Early Childhood Intervention Programs: What Do We Know?

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PREFACE

This paper was commissioned by the Brookings Roundtable on Children as part of the group's effort to find more effective ways of improving the life prospects of children, especially the most disadvantaged. The Roundtable is reviewing research in a number of areas relevant to this concern and will make the results broadly available.

The paper was written by Janet Currie, Professor of Economics at UCLA, a research associate with the National Bureau of Economic Research, and a member of the Children's Roundtable. Additional support for the paper was provided by the National Science Foundation, the National Institutes of Health, and the Canadian Institute for Advanced Research. Comments on earlier drafts were provided by Jeanne Brooks-Gunn, Greg Duncan, Bentley MacLeod, Deborah Phillips, and Isabel Sawhill. Matthew Neidell contributed excellent research assistance. The opinions expressed in the paper are the author's alone.

The paper reviews the literature on early childhood interventions, focusing on center-based programs for children between birth and school entry that emphasize school readiness as a goal. The studies reviewed have not produced consistent evidence of the long-term effectiveness (or lack of effectiveness) of early intervention. However, not all studies are created equal, and better studies tend to find larger and more significant long-term effects. Moreover, the author shows that the proven shorter and medium-term benefits of Head Start already pay back much of the cost of the program.

The existing literature also provides some guidelines for the design of early intervention programs. Specifically, it suggests that while it may be most useful to intervene before the age of three, interventions for preschool and for school-age children can also be effective. Second, the effects of early intervention are generally larger for more disadvantaged children, which provides a rationale for targeting such programs to these children. Third, the most important aspect of child care quality is the nature of the interaction between the teacher and the child. Small group sizes, better teacher training, and other regulable aspects of quality all make positive interactions more likely. Moreover, even rather loose federal oversight of these observable aspects of quality can be effective in eliminating poor quality programs.

The Roundtable is much indebted to Professor Currie for this careful and accessible review of the literature. It should be useful to all those concerned about what early education programs -- from Head Start to universal preschool -- can and cannot achieve.

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Early intervention programs are once again in the public eye. Questions being debated include: Whether government should fund a universal pre-school program; Whether Head Start should be fully funded so that all poor 3 to 5 year old children can attend; and whether to create a Head Start-like program for younger children. Are there policies the government can pursue to improve the quality of early interventions? More fundamentally, what is quality intervention, and how important is it to a child's future success in life?

Renewed interest in early intervention has been generated by new research on both model programs and large-scale, publicly funded interventions like Head Start. Findings from the "new brain" science are also generating excitement. These findings have been interpreted to suggest that early childhood, and especially the interval from birth to 3 years, offers a unique opportunity to change the life-course of children at risk.

Many programs affect the lives of young children. This essay focuses on center-based early childhood education programs for children between birth and school entry, which emphasize school readiness as a goal. Some of these programs may also include home visiting or parenting skills components, but we are excluding early intervention programs that have parenting skills and/or home-visiting as their primary focus. We have also excluded infant and child health programs from the scope of this review, though all these programs may well have important effects on child outcomes.[1]

I begin with a discussion of reasonable goals for early intervention programs. The theoretical case for early intervention is then reviewed. An overview of the evidence regarding the effects of model programs appears in section 3, and a discussion of the evidence regarding large-

[1] Excellent reviews of interventions focusing on parenting skills can be found in Brooks-Gunn, Berlin, Fuligni (1998) and Benasich, Brooks-Gunn and Clewell (1992), while Gomby *et al*. (1999) provide a review of interventions that emphasize home visiting. Currie (1998) discusses several interventions

scale public early intervention programs follows in sections 4. Sections 3 and 4 focus on the issue of whether or not the programs work. In section 5, I peer into the "black box" of program design to discuss what is known about how they work. That is, what can be said about the optimal timing, targeting, and content of early intervention programs on the basis of existing studies? I conclude with a discussion of the circumstances in which the benefits are likely to outweigh the costs of providing these programs.

1. What is the goal of early intervention?

Short-term goals such as providing a secure, stimulating environment or nutritious food to children who lack these essentials are surely worthwhile. However, many would argue that the ultimate goal of early intervention is to produce "better" adults, where "better" is measured in terms of things like schooling attainment, earnings, welfare use, and crime rates. Because it is often difficult to track the long-run outcomes of early intervention, evaluations generally focus on intermediate goals, such as producing children who arrive at school "ready to learn." Such students are thought to be more likely to succeed in school, and hence to have better long-term outcomes.

a) Increasing IQ Scores

One way to improve both intermediate and long-term outcomes would be to increase children's IQ scores. Many scholars, including Herrnstein and Murray (1994), have elucidated the links between IQ and other measures of adult success, and there is much public preoccupation with IQ scores as measures of the effectiveness of early intervention programs. Although high IQ is

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aimed at improving child health.

certainly not a perfect predictor of adult outcomes, it is positively correlated with success in many areas.

It can be surprisingly easy to create short-term gains in measured IQ scores. Zigler and Berman (1983) cite the case of an 8 week summer program that created a 10 point increase in measured IQ scores. They also cite a demonstration which showed that in the absence of any other intervention, repeating an IQ test at an interval of one week produced similar "gains" as children became more familiar with, and comfortable with, the test.

Unfortunately, these sorts of gains in IQ are generally short-lived. As we will see below, few early intervention programs have been shown to lead to long-term increases in IQ. If model programs cannot produce long-term gains in IQ, then it may be unrealistic to expect large-scale publicly funded programs like Head Start to do so. But producing long-term increases in IQ may not be the only way to achieve the goals of increasing school readiness and ultimately, of producing better adults. Skills other than those measured by IQ tests may be important to improving child outcomes.

b) Improving School Readiness

The Carnegie Foundation's 1991 survey of kindergarten teachers sheds an interesting light on this issue. The survey found that only 65% of entering students were deemed ready to learn. This figure has received a great deal of attention, and many people assume that the teachers were referring to shortfalls in the children's cognitive skills. Yet when asked to name the most important determinants of readiness to learn, the attributes cited most often by teachers were (in order): Being physically healthy, rested, and well-nourished; being able to communicate needs, wants, and thoughts verbally; enthusiasm and curiosity in approaching new activities; taking turns; and

knowing how to sit still and pay attention. While verbal skills are doubtless associated with IQ, the correspondence is not one for one, and teachers placed little weight on other measures of students' intellectual achievements. For example, only 10% of kindergarten teachers thought that it was important that entering children know the alphabet (Lewit and Baker, 1995).

Skeptics may find these teachers' views self-serving. After all, it is more pleasant to teach enthusiastic, verbal, well-behaved youngsters than sullen, silent, fidgety ones. However, there is evidence that the absence of obvious behavior problems and the development of skills such as self-control may be at least as important to future success in life as formal cognitive skills (c.f. Lee *et al*., 1990). Self control (e.g. the ability to sit still and pay attention) may even be necessary for the full development of formal cognitive skills.

Fortunately, there is evidence that self-control (or self-regulation as it is called in the developmental psychology literature) can be taught. For example, experiments have shown that young children can delay engaging in an attractive forbidden activity longer when they are given helpful hints about how to distract themselves.[2] Thus, improving skills such as self-control is a legitimate goal of early intervention programs.

2. What is the Theoretical Case for Early Intervention?

Much of the current enthusiasm for early intervention is based not on evidence of the effectiveness of existing programs, but on two theoretical arguments. The first is a sense that "an ounce of prevention is worth a pound of cure." That is, if effective means of preventing poor performance and social pathology could be developed, then they would almost certainly be more

[2] Rodriguez, Mischel and Shoda (1989) offer a brief overview of some of this evidence.

cost effective than attempts to treat these conditions after the fact. The second is that the "new brain science" suggests that early childhood is a key period for brain development.

a) Arguments in Favor of Prevention

I know that many early interventions have important effects on child outcomes. For example, lead abatement and the treatment of lead poisoning prevents permanent brain damage; routine screening of infants for phenylketonuria along with a special diet for affected individuals can prevent mental retardation; and abstention from alcohol during pregnancy prevents retardation caused by fetal alcohol syndrome. It stands to reason that it may be possible to prevent more subtle learning disabilities, school failure, and social maladjustment with the right interventions.

Furstenberg, Brooks-Gunn, and Morgan (1987) present evidence that it is important for children to get "off on the right foot" in school, and that on average children who started school from disadvantaged families had worse performances than other children even if their parent's situation improved subsequently. The difficulty of reversing negative outcomes later in life, for example through job training programs for high school dropouts, makes early intervention appear to be an even more attractive option. Public sector efforts to train low skilled workers have generally produced very small returns. Heckman (1999) points out that even if I assumed an optimistic 10% rate of return to the investment, it would still take at least $50,000 to raise the earnings of a welfare mother by $5,000 per year (e.g. from $10,000 to a still low $15,000).[3]

b) Arguments based on Brain Science

[3] Heckman (1999, page 105) concludes that "the lack of interest of private firms in training disadvantaged workers indicates the difficulty of the task and the likely low rates of return to this activity."

