reported.

5. Standard deviation units are a common way of expressing effect sizes. For comparison, the standard deviation is 15 to 16 points for a typical IQ test and 100 points for the SAT.

positive effects on children. Indeed, the reported program impacts on children's cognitive development and socioemotional development at age three were positive but not statistically significant. The effect of the program on participating children's cognitive development translated into effect sizes of about 0.10. Effect sizes for program impacts on measures of children's socioemotional development ranged from 0.02 to 0.19 of a standard deviation, with most below 0.10 (table 2.2).

Taken together, evaluations of many forms of parenting education programs support the conclusion that most programs for parents of young children can result in modest improvements in some aspects of parenting; however, such modest changes yield few and usually insignificant changes in children's developmental outcomes. The failure of these programs to result in improvements in children's outcomes may be due either to their failure to produce large improvements in parenting, or to the lack of links between the types of parenting behaviors targeted and the types of outcomes considered. At the same time, the evidence suggests that a particular parenting program model—an intensive home visiting program staffed by nurses and serving vulnerable first-time mothers—can be effective at improving children's developmental outcomes in meaningful ways.

In contrast to the largely ineffective parent *education* programs, parent *management training* programs appear to be a more promising strategy, at least for improving the behavior of children with serious behavior problems. These programs were developed in response to research showing that maladaptive parenting and parent-child interaction patterns are common in families of severely conduct-disordered children (Kazdin 1997; Kazdin and Weisz 1998; Taylor and Biglan 1998). Often described as coercive, this type of parenting involves harsh but inconsistent punishment for children's problem behavior and a failure to reward positive child behavior (Dumas 1989; Patterson, DeBaryshe, and Ramsey 1989).

Parent management training programs teach parents to respond more appropriately to their children's behavior. Specifically, parents are taught to reward and attend to their children's positive behavior but to ignore or punish their child's problem behavior appropriately and consistently. Treatment sessions provide parents with the opportunity to observe appropriate parenting skills as well as practice and refine their own use of these skills. Families involved in these types of programs include, but are not limited to, low-income families.

A successful example of parenting management training is Webster-Stratton's group discussion videotape program, now known as the Incredible Years program (Webster-Stratton, Kolpacoff, and Hollinsworth 1988). The program has been replicated and evaluated in several settings and has also been adapted for teachers in school settings. A recent evaluation of the program randomly assigned families to one of five variations of the treatment (combinations of parent training, child training, and teacher training) or a

waiting list control group. Of interest in our discussion is the comparison of families in which parents were engaged in training program to a control group that received no training. The parents met weekly in groups of ten to twelve parents and two therapists for two-hour sessions. Over the course of twenty-two to twenty-four weeks, parents watched seventeen videotaped programs on parenting and interpersonal skills. The parent training, as well as other treatment conditions, had large positive effects on measures of negative and positive parenting as well as parent and teacher reports of children's behavior (table 2, Webster-Stratton, Reid, and Hammond 2004). Studies have suggested that these effects are maintained at least a year after program completion (Webster-Stratton 1990). Foster, Olchowski, and Webster-Stratton (2008) provide estimates of program costs but not benefits.

One reason that parenting interventions may be more successful in reducing severe problem behavior than in promoting academic achievement is that parents of children with severe behavior problems may feel they are "under siege" and, thus, be more engaged in parenting programs than parents of children with less-severe problems (Webster-Stratton and Spitzer 1996). Most parents who participated in these studies were referred for treatment or were seeking help for their children's behavior. For example, to be admitted to Webster-Stratton's parenting program, parents had to be referred to the clinic for children's "excessive noncompliance, aggression, and oppositional behavior for more than six months" (Webster-Stratton 1990, 145).

More generally, reviews of evaluations of parent management training programs show that these programs can lead to meaningful reductions in children's problem behaviors. One review suggests that approximately two-thirds of the children exhibit clinically significant improvements in behavior at the completion of the program (Taylor and Biglan 1998). Another review suggests that the average effect size was 0.87 of a standard deviation—a large effect (Durlak, Fuhrman, and Lampman 1991). However it is important to caution that not all of the studies included in these reviews used random assignment, sample sizes were typically quite small, and attrition rates, if reported, were high. Perhaps most worrisome is that when families dropped out of treatment, they were not included in the follow-up study, suggesting that the evaluation findings reflect the effect of completing the program. Few studies have follow-up data beyond six months after program treatment, and, therefore, the long-term benefit of parenting programs is still questionable (Greenberg, Domitrovich, and Bumbarger 2000).

