

**DISCUSSION PAPER 111  
FEBRUARY 2007**

**CHILD INTERVENTIONS THAT MAY LEAD  
TO INCREASED ECONOMIC GROWTH**

Barbara Wolfe, PhD, University of Wisconsin-Madison  
Nathan Tefft, University of Wisconsin-Madison

**EARLY CHILDHOOD RESEARCH COLLABORATIVE**

<http://www.earlychildhoodrc.org>

The views expressed herein are those of the author(s) and do not necessarily reflect the views of the Early Childhood Research Collaborative.

University of Wisconsin-Madison research funded by The Pew Charitable Trusts, in collaboration with Robert Dugger and the Invest in Kids Working Group and by a grant from the National Institutes of Health under Ruth L. Kirschstein National Research Service Award T32 MH18029-20 from the National Institute of Mental Health.

©2006 by Barbara Wolfe and Nathan Tefft. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

## Child Interventions that May Lead to Increased Economic Growth

Barbara Wolfe and Nathan Tefft

ECRC Paper Series

February, 2007

### **ABSTRACT**

In this paper we seek to identify those childhood interventions that show real promise of positively influencing children's human capital accumulation. Next we explore the quality of existing research on these interventions; establish a set of quality standards that can be applied to evaluations of childhood interventions and finally focus on the extent to which research can link the interventions to economic growth.

Barbara Wolfe  
University of Wisconsin  
Department of Economics  
University of Wisconsin—Madison  
1180 Observatory Drive  
Madison, WI 53726-1393  
wolfe@lafollette.wisc.edu

Nathan Tefft  
Department of Economics  
University of Wisconsin, Madison  
1180 Observatory Drive  
Madison, WI 53706-1393  
nwtefft@wisc.edu

## **I. INTRODUCTION**

Interventions that both improve the economic future of today’s children and increase U.S. economic growth are a topic of increasing contemporary interest. The variety of such interventions—their nature, experimental design, and intended benefits—is extraordinary. In this article we first seek to identify those interventions that show real promise of positively influencing children’s human capital accumulation. We then explore the quality of existing research on these interventions, focusing in particular on whether the research can link the interventions to economic growth. We identify a small number of interventions that meet both criteria to some degree, and recommend these interventions to policy analysts interested in the extent to which future investment in such interventions may lead to economic growth and individual economic success. We find few CIs whose evaluation allows us to include them in this set. Based on this finding, we call attention to the need for better research designs in order for policy and decision makers to be able to make informed decisions that will lead to the replication of (only) successful programs and, ultimately, greater economic growth.

The criteria by which the interventions were selected include the quality of the experimental design, the breadth and duration of significant economic variables, and crucially, the relevance of these variables for macroeconomic analysis. This last criterion is important: to take advantage of existing theoretical frameworks, interventions must exhibit the characteristics for which these frameworks have been designed.

In seeking to cast as wide a net as possible we include examples from many different categories of programs. Restricting attention to a particular category, such as preschool or home visits, might ignore other programs that could yield relevant outcomes. We focus most of our attention on interventions targeted at younger children, “early childhood interventions” (ECIs),

because existing evidence suggests that they are the most promising. But we also consider programs targeted toward older children and adolescents; we refer to the broader class of interventions with the term “childhood interventions” (CIs). In this article we do not specifically limit our attention to programs that benefit disadvantaged children, although most of the currently implemented programs included in our review are in fact designed with this population in mind.

In section 2, we discuss other studies that have reviewed CIs, paying close attention to those that are relevant to economic growth. In section 3, we discuss why economic growth is an important issue for CIs, examine previous attempts at relating CI outcomes to human and health capital models, and provide a simple theoretical model of how this relationship might be estimated. From this type of model, the possible effects of particular CIs on economic growth might be calculated. Section 4 provides a discussion of the criteria used to select CIs for review. In Section 5, we review selected programs based on these criteria, and Section 6 offers concluding remarks. The interventions we find to be promising for economic growth are detailed in Tables 1 and 2.

## **II. PREVIOUS STUDIES**

Only in recent years have comprehensive, rigorous reviews of CIs been undertaken. We briefly characterize them here.

Karoly et al. (1998) reviewed programs that attempt to “overcome the cognitive, emotional, and resource limitations that may characterize the environments of disadvantaged children during the first several years of life,” outlining the estimated benefits and costs.

Barnett (1993,1995) reviewed a range of studies evaluating the benefits of various programs. His 1993 article focused on home visiting programs, in which professionals visit

homes with infants or very young children in order to provide both care and parental education, and noted specific cost-benefit analyses. His 1995 article broadened the review to include other types of CIs such as preschools, Head Start, and child care centers. In both studies the author paid attention to the long-term benefits of ECIs in particular.