Research on early brain development was highlighted in the White House Conference on Early Childhood in 1997. This research suggests that even a newborn can be regarded as a "scientist in the crib" possessed of an innate ability and drive to learn through interactions with the environment (Gopnik, Meltzoff, and Kuhl, 1999). Neuroscience has shown that brain growth (as measured by the number of connections between brain cells or brain synapses that are formed) is at its highest between the ages of 0 and 3; and that there are "critical periods" for some sensory, motor, and language capabilities that occur early in life. The idea of critical periods implies that if these periods are missed, then an organism's capabilities in these dimensions may be permanently impaired.

It is not easy to make the leap between basic scientific research regarding brain development and public policy, however. Bruer (1999) points out that although the number of brain synapses does increase rapidly from 0 to 3, it then declines to adult levels. Adults and infants have about the same synaptic densities, even though adults have many more capabilities than infants. Moreover, many skills such as short-term memory continue to improve until puberty even though synaptic densities are falling.

Gopnik, Meltzoff, and Kuhl (1999) explain that selective "synaptic pruning" in the brain--the elimination of connections that are not used--allows the connections that are used to be strengthened. Thus, most adults may not be able to learn a foreign language like a native speaker, but they can speak their native tongues with much greater fluency than a three year old, and they can certainly learn the vocabulary and grammar of foreign languages.

Bruer goes on to explain that critical periods have only been established with any certainty for very specific functions. Critical periods for some visual functions extend through age 8 or 9, while for some aspects of language acquisition, they extend through puberty. Moreover, no critical

periods have ever been established for culturally transmitted knowledge like reading and mathematics, and indeed we know that adults can learn these skills. Gopnik, Meltzoff, and Kuhl cite evidence from animal studies that critical periods may be socially determined. For example, in some species, young birds can learn songs from other birds even when they have passed the age when they can learn them from tape recordings.

Bruer suggests that the most solid conclusion that can be drawn from the literature on brain development and critical periods is that it is vital that sensory problems such as cataracts, eye misalignments, and chronic ear infections be identified and treated as soon as possible in young children. Gopnik, Meltzoff, and Kuhl caution that while we know that extreme deprivation can do terrible harm, we do not know that extra stimulation beyond what most infants would experience in any "normal" environment will have any permanent benefits.

There is some evidence that the first three years may be a "critical period" for mental health and social functioning. Animal studies involving rats and primates have shown that individuals subject to continuously high levels of stress at early ages experience changes in the parts of the brain that regulate stress hormones, as well as in areas of the brain responsible for learning and memory. These changes appear to be due to the damaging effects of sustaining high levels of stress hormones such as cortisol (Gunnar, 1998).

While there have been no direct studies of the effects of stress on the brain structure of human infants (experiments would be highly unethical), there is evidence that human infants subject to severe stress (because of abuse, or cold and distant caregivers) have similar abnormalities in the ambient levels of stress hormones. High levels of these stress hormones have been associated with an inability to pay attention and a lack of self-control in humans. However, if these highly stressed infants are given warm, sensitive alternative caregivers, they experience reductions in the levels of

stress hormones, at least temporarily. Hence, the evidence does suggest that children at risk of abuse or neglect could gain special benefits from spending time with alternative, nurturing caregivers (Gunnar, 1998).

These arguments suggest that we should not focus early childhood interventions exclusively on the 0 to 3 period, at the expense of other periods of childhood. Nor should we conclude that interventions aimed, for example, at 4 and 5 year old preschool children, are too little, too late.

3. What is the Evidence About Whether Early Intervention Programs *Can* Work?

There have been several excellent recent surveys of the early intervention literature. Table 1 consolidates information about "model" programs drawn from Table 1 of Barnett (1995) and Table 2.1 of Karoly (1998). These model programs were typically funded at higher levels and subject to more intensive supervision than large-scale, publicly-funded programs.

a) Not All Evaluations are Created Equal

The first point to note about Table 1 is that while there have been many model early intervention programs, few of them have been subjected to model evaluations. Randomized trials are the "gold-standard" for this type of research, notwithstanding the problems that can arise in implementing experimental designs and interpreting their findings (c.f. Heckman and Smith, 1993).

In a randomized trial, children are randomly assigned to treatment and control groups. The importance of random assignment is that experimenters can be reasonably certain that there are no pre-existing, unobserved, and uncontrolled differences between the treatments and controls. An example of random assignment that everyone is familiar with is a drug trial. Patients are randomly assigned to receive either the experimental drug or a placebo (or in some cases, an alternative drug

with known properties). Because of the random assignment, doctors can tell whether the drug works or not, simply by comparing the treatments and controls. It is important to note that a drug trial may not tell doctors much about *how* the drug works, but it is a very powerful method for determining whether or not it is effective. Similarly, a social experiment can give valuable information about whether or not a particular early intervention program is effective, even if the intervention acts in many complex ways on the child and his or her family.[4]

Most of the evaluations in Table 1 were conducted by drawing comparison samples in some fashion other than random assignment. Thus, one can never be certain that the differences between the treatments and controls reflect the effects of the experimental intervention rather than the effects of some other unobserved difference between the groups. For example, if participants in a program do better than observationally similar non-participants, it might be because parents of participants are more motivated to help their children than the parents of non-participants. This would be equivalent to trying a new drug therapy only on patients who were also taking other steps to improve their health. Alternatively, the directors of an early intervention program might select only the neediest children to participate in the program, in which case any positive program effects would tend to be understated by a comparison between the children who participated and those who did not. This would be equivalent to providing the experimental drug only to the sickest patients, and then trying to infer something about the drug's effects by comparing these patients to ones who started out healthier.

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[4] This point is often misunderstood. For example Schorr and Yankelovich (2000) argue that "...scientific experiments are best equipped to study isolated interventions, whereas the most promising social programs don't consist of discrete, circumscribed pieces..." However, there is no reason in principle that a randomized experiment cannot be used to study a complex intervention. The key question is whether it is feasible to carry out the random assignment or not.

Another problem that frequently afflicts even well-designed experimental evaluations is attrition, that is, people leaving the study. For example, the Institute for Developmental Studies program summarized in Table 1 (Deutsch *et al*., 1983) started with 503 participants but was able to conduct long-term follow-up (at grade 7) on only 97 of them. The 97 who were followed may not be at all representative of the initial sample. For example, those who were successfully followed might be from much more stable families. Unless attrition is random, it is difficult to draw any inferences about the long-term outcomes of the whole group from this small subset.

b) What Can We Conclude From Some of the Better Studies?

Four studies from Table 1 stand out because they used random assignment, are relatively free of attrition bias, and follow children at least into middle school. They are: The Early Training Project, the Carolina Abcedarian Project, the Perry Preschool Project, and the Milwaukee Project. The Infant Health and Development Project also used a randomized design and had low attrition, but followed children only to age 8. The first conclusion that can be drawn from these studies was alluded to above: Only the Milwaukee Project found any long-term effect on IQ. However, the Early Training, Carolina Abcedarian, and Perry Preschool Projects all found positive effects on measures of scholastic success, which strongly suggests that boosting IQ is not the only way to affect this important outcome.

The Early Training Project was the least intensive intervention of the three. It served 4 and 5 year olds, and involved weekly home visits during the year in addition to a 10 week part-day preschool for either two or three summers. It showed dramatic reductions in use of special education at age 12 (5% of the treatment group compared to 29% of the controls) and although there were no statistically significant differences between treatments and controls in achievement test

scores, grade retention, or high school graduation, the differences in the latter two outcomes were in the right direction. For example, 68% of the treatment group graduated compared to only 52% of the controls.

The Carolina Abecedarian Project involved a 4 way design. At birth children were randomized into a treatment group that received enriched center-based child care services for 8 hours per day, 5 days a week, 50 weeks per year, from birth to age 5, and a control group that did not receive these services. The teacher/student ratio ranged from 1:3 to 1:6 depending on the child's age. At school entry, the children were again randomized into two groups. One received no further intervention, and the other had a "Home School Resource Teacher" who provided additional instruction, a liaison between parents and school, and also served as a community resource person for the family (Campbell and Ramey, 1994, 1995).

At age 15, the Carolina Abcedarian Project found that the children who had received the preschool treatment had higher scores on achievement tests (especially reading) and reductions in the incidence of grade retention and special education, regardless of whether or not they had received further "treatment" once they entered school. In contrast, the effects of the intervention for school-aged children were generally either small or statistically insignificant. Retention in grade and being placed in the special education "track" are viewed by educators as predictors of dropping out of school. In addition, they create additional costs to society which have to be weighed against the costs of providing the early intervention. The investigators have now completed a follow-up assessment of the Abcedarian children at age 21.[5] One hundred and four of the original 111 infants

[5] As of this writing, the results of this follow-up had not yet appeared in a peer-reviewed scientific journal. A full report is due to be released on February 28, 2000. The following discussion is taken from the Executive Summary of the Carolina Abcedarian Project that is available on the investigators' web site, www.fpg.unc.edu/verity.

were assessed. At age 21, the children who received the preschool treatment had higher average tests scores and were twice as likely to still be in school or to have ever attended a four-year college.