2.5 Early Education Programs

An alternative to attempting to change parents' behavior is to provide children with high-quality center-based early childhood educational programs. This approach seeks to compensate for disadvantaging family backgrounds or poor parenting with time spent in a developmentally appropriate enrich-

ing and stimulating classroom setting. A growing body of research shows that a variety of different early childhood educational programs, ranging from very intensive model programs like Perry Preschool and Abecedarian, to larger-scale programs like Head Start and pre-K programs, are capable of generating meaningful gains in learning and perhaps longer-term life outcomes for low-income children. Moreover, the benefits generated by these programs often seem large enough to eclipse program costs.

The ability of intensive model programs to improve the life chances of disadvantaged children can be illustrated by the well-known Perry Preschool intervention. Perry provided one or two years of part-day educational services and home visits to a sample of low-income, low-IQ African American children aged three and four in Ypsilanti, Michigan, during the 1960s. Perry Preschool hired highly educated teachers (at least a BA) and was implemented as a randomized experiment (table 2.1). The great advantage of random assignment to the Perry program or the control condition is that differences in outcomes for treatments and controls can be attributed to the effects of the program with a high degree of confidence.

When the children entered school, those who had participated in the Perry program scored higher on IQ tests than those who had not—as shown in table 2.3, an impressive nine-tenths of a standard deviation higher (Schweinhart et al. 2005). These IQ effects, however, disappeared by third grade. Nevertheless, the program produced lasting effects through age forty on employment rates (76 percent for the program participation group, compared with 62 percent among the control group) and earnings (median annual earnings of $25,000 compared with $18,000 in 2007 dollars, not discounted back to age zero) and substantially reduced the chances that participants had been arrested (29 percent of the participating children reached age forty without an arrest as compared with 17 percent of the control group).

The Abecedarian program, which began in 1972 and served a sample of low-income, mostly African American families from Chapel Hill, North Carolina, was even more intensive than Perry (see table 2.1). Mothers and children assigned to the Abecedarian "treatment" received year-round, full-time center-based care for five years, starting with the child's first year of life. The Abecedarian preschool program included transportation, individualized educational activities that changed as the children aged, and low child-teacher ratios (3:1 for the youngest children and up to 6:1 for older children). Abecedarian teachers followed a curriculum that focused on language development and explained to teachers the importance of each task as well as how to teach it. High-quality health care, additional social services, and nutritional supplements were also provided to participating families (Ramey and Campbell 1979; Campbell et al. 2002; Barnett and Masse 2007).

Abecedarian was a high-cost, high-quality program run by researchers. It cost about $19,080 a year for each of a child's first five years and produced dramatic effects on the future life outcomes of its participants (Currie 2001).

Table 2.3 **Early childhood education programs—program impacts**

	Abecedarian	Perry Preschool	Head Start	State pre-K
			Short-term impacts	
Evaluation method	Experimental	Experimental	Experimental	
IQ scores, age three	1.22 SD	0.88 SD		
Reading/verbal, age three	0.69 SD	0.74 SD	0.35 SD	
Math/quant, age three	0.71 SD		0.21 SD (ns)	
Aggressive behavior, age three			–.10 SD (ns)	
Behavior problems, age three			–0.19 SD	
IQ scores, age four	0.93 SD	0.87 SD		
Reading/verbal, age four	0.68 SD	0.91 SD	0.13 SD	PPVT: –.16 SD (MI, NS); .36 SD (NJ); .29 SD (OK); .05 SD (SC, NS); .14 SD (WV, NS). Print awareness: .96 SD (MI); .50 SD (NJ); .43 SD (OK, NS); .79 SD (SC); .83 SD (WV, NS)
Math/quantitative, age four	0.57 SD		0.16 SD (ns)	.47 SD (MI); .23 SD (NJ); .35 SD (OK, NS); .11 SD (WV, NS)
Aggressive behavior, age four			–.04 SD (ns)	
Behavior problems, age four			–.01 SD (ns)	
IQ scores				
Age five	~0.66 SD			
Age six		0.32 SD		
Age twelve	0.50 SD			