Currie (2001) provided a thorough discussion of the issues surrounding educational interventions, again with particular attention to preschool programs. Specifically focusing on Head Start, the author showed that publicly funded CIs have displayed weaker positive effects than other model programs, often because the publicly funded programs have not undergone the same rigorous evaluations as the model programs. Currie argued that more thorough and rigorous evaluations are needed to determine the effectiveness of various educational CIs.

Aos et al. (2004) reviewed a substantial catalogue of CIs in all categories. Focusing on policy for the state of Washington, the authors discussed the merits of investing in CIs from the perspective of state funding and summarized estimated costs and benefits for the programs they included. The work is especially useful as a reference list for a large number of CI evaluations.

In another paper with a specific focus on state policy, Karoly and Bigelow (2005) asked whether a universal preschool program could be implemented for the state of California. The authors considered publicly funded, statewide programs such as those in Oklahoma and Georgia as well as the possibility of extending other proven model programs into universal programs. They reviewed the programs primarily in terms of the costs and benefits of implementing them in California, and they discussed possible benefits other than those commonly included in cost-benefit analysis, including macroeconomic benefits.

Rolnick and Grunewald (2003) considered CIs as investments in local economic development. They argued that more traditional developmental mechanisms, such as subsidies or

tax breaks for attracting businesses, are often zero-sum games at best, when viewed from a national perspective. In contrast, investments in CIs, and ECIs in particular, yield high rates of return, in their estimation. Focusing on preschool programs, the authors outlined specific policy options for the state of Minnesota and elsewhere. In a later article, Grunewald and Rolnick (2005) extended their discussion of economic development to other CIs and more thoroughly discussed the implementation of large-scale CIs.

### **III. THE QUESTION OF ECONOMIC GROWTH**

Our goal is to extend the discussion of CIs beyond the more traditional cost-benefit analysis to the question of economic growth. In this respect our approach is similar to that of Rolnick and Grunewald (2003). We suggest that most existing cost-benefit analyses of CIs do not tell the whole story and that, from the perspective of policy, economic growth analysis is an excellent addition. Economic growth is measurable and provides an indicator of broad societal benefits derived from CIs. Furthermore, consideration of economic growth helps take into account general equilibrium effects that cost-benefit analysis does not address.

An examination of CIs through the lens of human and health capital models can assist in making predictions about economic growth in several ways. The exact nature of the predictions depends on the model employed, but some commonly used economic growth indicators can be tied into such models. These indicators include, for example, the earnings growth and earnings distribution of the population, the probability of employment for a given set of individuals, the number of healthy and productive work days for the employed, and the level of productivity per hour of work. The impact of a program on these or any related indicators can be translated into changes in the rate of economic growth.

From a political perspective, it makes sense to address economic growth engendered by CIs, which otherwise may be misunderstood as benefiting only disadvantaged children. Framing the discussion in terms of economic growth reveals that many of the benefits of CIs carry over to society as a whole. These benefits are delivered through a variety of pathways: increases in labor force skills attract employers and increase innovation; increases in population health free up time for increased productivity and lessen the burden on the health care system; and reductions in crime lessen the burden on the criminal justice system and reduce the number of victims of crime.

### **Bringing Economic Theory to Bear**

One way to demonstrate the contribution of CIs to economic growth is to use theoretical frameworks designed to address such issues. Most commonly, the concept employed is that of human capital. In the theory as developed by Becker (1964) and Mincer (1974), human capital not only represents innate ability, but is a “stock” of skills and knowledge that increases an individual’s productivity in various ways.

Innate ability and education are often specified as basic inputs in the production of human capital. For example, Carneiro et al. (2003) propose a human capital production function that depends on the human capital of a child’s parents (to capture heritable innate ability and influences idiosyncratic to those parents) and human capital investments, often interpreted as formal and informal education. A key feature of this concept of human capital is that it is both cumulative and reinforcing; as Carneiro et al. (2003) note, “skill begets skill.” This insight helps to explain why the evidence suggests that ECIs are more productive than later interventions; earlier achievements allow individuals to learn more productively and extend their human capital later in life.

Carneiro and Heckman (2003) explore CIs in terms of this human capital formulation, offering evidence for predictions gleaned from human capital models. For example, their study demonstrates that earlier interventions yield greater gains than later ones, and that these relative gains increase over time—findings supportive of human capital model predictions. As an example of later interventions that offer lower gains than earlier interventions, the authors cite tuition subsidies, for which they find limited results. By and large, the authors argue that human capital models effectively describe the process through which ECIs are successful, thus lending support to the possibility of implementing such models in studying the effects of CIs on economic growth.

The model we suggest in this review is in the class of overlapping-generations models; it has many similarities to that proposed in Carneiro et al. (2003). Key relevant features of the model include the ability of parents to invest in prenatal care and interventions in early childhood and at other stages throughout the child's development. The model allows non-parents to invest in a child.. Parents are assumed to have an interest in the well-being of their descendants, so investment in their children yields benefits over a long time horizon. And, insofar as human capital development engenders economic growth, the model makes clear that early investment in a child's human capital will increase economic growth. (However, if individuals care about the strength of the economy as a whole, the altruistic assumption is not necessary for there to be at least some human capital investment.)