The most famous of these three interventions is the Perry Preschool Project, which found positive effects of the intervention on achievement tests, grades, high school graduation rates, and earnings, as well as negative effects on crime rates and welfare use (as of age 27). The Perry Preschool intervention involved a half-day preschool every week day plus a weekly 90 minute home visit, both for 8 months of the year, for 2 years. Teacher/student ratios were 1 to 6, and all teachers had masters degrees and training in child development (Schweinhart *et al*., 1993).

The results of the Milwaukee project are somewhat anomalous when compared to the three programs discussed above. Investigators found that at grade 8, treatment children had higher IQs than control children, but they enjoyed no other advantages. Their achievement test scores, grades, and rates of grade repetition were all similar to those of the controls. Once again, the Milwaukee project suggests that an exclusive focus on IQ is unwarranted because other factors also contribute to children's success at school and in life.

The many other studies reviewed in Table 1 also tend to find positive effects of early intervention, although the effects are often statistically insignificant. One interpretation of this observation is that well designed studies find larger and more significant effects of intervention than studies with weaker, non-randomized, designs. An alternative interpretation of the evidence is that the most intensive and expensive interventions were the most likely to have had significant effects.

The cost data needed to differentiate between these two explanations conclusively is lacking. However, both explanations suggest that advocates of early intervention should welcome rigorous evaluations. On the one hand, such evaluations may be more likely than more poorly designed ones to demonstrate significant effects. On the other hand, evaluations may show that

interventions must reach a certain level of intensity (in terms of time spent or quality) before they will have the desired effects, but that they are efficacious once they reach this threshold.

4. What is the Evidence Regarding the Effects of Large-Scale Publicly Funded Programs Like Head Start?

The evidence reviewed above suggests that model early intervention programs can have positive long-term effects on children. But there is a large gap between these programs and the large-scale publicly funded interventions that are currently in place. As anyone who has eaten cafeteria food knows, a recipe that works well for a small group may not translate well to a larger setting. The model programs were typically staffed by people who were more highly trained than those in publicly-funded programs were. They may also have been extraordinarily motivated to show that their particular intervention "worked."

a) Some Background Information About Large-Scale Publicly Funded Programs

Head Start is a preschool program for disadvantaged children which aims to improve their skills so that they can begin schooling on an equal footing with their more advantaged peers. Begun in 1965 as part of President Johnson's "War on Poverty," Head Start now serves almost 800,000 children in predominantly part-day programs (U.S. Administration on Children Youth and Families, 1999). However, though the program is large, enrollment represents only roughly 35% of eligible 3 and 4 year old children. The program is not an entitlement, but is funded by an appropriation, which means that when funds run out, eligible children cannot be served. Head Start is a popular program, and federal appropriations for it grew during both the Bush and Clinton administrations.

Head Start is run at the local level, but local operators are subject to federal quality guidelines. These guidelines specify that Head Start is to provide a wide range of services in addition to providing a nurturing learning environment. For example, Head Start is required to facilitate and monitor utilization of preventive medical care by participants, as well as to provide nutritious meals and snacks. The program has served as a model for state preschools targeted to low-income children in states such as California (U.S. GAO, 1995), and also for new (voluntary) universal preschool programs in Georgia and New York.

The successful demonstration programs discussed above were funded at higher levels than a typical publicly-funded program, a fact that is often noted in discussions of Head Start. For example, in 1998 it cost $5,021 to keep a child in a part-day Head Start program for 34 weeks a year, implying that it would cost approximately $10,152 to send a child for two years (if we discount all costs to the time the child enters at age 3). The two-year, part-day Perry Preschool intervention cost $12,884 per child (in 1999 dollars) for a program that lasted 8 months a year over the two years (Karoly, *et al*. 1998).[6]

The Administration for Children, Youth, and Families (ACYF) estimates that it would cost $2,394 to extend the Head Start program to full-year care, and an additional $1,615 to extend it to full-day/full-year care. That is, that it would cost approximately $9000 per child per year to have a child in a full-year, full-day Head Start program (Bourdette, 1999).[7] While a formal cost/benefit

[6] Twenty percent of the children participated in the program for only one year. The cost figure given by Karoly *et al*. is a weighted average that takes this into account. These figures imply then that the cost per year was about 7,000 1999 dollars.

[7] Some observers feel that this is an underestimate because a) it does not include the costs of other federal programs such as Medicaid which may be increased by Head Start; b) expanding Head Start from a part-day to a full-day program could increase costs if for example, one full-time staff member is more expensive than two part-time staffers, it is much more costly to procure space for a full day rather than a half day, or the increased demand for Head Start teachers raises wages of child care workers. Others feel that enrolling eligible children in programs like Medicaid is actually a

analysis of the Carolina Abcedarian project has not been conducted (one is currently underway), the preschool component of the intervention (which was full-day) cost about $15,000 per child, per year, and this part of the intervention lasted 5 years.[8] Fewell and Scott (1999) report that the IHDP program also cost about $15,000 per year per child, though 20% of the costs were in the form of transportation expenses. Thus, these comparisons suggest that it is reasonable to expect the effects of Head Start to be less than those of more expensive model programs.

b) Short-Term Effects of Head Start

Table 2, which is drawn from Table 2 in Barnett (1995) and Table 2.2 in Karoly (1998), summarizes what is known about the efficacy of Head Start, as well as various programs funded under Title 1 of the Federal Elementary and Secondary Education Act of 1965 which provides money to school districts with disadvantaged students.[9]

Table 2 documents the extraordinary fact that there has never been a large-scale, randomized trial of a typical Head Start program. Moreover, few existing studies have attempted to follow children past the elementary grades (though admittedly, long-term follow-up of a large group of children in a public program poses many technical problems). Studies typically find significant short-term effects on measures of cognitive skills, however. For example, the most recent federally-sponsored study of Head Start is FACES (The Head Start Family and Child Experiences Survey).[10]

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benefit, and that to date, increased demand for child care workers has had little effect on their relative wages.

[8] Ramey, Campbell and Blair (1998) state that on average the preschool component of the program cost about $6,000 per year. Children entered the preschool component between 1972 and 1983. Six thousand 1978 dollars are worth approximately $15,000 1999 dollars.

[9] In 1998, expenditures under Title 1 totaled 8 billion dollars. There are few restrictions on the way that the funds can be spent. Thus, Title 1 is more of a funding stream than a program, although the funds are occasionally spent on early intervention programs of the sort considered in this article.

[10] c.f. Zill, Resnick, and McKey, undated.

This study focuses on documenting improvements in the skills of Head Start children over the course of a year in the program. Unfortunately, the study design did not include a control group.

The cognitive gains of the Head Start children were assessed by comparing the Head Start children to national norms. Children made some gains relative to these norms in terms of vocabulary, but made no gains in letter-recognition or book-learning (i.e. knowing the front from the back of the book, or that reading goes from the top to the bottom of the page). The children also showed gains in social skills over the course of a year in Head Start. However, these could not be compared to any national norms, so it is unclear what to make of the finding--surely we would expect all preschool children to achieve some gains in social skills over the course of a year? The children did not show any declines in the frequency of problems that are often related to school failure such as overactive, aggressive, or anxious behaviors.

In view of the importance of health to school readiness, it is of interest to ask whether Head Start is living up to its mission of ensuring access to health care for participants. Immunization rates are often used as a marker for access to a broader array of services. A 1993 Inspector General's report (Office of the Inspector General, 1993) found that only 43.5% of the sample Head Start children had immunization records that were up to date. However, subsequent investigators have found that the actual immunization rate may be closer to 85%. It appears that the reason for the discrepancy is a lack of emphasis on record-keeping, rather than a lack of emphasis on immunization (Zigler and Styfco, 1994).

Still, it is not clear what the relevant comparison rate is, that is, what would the immunization rate have been in the absence of the program? Currie and Thomas (1995) (discussed further below) address this question and find that preschool children who attended Head Start were 8 to 9% more likely to be immunized than siblings who did not attend any preschool. This figure is

likely to be an under-estimate of the true effect of Head Start if there are spill-overs from the immunization of Head Start children to their siblings. For example, parents may learn of an accessible, low cost provider through Head Start, and take all their children to be immunized there.

These results suggest that in the short-term, Head Start is contributing to school readiness in terms of improving verbal skills and health, and perhaps social skills. A key question is whether these gains do in fact translate into any medium or longer-term improvements in outcomes?

c) Medium and Longer-Term Effects of Public Programs

On the whole, the results summarized in Table 2 are similar to those of the evaluations of model programs that did not use experimental designs. That is, evaluations show generally positive but often insignificant effects on long-term outcomes. Nevertheless, some of the non-experimental studies in Table 2 are worthy of note because of the careful attempts that were made to control statistically for possible non-random selection into the program. These include Lee *et al*. (1990), Reynold's (1998), and Currie and Thomas (1995, 1996).