			Long-term impacts
Evaluation method	Experimental	Experimental	Non-experimental
Age outcomes measured	Twenty-one	Forty	Twenty-three
High school graduation (%)	70 vs. 67 (ns)	77 vs. 60	86 vs. 65 (whites)
College entry (%)	36 vs. 14		
Ever arrested (%)		71 vs. 83	
Arrested 5× or more (%)		36 vs. 55	
Employment rate (%)	26 vs. 45	76 vs. 62	
Teen parent (%)	18 vs. 39		
Marijuana use (%)		48 vs. 71 (males)	
IQ scores	0.38 SD		

Notes: ns = not statistically significant (results otherwise are all statistically significant at conventional 5 percent cutoff). SD = standard deviation. Results for Head Start short-term impacts are estimates from Ludwig and Phillips (2007) for the effects of Head Start participation per se, calculated based on data from the recent randomized Head Start experimental evaluation (U.S. Department of Health and Human Services 2005). The age-four reading effect is the average of the treatment on the treated (TOT) estimates for the Peabody Picture Vocabulary Test (PPVT) for three- and four-year-olds. The effects of Head Start participation presented in the table equal the effects of assignment to the Head Start experimental treatment group on children's outcomes divided by the effects of treatment-group assignment on the probability of participating in Head Start. Results for Head Start's long-term impacts come from Garces, Thomas, and Currie (2002), and show the mean high school completion rate among all Head Start children in their sample versus this mean added to the estimated Head Start effect for whites (the white mean is not reported separately in the paper). Note that Ludwig and Miller (2007) find complementary evidence suggesting that Head Start's impacts on schooling attainment is large for blacks as well as whites. See also Schweinhart, Barnes, and Weikart (1993).

Early IQ scores of Abecedarian and control-group children averaged about 1 standard deviation below the mean, as might be expected for children from very economically disadvantaged backgrounds. By the time the Abecedarian children reached age five, however, their IQ scores were close to the national average and higher than scores of children who did not participate (table 2.3). Similarly large effects were observed for achievement on verbal and quantitative tests (Ramey and Campbell 1984). Nearly fifteen years later, the program's effect on IQ scores at age twenty-one was smaller than at age five (around 0.38 standard deviation) but still impressive. This problem of partial "fade out" of the effects of early education, which has been widely documented for a variety of different programs, suggests that sustaining the effects of early interventions on the child's ability to learn may require high-quality follow-up learning environments. We return to this point in the following.

Although early IQ effects faded somewhat over time with Abecedarian, other long-term effects were dramatic and arguably just as important for reducing poverty. For example, children who received the Abecedarian program entered college at 2.5 times the rate of the control group. The Abecedarian intervention also reduced rates of teen parenthood and marijuana use by nearly half. Smoking rates of Abecedarian participants were about 30 percent lower than those of the control group (Campbell et al. 2002). Although employment rates were not statistically different between the Abecedarian and control groups (64 percent compared with 50 percent), children who had participated in the program were about two-thirds more likely to be working in a skilled job (67 percent compared with 41 percent).[6]

Abecedarian's impacts on criminal behavior were not statistically significant, although the point estimates suggest lower rates of offending among the treatment than control-group children. Given the small size of the program it is difficult to draw any confident conclusions about Abecedarian's impacts on crime, which is particularly unfortunate for comparing benefit-cost ratios across programs because crime effects account for up to 70 percent of the dollar value of the benefits from the Perry Preschool program (Belfield et al. 2006).