Lee *et al*. (1990) began by conducting a spring canvas of all the children in a neighborhood who would be eligible to enter Head Start in the fall. The children who actually attended Head Start had lower scores on average than those who did not. Much of the difference could be accounted for by family characteristics. The children were followed into second grade, and it was found that Head Start attendance had positive effects on both verbal test scores and measures of social adjustment such as impulse control. Unfortunately, it was not possible to follow the children further to see whether these effects were sustained.

Reynolds' (1998) studied the Chicago Child-Parent Centers, an intervention that began with an enriched preschool program, and followed up with an enriched curriculum for school-aged

children up to age 9. One way to think about this intervention is that it is similar to providing a Head Start-like preschool program and then improving the school subsequently attended by the Head Start children.

Reynolds followed a sample of children who had all participated in the preschool and kindergarten components of the CPC program through 7th grade. Some participated in CPC after kindergarten (the treatments) and some did not (the controls). In addition, some attended schools in which the extended program was offered for 2 years, while some attended schools in which it was offered for 3 years.

Although his study cannot meet the gold standard of random assignment, Reynolds' study is interesting in part because he uses several different statistical methods to control for the possibly unobserved characteristics of the (non-randomly assigned) treatment and control children. Reynolds' results are robust to the use of different methodologies. Most notably he finds significant reductions in the rates of grade retention, special education, and delinquency in the treatment group, as well as higher reading scores.[11]

Currie and Thomas' (1995) evaluation of Head Start uses a national sample of children from the National Longitudinal Survey's Child-Mother data set. They attempt to control for unobserved characteristics of children by comparing siblings who participated in Head Start to those who did not. The idea is that by using siblings as the controls, any shared characteristics of family background will be controlled for. As discussed above, unobserved characteristics such as the

[11] Reynold's uses three different methods. First, he conducts an analysis of the initial differences in test scores between the two groups, and finds that most of it can be explained by observable characteristics. That is, there do not appear to be large pre-existing unobservable differences between the treatments and the controls. Second, he estimates a model in which selection into the treatment group is controlled for (via Heckman's (1979) procedure). In this model, it is assumed that the characteristics of each school site affected selection into the treatment group without having additional direct effects on child outcomes. A third approach is to compare children in schools that

parents' views on the importance of education are likely to contaminate estimates of program effects if they are not accounted for.

The Currie and Thomas evaluation is one of very few to have included significant samples of the 60% of Head Start children who are not African-American. The estimates for African-Americans parallel those of studies in which subjects were randomly assigned, which lends them additional credibility. Initial gains in vocabulary and reading test scores "faded out" while the children were still in elementary grades. For whites, however, there were persistent gains in test scores, as well as reductions in grade repetition. It is worth emphasizing that the initial gains in test scores were the same for whites and blacks--thus, the real difference was not in the initial impact of the Head Start program but in what happened to the children after they left.

In conjunction with Reynold's work and with evidence that Head Start children often go on to attend poor schools (Lee and Loeb, 1995; Currie and Thomas, 1999) these results suggest that fade out may be due not to deficiencies in the Head Start program but to problems of subsequent school quality. Currie and Thomas (2000) find that black children who attended Head Start go on to attend schools of lower quality than other black children. However, the same is not true among whites. Thus, poor school quality offers a potential explanation for fade out of Head Start effects among black children.

We are not aware of any published study that follows Head Start participants into adulthood. Indeed, it may be extremely difficult to design such a study using random assignment given the fact that one would have to rely on the cooperation of parents and subjects over a very long time period. One possible alternative is to use retrospective information about Head Start participation collected from individuals participating in existing large-scale, publicly funded, long-term studies such as the

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offered the treatment for two years to those in schools that offered it for three.

Panel Study of Income Dynamics. However, the use of retrospective data raises additional problems regarding the accuracy of people's recollections. In work in progress, Garces, Thomas, and Currie (1999) are using retrospective data about the Head Start participation of young adults who have been tracked since childhood as part of the PSID. A supplement fielded in 1995 asked whether these people had participated in Head Start as children. Preliminary analyses of these data show that Head Start participants were very disadvantaged relative to other children. Yet, they showed rates of college attendance similar to those of children who had attended other preschools. Once all of the observable characteristics of the children were controlled for, (such as maternal and paternal education, and family income), both groups were 5% more likely to attend college than children who had attended no preschool.

The evidence in support of favorable long-term effects of public programs is much less conclusive than the evidence showing positive effects of model programs. The Advisory Committee on Head Start Research and Evaluation has recently recommended that the Department of Health and Human Services conduct an evaluation that relies on random assignment of children in sites in which funds are insufficient to serve all eligible children.[12] That is, if some children are to be denied access to services in any case, the committee recommends that this be done randomly so that the effect of the Head Start "treatment" can be rigorously assessed. The evaluations are to focus on the intermediate outcome of school readiness. Longer-term follow-up of treated children would be very useful, but raises many technical problems to do with tracking individuals over long periods of time.

5. Getting Inside the Black Box of Program Design

[12] The report is available on the web at www.acf.dhhs.gov/programs/hsreac/oct99/textrpt.htm.

As discussed above, randomized trials can tell us whether or not a program works, without telling us a great deal about exactly *how* it works. The evidence summarized above suggests that some model programs have had significant positive effects on child outcomes over both the short and long-term, and that publicly-funded programs like Head Start can also be effective. This section discusses what we can learn from existing studies about the specifics of good program design. The issues that are discussed below include how the program should be targeted, how we can determine whether the program is of high quality, and whether there is an optimal age for intervention.

a) Are the Benefits of Early Intervention Greater for More Disadvantaged Children?

Questions of fairness inevitably arise when the government provides services to some groups and not others. If the government were to provide an enriched child care experience to all poor children who desired it (as it would if Head Start were fully funded), it would raise the question of whether it was legitimate to exclude near-poor children who could also benefit. Thus, an important question for policy makers seeking to know "where to draw the line" is whether the benefits of early intervention are greater for more disadvantaged children.

Unfortunately, it is difficult to answer this question conclusively given the available information. The answer is also likely to depend on exactly what dimension of disadvantage is being targeted (e.g. children of low birthweight, children from poor families, or children from historically underprivileged groups). However, a tentative answer is "yes."

All of the children in the Carolina Abcedarian project were deemed to be at risk of mental retardation. Within this group, the investigators found positive effects that were twice as large for the most disadvantaged children as they were for the other children. The Infant Health and

Development Project discussed in Table 1 took low birthweight children between 12 and 36 months and placed them in an enriched full-day child care setting. This intervention found positive effects on math scores only for a group of relatively high birthweight children within their low birthweight sample. But within this group, it was the children of the poorest and least educated mothers who gained most.

Currie and Thomas (1999b) find that gains in test scores associated with Head Start are greater for Hispanic children than for non-Hispanic whites. Since Hispanic children suffer disproportionately from poverty and may also face language barriers, it is interesting to try to separate out these two aspects of disadvantage. Currie and Thomas found that among first-generation children, the effects of Head Start were largest among children of mothers who had been interviewed in Spanish, suggesting that at least some of the positive effect of the program was due to increased preschool exposure to "mainstream" language.

b) Are the Benefits of Quality Child Care Greater for More Disadvantaged Children?

Evidence from broader studies of child care quality is also relevant to the discussion of whether early intervention programs should be targeted to disadvantaged children. For example, the Cost, Quality, and Outcomes (CQO) study surveyed children and staff in 401 centers in 4 states, and has followed them through second grade. This study found that higher quality care was associated with more positive cognitive and social outcomes, and that these effects were greatest for children whose mothers had the least education (Cost, Quality and Child Outcomes Study Team, 1995, 1999).

The National Institutes of Child Health and Human Development Study of Early Child Care is following 1,364 children in 10 sites around the country and has found that low quality care is

associated with "insecure attachment" of children to their mothers, but only among children whose mothers are less sensitive to their needs to begin with (NICHD early Child Care Research Network, 1999a). Insecure attachment of children to their mothers is of interest because it has been associated with future behavior problems and with a lower willingness of children to explore their environments. At a biochemical level, insecurely attached infants exhibit higher cortisol levels in response to stressful events, which may lead to permanent changes in the brain, as discussed above (Nachmias, 1996; Gunnar, 1996).

These observational studies of child care quality could not fully control for the fact that children are not randomly assigned to centers of different quality. Chances are strong that children in poor quality child care are also disadvantaged in other unobserved respects.[13] Children who suffer disadvantages such as low income, but manage to attend centers of relatively high quality may also enjoy other advantages that are not observed by the researchers, such as parents who place a high value on education. Thus, inferences from these studies should be viewed with some caution.

Finally, we can draw on evidence from other countries. For example, a study of a national sample of 20,000 6th graders conducted by the French government in 1980 found that those who had attended preschool were less likely to have repeated grades. Moreover, the difference in retention rates between children whose fathers were in the highest occupational category (professionals) and those whose fathers were in the lowest category (unskilled manual workers) was 30% among children who had attended preschool for one year, compared to 24% among children who had attended preschool for three years (McMahan, 1992). Canadian and British studies cited

[13] Researchers in the CQO study controlled only for maternal education, gender, and ethnicity, while researchers in the NICHD study were able to control for a broader array of observable characteristics.

by Boocock (1995) also found some evidence of larger effects of preschool among more disadvantaged children.

These disparate findings suggest that, where budgets are limited, it is appropriate to target early intervention to the most disadvantaged children. They also suggest that factors such as being at risk of abuse or neglect, lack of maternal education, and limited English-language proficiency should be taken into account when defining "disadvantage" rather than focusing only on family income. Finally, while disadvantaged children may benefit disproportionately from high quality care, they also appear to suffer disproportionately from exposure to low quality care.

c) What is a Quality Preschool Program?

Although there are several different scales for assessing child care/preschool quality, assessments generally have two components, one that evaluates "structure" and one that evaluates "classroom process." Structure refers to such easily measurable attributes as the teacher/pupil ratio, class size, and teacher/administrator background and experience.[14] Classroom process refers to less easily quantifiable qualities such as the nature of teacher/child interactions, the layout of classroom materials, and whether the activities are "developmentally appropriate."

Perhaps unsurprisingly, the two types of measures tend to be correlated. The NICHD Study of Early Child Care found that child care situations with better "structures" (e.g. safer, cleaner, more stimulating environments and better child-staff ratios) also tended to be better in terms of "classroom process" (e.g. care givers who were more sensitive and provided more cognitively

[14] For example, the Early Childhood Environment Rating Scale, Revised Edition, consists of 43 items including ratings of interactions between children and staff, interactions among children and discipline; curriculum items such as teaching of numbers; health and safety items; ratings of space and furnishing; and ratings of personal care routines. See www.fpg.unc.edu/~ecers/ratingscales.html.

stimulating care).[15] However, the NICHD study found that the combination of family income, maternal vocabulary, home environment and maternal cognitive stimulation were stronger predictors of children's behavior problems and cognitive development than any characteristics of the child care they were in (NICHD Early Child Care Research Network, 1998, forthcoming). Children in high quality centers have fewer behavior problems and better cognitive and language development than children in poorer centers, but it is not clear to what extent this is due to unobserved aspects of family background which are associated with being placed in higher quality care.

d) Is Head Start a Quality Program?

One of the most interesting findings of the FACES study is that Head Start centers have been found to be of higher quality on average than other preschool programs (Resnick and Zill), though they are of lower quality than the model preschool programs discussed above (Frede, 1995). This relatively favorable ranking of Head Start is perhaps unsurprising given that most child care centers are rated as poor or mediocre in quality by child care experts, and that these experts find that parents are often unable to distinguish good from poor quality centers (Helburn and Howes, 1995; U.S. DHHS, 1998).

The better than average rating of Head Start centers in the FACES study appears to reflect the fact that there are very few really bad Head Start programs. An earlier study funded by the U.S. Dept. of Education found the same thing (U.S. Dept. of Education, 1993). In contrast, the Cost, Quality, and Outcomes study found that 11% of the sites they surveyed offered care that did not meet minimum levels of quality (Cost, Quality and Outcomes Study Team, 1999).

[15] NICHD Early Child Care Research Network (1999b).

However, the quality of Head Start is not uniform. For example, the FACES study found that Head Start classroom quality was higher in programs with higher family incomes, and in those with fewer minority families. Zigler and Styfco (1994) argue that funds are insufficient to allow for meaningful enforcement of Head Start program standards, which may be one reason for the variation in quality. Still, it is interesting that the mere existence of these standards seems to be sufficient to guarantee a minimum level of quality higher than the minimum observed in the private sector.

e) What is the Importance of an Academically Oriented Curriculum?

Head Start program standards have been criticized as inadequate because they do not lay out an academically oriented curriculum (c.f. Ravitch, 1998). The FACES study found that most soon-to-be graduates of Head Start could not yet identify most letters of the alphabet, or write letters of the alphabet on request. Zill, Resnick, and McKey (undated) point out that this is probably because these skills are not emphasized by Head Start teachers. Recall that, as discussed above, most kindergarten teachers did not think it particularly important that children arrive at school with these skills. Thus, rightly or wrongly, the Head Start teachers are in step with the majority opinion among preschool educators on this point.

U.S. studies have found little proof that the type of curriculum matters. Frede (1995) summarizes this literature and argues that the commonalties between the different types of curricula in effect may be more important than the differences. Most preschool programs expose children to learning in ways that are similar to formal schools (i.e. as a class and in small groups as well as in individual interactions with a teacher). Most programs also place a strong emphasis on language, and encourage children to use language to express themselves. Classroom materials and activities

usually involve concepts such as shapes, colors, sizes, numbers and so on. Boocock (1995) cites evidence from several international studies which concluded that preschool experiences *per se* had a bigger effect on outcomes than curriculum, as long as the care was of sufficient quality in other respects. What has been found to matter is not the content of the curriculum *per se*, but the manner of relating to the children. In general, didactic teaching methods and punitive strategies for dealing with children are associated with less favorable outcomes (Phillips and Stipek, 1993). There is no inherent link between the content of the curriculum and the instructional approach, however.

f) Cultural Variation in the Concept of Child Care Quality

There is some evidence that the concept of child care quality is culturally determined. For example, American experts value interactions and activities that foster a child's individuality, while in Japan (where most children attend preschool) teachers strive to instill respect for the group (Boocock, 1995). In French *ecoles maternelles*, young children follow a predominantly academic curriculum in groups of 25 to 35 students, which are very large relative to what is recommended by American quality guidelines.

It is interesting to speculate on how the *ecoles maternelles*, which are highly regarded by many observers, would rate on American quality scales. The large group sizes and structured curriculum presumably make it difficult for teachers to be very responsive to individual students. One study of seven day care centers in France and Hungary found that cortisol levels were positively correlated with group size and higher child/staff ratios (Legendre and Kortinus, 1996). On the other hand, the teachers in the *ecoles maternelles* are highly trained and paid on the same scale as elementary school teachers. Both higher pay and better training have been associated with higher quality care in American studies.

g) Regulation of Child Care Quality

The available evidence suggests that the most important aspect of quality is the nature of the interaction between the teacher and the child, which is difficult to regulate. However, small group sizes, better teacher training, and other regulable aspects of quality all make such interactions more likely. Even rather loose regulation of these observable aspects of quality by Head Start has been shown to be effective in eliminating poor quality programs.

This observation does not necessarily mean that it would be beneficial to regulate private sector child care more closely, however. In the absence of increased public provision of child care, increased regulation of private child care centers could drive up costs, which could have the paradoxical effect of pushing more children into unregulated informal care arrangements (Hotz and Kilburn, 1996).

h) Is there an Optimal Age for Intervention?

Many observers draw on brain science to argue that the period between birth and 3 years deserves special attention. However, as discussed above, the science does not seem to be sufficiently well developed to justify targeting scarce resources primarily to children in this age group. In fact, some experts believe that in order to have any effect, intervention must be continued at least into the early grades.

As discussed above, the design of the Carolina Abcedarian project allowed researchers to assess the separate effects of the birth to 5 intervention, and the subsequent intervention at school age. Campbell and Ramey (1994, 1995) find that the intervention from birth to 5 was much more effective than the later intervention. However, one cannot infer from this result that it was the 0 to 3

part of the intervention that was critical. On the other hand, the Infant Health and Development Project, which treated children with center-based care from 12 to 36 months, had no effect on grade repetition or special education (by age 8) although it did have a positive effect on mathematics scores among the "heavier" low birthweight babies, as noted previously.

Evaluations of the Chicago Child-Parent Centers suggest that following up on a Head Start-like intervention into the early grades has a more positive effect than Head Start alone, while on the other hand, the Perry Preschool Project produced dramatic effects with only a two-year preschool intervention of high quality.

These conflicting results suggest that it may be more important to worry about the quality of the intervention, than about the exact timing of it. Quality is of particular concern given that in most cases, the alternative to high quality preschool experience is not home care, but lower quality child care. The NICHD Early Child Care Study found that most infants were placed in some sort of non-maternal care by 4 months of age (NICHD Early Childcare Research Network, 1997).

The available evidence does not allow us to conclusively identify any optimal age for intervention. It does suggest however, that we should be wary of claims that a short intervention delivered at any particular age is a "magic bullet" that can greatly reduce the effects of a lifetime of deprivation.