Encouraging evidence on existing publicly funded early education programs illustrate what can be achieved for large numbers of children in programs of more variable quality than Perry or Abecedarian. A recent random-assignment experimental evaluation of Head Start found positive short-term effects of program participation on elementary prereading and prewriting for three- and four-year olds equal to about 0.3 and 0.2

6. In addition, criminal involvement was less common for treatments than controls (14 percent vs. 18 percent for misdemeanor convictions, and 8 percent vs. 12 percent for felony convictions) although the absolute numbers of those arrested in the two Abecedarian groups were small enough that it is impossible to prove statistically that this particular difference did not result from chance.

of a standard deviation, respectively, but not on advanced skills in these two outcome domains (table 2.3).[7] Head Start participation also increased parent-reported literacy skills of children by around 0.45 of a standard deviation. Statistically significant effects on other outcome domains were typically concentrated among three-year-olds, with effect sizes of 0.15 for vocabulary and 0.20 for problem behaviors. Effects on math skills were positive but not statistically significant. However, if one calculates Head Start impacts pooling together the three- and four-year-olds in the experiment, rather than showing results only separately for each age group, the increased statistical power leads to statistically significant program impacts on math and almost all of the main cognitive skill outcomes in the report (Ludwig and Phillips 2007).

As for behavior and socioemotional outcomes, the Head Start experimental evaluation finds that three-year-olds assigned to the experimental rather than treatment group have lower scores on the total problem behavior scale and the hyperactive behavior scale (effect sizes from attending Head Start equal to .19 and .26, respectively), with most of the other measures in the direction of better socioemotional outcomes for treatment group children relative to controls, but not statistically significant. Among four-year-olds, none of the estimated Head Start effects on socioemotional outcomes was statistically significant.

For policy purposes, the crucial question is whether these early improvements from Head Start attendance translate into better adjustment in adolescence and a successful transition into adulthood. Nonexperimental studies of children who participated in Head Start several decades ago suggest lasting effects on schooling attainment and perhaps criminal activity, although test score effects appear to fade out over time (Currie and Thomas 1995; Garces, Thomas, and Currie 2002; Ludwig and Miller 2007; Deming 2009).

Of course, it is possible that the long-term effects of Head Start on more recent cohorts of children may differ from those for previous cohorts of

7. See Puma et al. (2005). Note that the point estimates we report in the text are larger than those in the Puma report, which presents the difference in average outcomes for all children assigned to the treatment group with all children assigned to the control group, known in the program evaluation literature as the "intent to treat" (ITT) effect. But not all of the four-year-old children assigned to the experimental group participated in Head Start (the figure is around 84 percent), while some four-year-olds (18 percent) assigned to the control group enrolled in the program. If we divide the ITT effect by the difference between the treatment and control groups in Head Start participation (66 percent), the implied effect of Head Start participation on participants is around 1.5 times as large as the ITT effects presented in Puma et al. For a discussion of this methodology, see Bloom (1984). If we define the "treatment" more broadly as participation in any center-based care, the effects of Head Start participation may be up to 2.5 times as large as the ITT impacts reported by Puma et al. because more than 96 percent of the treatment group receives some sort of center-based care in the experiment but so does about 55 percent of the control group (see exhibits 3.2 and 3.3 by Puma et al. 2005). For more on our calculations, see Ludwig and Phillips (2007).

program participants because of changes over time in program quality or the quality of the environments experienced by children who do not attend Head Start. But the short-term test score impacts that have been estimated for recent cohorts of Head Start participants in the randomized experiment described in the preceding appear to be similar to those found by researchers among earlier cohorts of children. So there is a reason for cautious optimism that Head Start might improve the long-term outcomes for recent waves of program participants, even though this cannot be directly tested for many years (see Ludwig and Phillips [2007] for additional discussion).

Wong et al. (2008) examined the effects of newer state-initiated pre-K programs on children's test scores. These studies typically find short-run effects on achievement test scores that are slightly larger than those estimated for Head Start (table 2.3), although the size of the impacts varies considerably across states and outcome domains. The average effect size of participation in pre-K across the states is equal to .14 standard deviations for the Peabody Picture Vocabulary Test (PPVT), .29 standard deviations for math, and .70 standard deviations for print awareness.[8] In a head-to-head regression-discontinuity-based comparison of Head Start and pre-K programs in Tulsa, Gormley, Phillips, and Gayer (2008) found that pre-K students outperformed Head Start students on early reading and writing but not early math skills. These recent pre-K studies have not considered children's behavior or socioemotional outcomes, but evidence from rigorous research is mixed (Magnuson, Ruhm, and Waldfogel 2007).