6. The Costs and Benefits of Early Intervention

An unfortunate feature of most studies of early intervention programs is that they do not report measures of costs and benefits. The Perry Preschool Project is an important exception to this rule, and analyses of these data have been widely quoted to argue that early interventions can pay for themselves in terms of reduced costs to society later on. For example, a New York State Board

of Regent's background paper in support of expanded early childhood education services states that "Investing $1 in quality early education saves $7 by reducing later grade retention and special education placement and increasing high school graduation rates" (NY Board of Regents, 1993, page 2).

a) Limitations of Cost-Benefit Analysis

Besides the obvious caveat that the Perry Preschool is not representative of the average early intervention program, there are other problems involved in taking the dollar figure produced by a particular cost-benefit study and applying it more generally. First, cost-benefit calculations are generally sensitive to the assumptions underlying them. For example, since the costs of the program are borne "up front" while some of the benefits appear only later, the rate at which society is willing to tradeoff future benefits for current benefits (the discount rate) will affect the estimated value of the benefit.

Similarly, benefits may appear larger or smaller depending on what is counted. For example, benefits due to child care provision may or may not be included. Other categories of benefits that have been included in cost-benefit studies are reductions in criminal activity and welfare use, and the value of providing job-training to parents who become Head Start teachers. In fact, the existing analyses of Perry Preschool do not attempt to put a dollar value on all of the benefits of the program. They focus on the narrower question of whether the program produced cost savings to government.[16] A complete cost/benefit analysis would consider not only whether all of the benefits of a particular program were greater than its costs, but also whether the benefits of a

[16] See Karoly *et al*. for a re-examination of the costs and benefits of Perry Preschool and for a fuller discussion of the issues involved in making these calculations.

particular program were greater than those of alternative programs aimed at improving child outcomes (such as Temporary Assistance for Needy Families).

A final caveat is that it is risky to extrapolate from studies conducted 20 or 30 years ago to those in effect today, especially considering that the problems of the children served (single-parenthood, parental drug use, neighborhood crime) are now more severe. The meaning of outcomes such as grade repetition may also have changed over time, if as some critics charge, practices such as social promotion have become more common in American schools. Clearly, cost/benefit analysis should not be regarded as an exact science.

b) Some Illustrative Cost-Benefit Calculations for Head Start

These caveats notwithstanding, some "back-of-the envelope" cost/benefit calculations for Head Start are presented in Tables 3. One of the questions that has been addressed in this essay is whether the Head Start program has long-term benefits. A point that is often lost in the controversy over whether there are long-term benefits of Head Start is that there are many well-documented short-term benefits. Depending on precisely which benefits are counted and on how we value them, it can be shown that the short and medium-term benefits of Head Start already pay back much of the cost of the program.

The first panel of Table 3 presents an estimate of the cost of sending 1,000 children to a regular part-day, part-year Head Start program for two years. Perhaps surprisingly, there is some controversy even over this number. The federal costs per child are published annually by the Administration on Children, Youth, and Families. However, the program guidelines require some matching by local Head Start agencies. Often this match is in kind, so it is not clear what dollar value should be attached to it. Following Barnett (1998), I assume that the local match is worth

20% of what is spent by the federal government. Similarly, Head Start may increase participation in other programs such as Medicaid and the Child and Adult Care Food Program (which subsidizes meals and snacks for children in day care). It is difficult to estimate these costs without knowing what participation in these programs would have been in the absence of Head Start. Moreover, if one wishes to compare Head Start to another child care program, these costs may net out because the other child care program may also increase expenditures under other programs.

These costs can be compared to estimates of the value of short, medium, and long-term benefits of Head Start. By short-term benefits, I mean those that accrue to children and families while they participate in the program. Short-term benefits in terms of the improved health and well-being of both children and their families may be substantial, although it is difficult to place a dollar amount on them. Children benefit from improved health and nutrition, and from being in a safe and nurturing environment. Benasich, Brooks-Gunn and Clewell (1992) show that mothers can also benefit from early intervention programs in terms of measures such as self-esteem, mental health, parenting skills, and even employment.

In this era of welfare reform, in which mothers of young children are generally expected to work, it is worth stating the obvious fact that Head Start also provides child care. Table 3 provides two different valuations of the child care provided by Head Start. The first uses the hourly cost of "mediocre" child care. The Cost, Quality, and Outcomes study reported that the average cost of providing "mediocre" care was $2.11 per child per hour, which implies an annual value of $1,435 per child for the part-day, part-year care provided by Head Start.[17] Valued this way, the child-care

[17] Child Care Quality and Outcomes Study Team, 1995, page 44. This figure is for "expended" costs. The study team argues that some of the cost of child care is "hidden" primarily in the form of "foregone wages" of child care workers. That is, if child care workers were paid higher wages, costs would be somewhat larger. However, the expended costs seem closer conceptually to the market price for child care.

benefit provided by Head Start pays back 23% of the federal and local cost of providing the program. Note that while I am ignoring costs to other programs in this calculation, I am also ignoring benefits accruing from improved health and nutrition.[18]

As discussed above, the ACYF estimates that Head Start could be converted to a full-day, full-year program at a cost of approximately $9,000 per child, per year. Thus, if we continue to assume a 20% local match, the cost of sending 1,000 children to Head Start for two years would rise to $21,085,715. The short-term benefits of Head Start in terms of child care provided would also rise. If we use the $2.11 per child per hour figure, they would rise to $9,269,905 and the child care benefit alone would account for 44% of the cost of the Head Start program.[19]

A second way to value the child care provided by Head Start is to use the amount that employed mothers actually spend. Blau (2000) reports that in 1993, the average employed mother spent $80.57 (1999 dollars) per week on child care, if she makes any payment. At this rate, and assuming that most mother's work full-time, the child care provided by a full-day, full-year Head Start would be worth $4,029 per child, per year. However, only 55.6% of employed mothers of preschool children report making payments for child care, so this number overstates willingness to pay. Still, care provided free by relatives or friends is not worthless, so the value of child care must lie between $2,240 (55.6% of $4,029) and $4,029. These figures imply that the child care provided by a full-day Head Start program would pay back 21 to 37% of the costs of the program.

The third panel of the table extrapolates from some of the work discussed above to estimate "medium-term" benefits of Head Start in terms of the prevention of special education and grade repetition. Many of the studies listed in Table 2 suggest that Head Start can prevent children from

[18] Presumably, programs such as Medicaid exist because people feel that the benefits in terms of improved child health are worth the costs of the program.

[19] The calculation is $2.11 x 45 hours per week x 50 weeks x 1000 children x 2 years, where the

being placed in the special education track. Since special education is substantially more expensive than regular schooling, and since children who enter special education are likely to stay in that track, the potential cost savings are great, and account for approximately 15% of the federal and local costs of Head Start. Preventing grade repetition generates much smaller savings, since I assume that only an extra additional year of schooling is involved, and that only 60% of the children actually benefit from reductions in the rate of grade repetition.[20]

The literature suggests that there may be other medium-term and longer-term benefits to Head Start. For example, a more positive attitude towards schooling on the part of the child could lead to higher ultimate schooling attainment and wages even if it has no immediate effect on test scores. The rosiest scenario is one in which Head Start has positive long-term effects similar to those of Perry Preschool including increases in wages and tax payments, and decreases in crime and teen pregnancy. For example, Barnett (1993) values the benefits of Perry Preschool in terms of increased tax payments to government and reductions in welfare payments at about $29,326 (1999 dollars) per child. Given the short and medium-term benefits discussed above, Head Start would pay for itself if it yielded long-term benefits that were even a quarter as large as those of Perry Preschool.

7. Conclusions

It is disappointing that numerous studies have not produced more consistent evidence of the long-term effectiveness (or lack of effectiveness) of early intervention. However, all studies are not created equal, and better studies tend to find larger and more significant effects of early intervention

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second year is discounted at 5%.

[20] Recall that Currie and Thomas (1995) did not find effects on grade repetition for black Head Start children.

programs. Moreover, the shorter-term benefits of programs like Head Start should not be forgotten, particularly in this era of welfare reform when most mothers of young children are expected to work. Estimates discussed above suggest that these shorter term benefits could easily offset 40 to 60% of the costs of the Head Start program.

The existing literature also provides some guidelines for program design. Specifically, it suggests that while it may be useful to intervene before 3 years old, interventions for preschool and for school age children can also be effective. Thus, the first three years should not be emphasized at the expense of interventions aimed at older children. Second, the effects of early intervention have often been found to be larger for more disadvantaged children, which provides a rationale for targeting such programs to these children. In addition to focusing on low-income children, it might be useful to target other aspects of disadvantage, such as lack of maternal education. Third, the most important aspect of quality is likely to be the nature of the interaction between the teacher and the child. Small group sizes, better teacher training, and other regulable aspects of quality all make such interactions more likely. Moreover, even rather loose regulation of these observable aspects of quality by Head Start has been shown to be effective in eliminating poor quality programs.

These considerations suggest that it would be good public policy to fully fund Head Start so that all poor children could participate, and to extend it to be a full-day, full-year program. It might also be a good idea to extend eligibility to some groups of children who are not poor, such as those at risk of abuse or neglect; children of high school dropouts; and children with limited English language proficiency.

The available evidence sheds less light on the wisdom of establishing a universal public preschool program. Such a program would provide a large child care subsidy to many middle-class as well as lower income families, rather than targeting benefits primarily towards the neediest

children. However, such a program might enjoy greater popular support than one targeted only to needy children. Opponents of universal preschool programs point out that public school systems are struggling to meet their current educational mandates, and are ill-equipped to extend their mission to preschool (c.f. Olsen, 1999). The success of Head Start offers an alternative vision for the establishment of a universal preschool program which is separate from the public school system, and subject to federal oversight.

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Table 1. Model Early Childhood Programs[a]

Program Name[b]	Program Description	Age of Participation	Sample Size[c]	Outcomes[d]
Carolina Abecedarian (Campbell & Ramey (1994)) (Campbell et al (unpublished))	Preschoolers: full-day child care School age: parent program (randomized)	Entry 6 weeks to 3 months Exit: 5 to 8 years	Initial: T=57, C=54 Age 8: T=48, C=42 Age 15: T=48, C=44 Age 21: T=53, C=51	IQ: T>C at age 12, T=C at age 15 Achievement tests: T>C at ages 8, 15, 21 Special education: T<C at age 15 Grade retention: T<C at age 15 School dropout: T<C at age 21 College attendance: T>C at age 21 Employment status: T=C at age 21 Average age first child born: T>C at age 21
Houston Parent Child Development Center (Johnson and Walker (1991))[e]	Home visits Full-day child care Center-based program for parents (randomized)	Entry: 1 to 3 years Exit: 3 to 5 years	Initial: T=97, C=119 Grades 2 to 5: T=50, C=87	Achievement tests: T=C Grades: T=C Bilingual education: T<C Special education: T=C Grade retention: T=C
Infant Health and Development Project (McCarton et al (1997))[f]	Home visits Full-day child care (randomized)	Entry: birth (home visits) 1 year (care) Exit: 3 years	Initial: T=377, C=608 Age 8: T=336, C=538	IQ: T>C ages 3,5,8 Behavioral problems: T<C ages 3,5; T=C age 8 Math achievement: T>C age 8 Grade retention: T=C age 8 Special education: T=C age 8 General health: T=C age 8
Florida Parent Education Program (Jester & Guinagh (1983))	Home visits Twice weekly part-day preschool (ages 2 to 3 years) (not randomized)	Entry: 3 to 24 months Exit: 3 years	Initial: T=288, C=109 Grades 4 to 7: T=83, C=24	IQ: T=C Math achievement: T>C Reading achievement: T=C Special education: T<C Grade retention: T=C
Milwaukee Project (Garber (1988))	Full-day child care Job and academic training for mothers (randomized)	Entry: 3 to 6 months Exit: 5 years	Initial: T=20, C=20 Grade 4,8: T=17, C=18	IQ: T>C at grade 8 Achievement tests: T=C Grades: T=C Special education:T=C Grade retention: T=C
Syracuse Family Development Research Program (Lally et al (1988))	Home visits Full-day child care (not randomized)	Entry: 6 months Exit: 5 years	Initial: T=82, C=72 Parents: T=52, C=42 Children: T=49, C=39 (grades 7 to 8)	IQ: T=C at age 5 Teacher ratings: T>C (girls only) Grades: T>C (girls only) Attendance: T>C (girls only)
Yale Child Welfare Program (Seitz and Apfel (1994))[e]	Home visits Full-day child care Pediatric Care Developmental Screenings (not randomized)	Entry: Prenatal Exit: 30 months	Initial: T=18, C=18 Age 7 to 8: T=17, C1=33, C2=31 Age 10: T=16, C=16	IQ: T=C at age 10 Achievement tests: T=C Attendance: T>C Teacher ratings: T=C Special education:T=C
Curriculum Comparison Study (Miller & Bizzell (1984))[e]	Part-day preschool program Kindergarten program (not randomized)	Entry: 4 years Exit: 5 or 6 years	Initial: T=244, C=68 Post High School: T=168, C=51	Special education:T=C, grade 12 Grade retention: T=C, grade 12 High school graduation: T=C
Early Training Project (Gray et al (1983))	Home visits Summer part-day preschool program (randomized)	Entry: 4 to 5 years Exit: 6 years	Initial: T=44, C=21 Post High School: T=36, C=16	IQ: T=C at age 17 Achievement tests: T=C Special education:T<C, grade 12 Grade retention: T=C High school graduation: T=C
Experimental Variation of Head Start (Karnes et al (1983))	Preschool program (not randomized)	Entry: 4 years Exit: 5 years	Initial: T=116, C=24 Post High School: T=102, C=19	IQ: T>C at age 13 Achievement tests: T=C Special education:T=C, grade 7 Grade retention: T=C, grade 7
Harlem Training Project (Palmer (1983))	One-to-one tutoring or child-directed play (not randomized)	Entry: 2 to 3 years Exit: 4 years	Initial: T=244, C=68 Post High School: T=168, C=51	IQ: T=C at age 12 Math achievement: T>C Reading achievement: T<C Grade retention: T<C, grade 7
High/Scope Perry Preschool Project (Schweinhart et al (1993))[f]	Home visits Preschool program (randomized)	Entry: 3 to 4 years Exit: 5 years	Initial: T=58, C=65 Age 27: T=58, C=63	IQ: T>C at ages 5,7; T=C at ages 8,14 Achievement tests: T>C at ages 9,14 High school GPA: T>C Special education:T=C, grade 12 Grade retention: T=C, grade 12 High school graduation: T>C Postsecondary education: T=C age 27 Arrests: T<C at age 27 Employment: T>C age 19, T=C age 27 Monthly earnings: T>C at age 27 Receive public assistance: T<C age 27 Teen pregnancies: T=C at age 19
Howard University Project (Herzog et al (1974))	Preschool Program (not randomized)	Entry: 3 years Exit: 5 years	Initial: T=38, C=69 Grade 4: T=30, C=69	Grade retention: T=C
Institute for Developmental Studies (Deutsch et al (1983))	Home visits Part-day preschool program Parent center school (K-3) (randomized)	Entry: 4 years Exit: 9 years	Initial: T=312, C=191 Grade 7: T=63, C=34	Special education:T=C Grade retention: T=C
Philadelphia Project (Beller (1983))	Home visits Part-day preschool program (not randomized)	Entry: 4 years Exit: 5 years	Initial: T=60, C=53 Post High School: T=44, C=37	IQ: T>C at age 10 Achievement tests: T=C Special education:T=C, grade 12 Grade retention: T=C, grade 12
Project Carolina Approach to Responsive Education (Wasik et al (1990))[f]	Home visits and full-day child care (T1) Home visits (T2) (not randomized)	Entry: 4 weeks (home visits) 6 weeks to 3 months (care) Exit: 5 years	Initial: T1=17, T2=25, C=23 Age 5: T1=14, T2=23, C=22	IQ: T1>T2, T1>C ages 1,3 T1>T2,T1=C age 5

Notes

[a]See Barnett and Karoly et al for more detailed information about studies described in this table.

[b]Programs are grouped such that those enrolling children younger than three years old appear first, followed by those enrolling children after age three.

[c]Throughout the table, 'T' refers to treatment group and 'C' refers to control or comparison group.

[d]Outcomes listed as T>C or C>T were statistically significant at the 5% level.