Why are the effects estimated for recent state pre-K programs somewhat larger than those for Head Start? One possible explanation is that pre-K programs hire more qualified teachers, pay them more, and offer a more academically oriented curriculum than do Head Start programs. Another explanation is that the Head Start comparison group received more center-based care than did children in the pre-K comparison group.[9] A third possible explanation is that the recent Head Start study relies on a rigorous randomized experimental design. Although the recent state pre-K studies are big improvements over past efforts to examine such programs, all are nonetheless derived using a research design that may be susceptible to bias that may overstate the benefits of pre-K participation.[10]

8. Studies of the Tulsa pre-K program find effects on prereading skills (letter-word identification) of around 0.8 of a standard deviation and for early math scores (applied problems) of around 0.38 of a standard deviation (Gormley et al. 2005; see also Gormley and Gayer 2005). We focus on the study by Wong et al. (2008) because of the more generalizable sample, which seems important given their evidence of variability across states in program impacts.

9. See http://www.northwestern.edu/ipr/events/briefingdec06-cook/slide16.html.

10. Specifically, these recent studies all use a regression discontinuity design that compares fall semester tests for kindergarten children who participated in pre-K the previous year and have birthdates close to the cutoff for having enrolled last year with fall tests of children who are just starting pre-K by virtue of having birthdates that just barely excluded them from participating the previous year. The key assumption behind these studies is that the selection process of children into pre-K does not change dramatically by child age around the birthday

While there remains some uncertainty about what is the "best" early childhood program model, it seems clear that early education interventions represent a promising way to improve the life chances of poor children. The importance of the early years is not well reflected in current federal government budget priorities, which allocate nearly seven times as much money per capita for K-12 schooling as for early education and child care subsidies for three- to five-year-olds.[11]

2.6 Link between Early Childhood Outcomes and Adult Poverty

We have good evidence that both small-scale model programs like Perry Preschool or Abecedarian and Head Start can generate long-term benefits for children in these programs when compared with children in no-treatment control groups, most of whom were in maternal care. Most relevant for current social policy is what can be accomplished by Head Start, pre-K programs, home visitation, or parent management intervention programs as they operate today in an environment in which higher levels of maternal employment has led to much larger fractions of children experiencing center-based child care. For recent cohorts of children, we can only assess the program's impacts in the short term, and so understanding implications for future poverty rates will necessarily require some extrapolation and educated guessing. In this section, we consider several different approaches for answering this question.

One way to think about the long-term consequences for poverty from children's short-term cognitive test score gains takes advantage of the fact that with the Perry experiment, we have extended longitudinal information for program participants from early childhood to age forty. At the end of the second year of services, Perry had increased PPVT vocabulary scores by around .9l standard deviations and scores on a test of nonverbal intellectual performance (the Leiter International Performance test) by around .77

enrollment cutoff (that is, changes "smoothly" with child age), but this need not be the case because there is a discrete change at the birthday threshold in terms of the choice set that families face in making this decision. Suppose, for instance, that among the children whose birthdays just barely excluded them from enrolling in pre-K during the previous year, those with the most motivated parents wound up being sent the previous year to private programs that are analogous to the public pre-K program and are then enrolled in private kindergarten programs in the fall semester that the pre-K study outcome measures are collected. This type of selection would reduce the share of more-motivated parents among the control group in the pre-K studies and lead them to overstate the benefits of pre-K participation.

11. According to U.S. Budget, Fiscal Year 2005, the United States now spends more than $530 billion a year on elementary and secondary schooling for children aged five and older, including $13 billion in extra federal funding through the Title I program for schools serving poor children. In contrast, the federal government spends only about $18 billion on the Head Start program and child care subsidies, most of which go to preschoolers (see testimony of Douglas J. Besharov before the Subcommittee on 21st Century Competitiveness of the Committee on Education and the Workforce, February 27, 2002, www.welfareacademy.org/pubs/testimony-022702.pdf [February 2007]).

standard deviations (Schweinhart et al. 2005, 61). By age nine, the impact on vocabulary scores had faded out entirely, while around half of the original impact on nonverbal performance had dissipated. By age fourteen, impacts on reading and math scores are just over .3 standard deviations, and the gap in high school completion was about 17 percentage points. In unpublished calculations that he generously shared with us, Clive Belfield found that Perry reduced adult poverty rates by about one-fifth at age twenty-seven and one-quarter at age forty. Put differently, for each $1,000 in program spending per child, Perry Preschool reduces long-term adult poverty rates among program participants by around (.25 / $15.71) = .016 (around 1.5 percent).

By way of comparison, the set of five state pre-K programs evaluated by Wong et al. (2008) cost around $6,100 on average, and achieved PPVT score gains at age four that were .14 standard deviations, on average. Put differently, the five state pre-K programs studied by Wong cost around 40 percent as much as Perry and increase PPVT scores at age four by around 15 percent as much so that the expected effect on long-term poverty from enrolling in one of these pre-K programs is (.15 × .25) = .0375. Thus, according to this method, each $1,000 in spending per child on the state pre-K programs is estimated to reduce long-term poverty among program participants by around (.0375 / 6.1) = .006, or six-tenths of a percent.

Head Start costs around 50 percent as much as Perry and increases PPVT scores by .12 standard deviations (this is the average treatment effect on enrollees—-the so-called treatment on the treated [TOT] effect for three- and four-year-olds together in the Head Start experiment), or about 13 percent of Perry's impacts. Enrollment in Head Start would under this procedure then be expected to reduce long-term poverty by (.13 × .25) = .0325, so for each $1,000 in spending per child on Head Start, long-term poverty rates among participating children when they reach adulthood would be reduced by (.0325 / 8) = .004, or four-tenths of a percent. (Head Start looks a bit more favorable compared to Perry if we focus on scores for other reading or vocabulary tests such as the Woodcock-Johnson-Revised tests for letter identification or spelling, although results for those tests are not available for the Perry Preschool sample.)

Of course it might be possible that long-term gains are not strictly proportional to short-term impacts. For example, it could be the case that some minimum short-term impact is necessary in order to generate lasting cognitive, socioemotional, or behavioral benefits. It could also be the case that the long-term behavioral consequences of achievement impacts on the low-IQ sample of Michigan children in Perry Preschool are different from those arising from similar-sized impacts on a more representative population of children in current Head Start or state pre-K programs.

A different sort of concern with these calculations is that they focus on the proportion of program participants for whom earnings and other sources of family income are pushed above some specific threshold, in this case the

federal poverty line. But earnings increases for people who would still find themselves below the poverty line (or for those who are "nearly poor" above the poverty line) should also count in any social accounting of the value of these programs. So a potentially better measure of the value of early childhood programs would be to focus on earnings. Belfield et al. (2006) found Perry increased participants' lifetime earnings by about $61,000 (discounted by 3 percent, in 2007 dollars). If, as calculated in the preceding, pre-K effects are about 15 percent those of Perry, we would expect increases in lifetime earnings of (.15 × $61,000) = $9,150. Likewise, if Head Start effects amount to about 13 percent those of Perry, increases in earnings might amount to about (.13 × $61,000) = $7,930.

We can also estimate long-term earnings gains from these early childhood programs using associations from observational data. Because few studies have followed people from early childhood all the way through adulthood, this exercise is necessarily subject to some uncertainty. The British National Child Development Study (NCDS) is one of the few data sets available for this purpose and includes achievement test scores measured at age seven and earnings measured at age thirty-three for a sample of people born in the United Kingdom in 1958. Krueger (2003) argues that analyses of these data suggest that an increase in early childhood test scores in either reading or math of 1 standard deviation might plausibly be associated with higher lifetime earnings of about 8 percent (using a 3 percent discount rate and assuming no productivity growth in the economy over time), although we suspect this is likely to be an upper bound of the effect.[12] If the .08 estimate is correct, the implication is that a 1 standard deviation increase in test scores boosts lifetime present value earnings by around $75,870 in 1998 dollars, or around $97,000 in 2007 dollars, and assuming proportional effects based on PPVT scores this estimate could be used to provide rough estimates of Head Start and pre-K benefits ($12,610 for Head Start and $13,580 for pre-K).