[e]Most recent published document. See Barnett for description of other studies

[f]Most recent published document. See Karoly for description of other studies

Table 2. Large-Scale Public Early Childhood Programs[a,b]

Program Name[c]	Study Design	Age of Participation	Sample Size[d]	Outcomes[e]
Chicago Child-Parent Center and Expansion Program (Fuerst & Fuerst (1993))	Compared former CPC children with non-CPC children from same feeder schools	Entry: 3 to 4 years Exit: 9 years	Initial: T=684, C=304 Post High School: T=513, C=244	Achievement tests: T>C grade 2, T=C grade 8 High school graduation: T>C
Chicago Child-Parent Center and Expansion Program (Reynolds et al (2000)) (Temple et al (2000))	Compared former CPC children with similarly poor children eligible for CPC but it was not offered in neighborhood	Entry: 3 to 4 years Exit: 9 years	T=837, C=444	School dropout: T<C at age 20 High school completion: T>C at age 20 Delinquency and crime: T<C at age 17 Grade retention: T<C at age 15 Special education: T<C at age 18 Proficiency skills test: T>C at ages 14/15
Cincinnati Title I Preschool (Nieman & Gaithright (1981))	Compared full-day kindergarten and mostly preschool to half-day kindergarten and mostly no preschool	Entry: 4 or 5 years Exit: 6 years	Initial: T=688, C=524 Grade 8: T=410, C=141	Achievement tests: T>C grades 1,5,8 Special education: T=C grade 8 Grade retention: T=C grade 8
Maryland Extended Elementary Pre-K (Eckroade et al (1988))[g]	Compared attenders to nonattenders at grade 8	Entry: 4 years Exit: 5 years	T=356, C=306	Achievement tests: T>C grades 3,5,8 Special Education: T<C age 8 Grade retention: T<C age 8
New York State Experimental Prekindergarten (State Education Dept. (1982))	Compared attenders with children in same district on waiting list and with other districts with no Pre-K program	Entry: 3 or 4 years Exit: 5 years	Initial: T=1800, no control Grade 3: T=1348, C=258	Achievement tests: T>C in K, T=C in grade 1 Special education: T=C Grade retention: T<C
Detroit Head Start and Title I Preschool (Clark (1979))	Compared attenders with those eligible but did not attend at grade 4	Entry: 4 years Exit: 5 years	unknown, unpublished document	Achievement tests: T>C in grade 4
DC Public Schools and Head Start (Marcon (1993))	Compared kindergartners who attended with those who did not attend	Entry: 4 years Exit: 5 years	Initial: T=372, C=89 Grades 4 and 5: varies	Achievement tests: T=C in grades 3 to 5 Special education: T=C grade 4 Grade retention: T=C grade 4
Florida Learn to Learn and Head Start (Sprigle & Schaefer (1985))	Compared at age 4 attenders with nonattenders	Entry: 4 years Exit: 5 years	Initial: T=45, C=45 Grade 6: T=44, C=39	Achievement tests: T=C Special education: T=C Grade retention: T=C
Philadelphia School District Get Set and Head Start (Copple et al (1987))	Compared children in enriched K-3 program who had and had not attended	Entry: 4 years Exit: 5 years	Initial: T=1082, C=1615 Grades 4 to 8: T=688, C=524	Achievement tests: T=C Grade retention: T<C School absence: T<C
Seattle DISTAR and Head Start (Evans (1985))	Compared attenders with matched children from same school and grades	Entry: 4 years Exit: 5 years	Initial: T=92, no control Grades 6 & 8: T=44, C=20	Achievement tests: T=C
Cincinnati Head Start (Pinkleton (1976))	Compared attenders with nonattenders at third grade	Entry: 4 years Exit: 5 years	unknown, unpublished document	Achievement tests: T=C
Detroit Head Start (O'Piela (1976))	Compared attenders with children in Title I elementary programs at grade 4.	Entry: 4 years Exit: 5 years	unknown, unpublished document	Achievement tests: T>C
ETS Longitudinal Study of Head Start (Lee et al (1990))[g]	Compared attenders with children who attended other or no preschools at grade 3	Entry: 4 years Exit: 5 years	T=333, C=313	Achievement tests: T>C grade 1; T=C in grades 2,3
Hartford Head Start (Goodstein (1975))	Compared attenders with nonattenders	Entry: 4 years Exit: 5 years	Initial: T=293, no control Grade 6: T=148, C=50	Achievement tests: T=C Special education: T=C Grade retention: T<C
Head Start Family and Child Experiences Survey (Zill et al (1998))	Studied gains made by Head Start children at age 4 or older	Entry: 3-4 years Exit: 4-5 years	T=1580, no control	Achievement tests: T>C Other gains cannot be compared to any control
Kanawha County, WV Head Start (Kanawha Board of Ed (1978))	Compared attenders with low-income nonattenders at grade 3	Entry: 4 years Exit: 5 years	unknown, unpublished document	Achievement tests: T=C
Montgomery County, MD Head Start (Hebbler (1985))	Compared attenders of 8 or 9 months to attenders <= 1 month	Entry: 4 years Exit: 5 years	Initial: T=1915, C=619 Grade 11: T=186, C=112	Achievement tests: T=C most grades, T>C grade 11
NLSCM Head Start (Currie & Thomas (1995, 1999))	Compared difference between attended and nonattended siblings with difference between preschool and nonpreschool siblings at various grades	Entry: 3 to 5 years Exit: 5 to 6 years	T=896, C=911 Hispanic study: T=182, C=568	Achievement tests: T>C (whites only) Grade retention: T>C (whites only) Immunization rates: T>C Child height-for-age: T=C Achievement tests: T>C (hispanics only) Grade retention: T>C (hispanics only)
New Haven Head Start (Abelson et al (1974))[g]	Compared attenders with nonattenders	Entry: 4 years Exit: 5 years	Initial: T=61, C=48 Grade 3: T=35, C=26	Achievement tests: T>C grade 1; T=C grade 3 Grade retention: T<C
PSID Head Start (Garces et al (1999))	Compared Head Start participants to non participants between ages 18 and 31.	Entry: 3-4 years	T=583, C=3502	Grade retention: T=C High school graduation: T=C Teen pregnancy T=C Welfare T=C Arrests T<C College T>C
Pennsylvania Head Start (Reedy)	Compared attenders with nonattenders who were rejected	Entry: 3 to 5 years Exit: 5 to 6 years	Initial: T=98, no control Grade 3: T=54, C=18	Achievement tests: T=C
Rome, Georgia Head Start (McDonald & Monroe (1981))	Compared attenders with with nonattenders in first grade in disadvantaged schools	Entry: 5 years Exit: 6 years	Initial: T=130, C=88 Post High School: T=94, C=60	Achievement tests: T>C grade 5; T=C grades 6+ Special Education: T<C Grade retention: T=C
Westinghouse National Evaluation of Head Start (Westinghouse Learning Corporation (1969))	Compared attenders with nonattenders at grades 1 to 3	Entry: 4 or 5 years Exit: 5 or 6 years	T=1988, C=1992	Achievement tests: T>C grade 1; T=C grades 2,3

Notes

[a]See Barnett and Karoly et al for more detailed information about studies described in this table.

[b]None of these evaluations were randomized.

[c]Programs are grouped such that public school program studies are listed first, followed by program studies involving both public school programs and Head Start, and then Head Start studies.

[d]Throughout the table, 'T' refers to treatment group and 'C' refers to control or comparison group.

[e]Outcomes listed as T>C or C>T were statistically significant at the 5% level.

[g]Most recent published document. See Barnett for description of other studies

Table 3: The Costs and Benefits of Head Start[1]

Costs of sending 1,000 children to a regular part-day, part-year Head Start for two years:

Federal cost	$10,152,381 (5,200,000 + 5,200,000/1.05).
Local cost	$2,030,476 (assumes 20% local matching. Much local matching is in-kind, so the proper valuation of it may be unclear).
Costs to other programs (e.g. Medicaid and Child and Adult Care Food Program).	??
Short-Term Benefits	
Improved health and nutrition, prevention of abuse and neglect, benefits to other members of family including parents and siblings	??
Child Care I: (part-day, part-year valued at cost of "mediocre" child care)	$1,435 per child per year ($2.11 x 20 hours per week x 34 weeks per year). Total benefit=$2,801,667.
Child Care II: (full-day, full-year valued employed mother spends $80.57 per week conditional on spending children report making payments for child care).[2] Total benefit	Between $2240 and $4029 and per child per year (The average at mean of what employed mothers actually pay) anything, but only 55.6% of employed mothers of preschool between $4,373,033 and $7,866,143.
Medium-Term Benefits[3]	
Preventing special education.	Assumptions: rate of special education is approximately 12%, and is reduced by a similar amount as grade repetition. Thus, 28 fewer children are placed in special education. Special education costs approximately $8,000 per year more than regular education and once placed in this track, children are unlikely to rejoin the mainstream. Children are assumed to leave school after 11 years. Discount rate of 5%. Total cost saving=$1,855,245. (28 x $\{8000/(1.05)^3 + ... 8000/(1.05)^{14}\}$).
Preventing grade repetition.	Assumptions: rate of grade repetition is approximately 20% and is reduced by 28%. Thus, 56 fewer children (out of the 1,000) repeat a grade. Cost of a year of elementary education=$6,000. Most children who repeat, repeat kindergarten or first grade. Discount rate is 5%. 40% of children do not receive benefits in terms of prevention of grade repetition. Total cost saving=$174,149=$[.6*(56 x 6000/(1.05)^3]$.
Any other continuing benefits to children and families of getting off to a good start.	??
Long-Term Benefits	
Possible improvements in schooling attainment and wages, and reductions in crime, teen pregnancy, etc.	??

1 All costs and benefits are discounted to the time that the child was age 3, and are presented in 1999 dollars.

2 See Blau (2000).

3 Estimates of effects of Head Start on grade repetition are based on Currie and Thomas (1995). Currie and Thomas do not examine the probability of special education placement, but many of the studies listed in Table 2 do examine this. Estimates of the costs of special education and grade repetition, and of the number of children in special education are thanks to Caroline Minter Hoxby and Julie Berry Cullen.