There remains some debate about the relative importance of different early childhood cognitive or noncognitive skills in predicting subsequent outcomes, although the literature as a whole is consistent with the idea that there are multiple pathways to long-term success.[13] For example, Duncan

12. This estimate is derived from Currie and Thomas's (1999) analysis and is based on estimates from a regression model without any covariates and, as such, is likely to reflect an upper bound of the association. Yet this impact is smaller than what has been estimated for a 1 standard deviation increase in test scores measured during adolescence for more recent U.S. samples, which typically suggest earnings gains of around 10 to 20 percent. The difference is presumably due as Krueger notes to some combination of differences in the time period studied, the U.S. and U.K. labor markets, the fact that Currie and Thomas control for both reading and math scores simultaneously while most U.S. studies examine one type of test score at a time in their effects on earnings, and the different age at which the test scores are measured.

13. For example, Duncan et al. (2007) do not find much evidence that behavior outcomes measured during early childhood (aside from attention skills) predict later test scores although other correlational studies have found that socioemotional outcomes, notably aggressive behavior, do seem to contribute to children's achievement trajectories (Hinshaw 1992; Jimerson,

et al. (2007) find that early math skills are the strongest predictor of subsequent academic achievement; early reading and attention skills also predict later test scores but just not quite as strongly as do early math skills. The fact that early childhood programs like Head Start achieve long-term behavioral impacts despite "fade out" of initial achievement test score gains raises the question of whether lasting program impacts on socioemotional or behavior skills might be the key drivers of long-term program impacts on outcomes such as school completion or employment (see, for example, Carniero and Heckman 2003). Unfortunately, with most short-run research focusing on academic and cognitive outcomes, it is unclear what dimensions of early behavior might be affected by the program and whether such effects persist over time. A possible alternative explanation is that short-term boosts in academic skills are a key mechanism for reducing special education placement and improving socioemotional skills such as motivation and persistence by, for example, increasing children's confidence in school (Barnett, Young, and Schweinhart 1998; Deming 2009). Our calculations here assume that short-term test scores are serving as a proxy for the bundle of early skills that promote long-term outcomes, not only academic or cognitive skills.

One possible objection is that we are trying to use nonexperimental correlations between early test scores and adult earnings to extrapolate earnings gains from short-term experimental impacts, which fade over time. But as noted in the preceding, there is considerable fade out in nonexperimental achievement test advantage as well—that is, test scores measured in early childhood and adolescence are correlated, but imperfectly.[14] That said, estimating the long-run program impacts on earnings based on correlations observed in population data from the United Kingdom has many limitations and is, at best, a good guess based on available evidence.

2.7 Other Potential Benefits from Early Childhood Interventions

The previous section focuses on just part of the long-term benefits of early childhood interventions, specifically those that result from increased adult earnings and reductions in adult poverty rates. But as noted in the preceding, most of these programs generate other benefits to society that would also need to be accounted for in a systematic benefit-cost analysis for purposes of allocating scarce government resources across competing potential uses.

Despite this partial fade out of test score impacts, Perry Preschool shows

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Egeland, and Teo 1999; Miles and Stipek 2006; Tremblay et al. 1992). Despite efforts to reduce omitted-variable biases, because the Duncan et al. (2007) study is nonexperimental, the estimates may not identify causal impacts.

14. Jencks and Phillips (1998, 28) think a plausible estimate is that the correlation between first and twelfth grade test scores is around .52. The implication is that a child starting at the sixteenth percentile of the test score distribution in first grade will on average be at the twenty-seventh percentile of the distribution in twelfth grade.

large long-term impacts on schooling, crime, and other behavioral outcomes measured through age forty (Schweinhart et al. 2005). For example, the study found that Perry Preschool reduced criminal activity (with 83 percent of the control group having been arrested by age forty, as against 71 percent of the treatment group).[15] The dollar value of Perry Preschool's long-term benefits (in 2007 dollars) range from around $102,000 using a 7 percent discount rate, to about $277,000 using a 3 percent discount rate (Belfield et al. 2006, 180–81). Reductions in crime account for fully two-thirds of the dollar-value benefits of Perry, and a large share of the dollar-value benefits of the Olds home visitation program as well. While there has to date been no long-term study of the effects of state pre-K programs, previous research on Head Start suggests that large-scale government program might reduce crime (Garces, Thomas, and Currie 2002; Deming 2009) and improve health outcomes (Ludwig and Miller 2007).

Finally, we note that early childhood interventions may reduce both future and current poverty. Early childhood development programs may effectively serve as subsidized child care that may result in increased employment and work effort and, thus, in turn, higher earnings for participating families. A good portion of the spending on subsidized care itself amounts to "near cash" income for the poor families and should figure into a poverty status calculation based on an expansive definition of family income.

2.8 Conclusion

Many antipoverty strategies confront society with some trade-off between equity and efficiency: policies or programs that transfer resources to the poor often run the risk of reducing work effort by program participants (the Earned Income Tax Credit being one noteworthy exception in that regard, at least with respect to labor force participation rates), and raising government revenue through taxation generates some deadweight loss to society as well. Put differently, poverty programs targeted at providing help to adults typically serve to redistribute resources but may make the overall "pie" smaller. On the other hand, human capital programs targeted at poor children can help reduce poverty while at the same time enhancing future economic growth and competitiveness and increasing the overall resources available to society. A growing body of research in a variety of fields ranging from neuroscience to economics suggests that investing in the earliest years of life for disadvantaged children may be a particularly promising strategy. Most social policies are devoted to playing catch-up against children's early disadvantages, but disparities are already apparent among young children, and many disadvantaged children never catch up. Programs that try

15. See Schweinhart et al. (2005), *Lifetime Effects* (see their note 17).

to improve young children's school readiness could be an effective way to combat poverty.

In the choice between child- and parent-based programs, in general, the former have a much better track record than the latter. There is a very strong body of research suggesting that a wide range of high-quality early childhood education centers are capable of enhancing the developmental outcomes of low-income children and produce benefits to society well in excess of program costs. Evidence from program evaluation research supports efforts to enroll children who are living in poverty in high-quality early care and education programs, beginning around age three.

Two types of parent-based programs show considerable promise. Intensive family support through home visiting by skilled personnel can produce benefits for children and parents, especially when it is targeted to families at high risk. The best studied and most effective example of this model provides nurse home visitation targeted to first-time parents who are living in poverty. Home visitation and parenting programs staffed by paraprofessionals of low intensity (for example, fewer than ten visits) or provided on a universal basis appear unlikely to produce significant lasting benefits for children (Olds, Sadler, and Kitzman 2007). Among children with identified behavior problems, some programs have proved effective at reducing children's problem behavior in the short term, particularly in the home setting. But there is no evidence that these behavior-focused programs have positive effects on children's academic outcomes.

For the purpose of increasing children's academic skills, the available evidence seems to point, at least tentatively, toward the relative cost-effectiveness of child-focused interventions like center-based early childhood education over even the most successful parent-focused programs. For example, the Olds nurse family visitation program generated gains in Stanford-Binet scores of around .2 standard deviations at age four, two years after program completion (among the high risk Elmira sample) at a cost of around $10,300 per child. In contrast, the federal Head Start program increases reading scores for three- and four-year-olds by around .12 standard deviations, with larger impacts on other cognitive outcomes, at a cost that is around 10 percent higher than the home visitation program. But newer state pre-K programs seem to generate even larger cognitive test score gains at even lower per-pupil costs, although nothing is known to date about their effects on key behavior and socioemotional outcomes that also predict adult poverty status, and the quality of the evaluation evidence for these state pre-K programs is not quite as strong as what is available for Head Start.

So while there remains some uncertainty about what form new investments early childhood programs should take—for example, whether we should expand Head Start program, or increase pre-K programs—there are reasons to be confident that additional spending on quality programs may reduce poverty in America over the long term. These early childhood

programs also generate a number of other important benefits to both program participants and society at large, including improved health and reductions in criminal offending rates. If we adopt an appropriately broad view of what benefits should count in any program evaluation, then there would seem to be very few other antipoverty strategies that are capable of generating benefits on the order of what have been estimated for early childhood educational programs.

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