Although we will not do so explicitly, a health capital formulation may be substituted for or used to supplement the human capital basis for the model. The health capital model is in the spirit of Grossman's (1972) model, which views health capital as a stock from which healthy

time is produced, allowing more time to be allocated to both leisure and labor. Health is, therefore, viewed as a form of human capital with positive effects on economic growth.

The model background is as follows. There are an infinite number of time periods, denoted by  $t \in \{0, 1, 2, \dots\}$ . Individuals live for three periods, child, young (adult), and old; in each period there is an equal number of individuals of each age. We limit the number of periods to be as few as possible for simplicity, but each of the three periods may be expanded to as many sub-periods as is required. The timing is such that at the end of a given period, the young produce new children to replace the old who die, and the children and young grow into young and old, respectively. This process thus repeats infinitely.

All individuals are endowed with ability  $a'$  at birth; this may be thought of as a genetic indicator, but is not necessarily so. A child's ability is a function of his or her parent's ability, denoted as  $a$ ,

$$a' = A(a; \alpha),$$

where  $\alpha$  is some idiosyncratic shock, making the parent uncertain of a future child's ability.

Next, parents differ in human capital, denoted  $h$ . A parent's human capital is important in that his or her wage depends on it, and insofar as the parent's human capital influences the production of the child's human capital, denoted  $h'$ . Let  $x, x'$  be the resources devoted to producing the child's human capital in a given period; these represent prenatal investments (when the parent is young) and investments made during childhood development (when the parent is old), respectively. Then, the child's human capital production function is,

$$h' = H(a', h, x, x').$$

We assume that the function  $H$  is strictly increasing in all arguments and is strictly concave.

Next, the budget constraint of the young consists of the decision between consumption and investment in prenatal care; income is dependent on the parent's human capital, government transfers, and an idiosyncratic shock. Subscripts refer to the period in which the quantities exist, and superscripts refer to the period in which an individual was born (a child). The budget constraint is,

$$c_t^{t-1} + p_x x_t^{t+1} = wh^{t-1} + \tau + \varepsilon_t^{t-1}.$$

where,  $c_t^{t-1}$  is a  $t-1$  period person's (parent's) consumption in period  $t$ ,  $p_x$  is the price of investment and  $x_t^{t+1}$  is prenatal care purchased in period  $t$  for the future  $t+1$  period child,  $w$  is the wage rate in terms of human capital,  $h^{t-1}$  is the parent's human capital,  $\tau$  are government transfers, and  $\varepsilon_t^{t-1}$  is an idiosyncratic income shock that is unknown until period  $t$ . The period  $t+1$  budget constraint for the old (the individuals who were young in period  $t$ ) is analogous, given by,

$$c_{t+1}^{t-1} + p_x x_{t+1}^{t+1} = wh^{t-1} + \tau + \varepsilon_{t+1}^{t-1}.$$

Here,  $x$  refers to investment in childhood human capital development. Obviously, there is reason to believe that the units of investment between prenatal care and childhood development or even within childhood development itself vary considerably, since there is significant heterogeneity in the types of investment that a parent might make. For simplicity, though, we maintain the assumption that the units of investment are the same across both periods.

Finally, we describe the maximization problems faced by parents. In this model, children are at the mercy of their parents during the prenatal period and through childhood, so it is only when children become young adults that they make their own decisions. Thus, there are two value functions, one for the young and one for the old. The young adult solves the problem,

$$V(\varepsilon_t^{t-1}, h^{t-1}) = \max \{ u(c_t^{t-1}) + \beta E[W(\varepsilon_{t+1}^{t-1}, h^{t-1}, a^{t+1}, x_t^{t+1}) | \varepsilon_{t+1}^{t-1}, \alpha^{t-1}] \}$$

$$s.t. \quad c_t^{t-1} + p_x x_t^{t+1} = wh^{t-1} + \tau + \varepsilon_t^{t-1},$$

whereas the period  $t+1$  older adults solve,

$$W(\varepsilon_{t+1}^{t-1}, h^{t-1}, a^{t+1}, x_t^{t+1}) = \max \{ u(c_t^{t-1}) + \beta \theta E[V(\varepsilon_{t+2}^{t+1}, h^{t+1}) | \varepsilon_{t+2}^{t+1}] \}$$

$$s.t. \quad c_{t+1}^{t-1} + p_x x_{t+1}^{t+1} = wh^{t-1} + \tau + \varepsilon_{t+1}^{t-1}$$

Here, the function  $u$  is current-period utility, whereas  $\beta$  is the discount rate and  $\theta$  is an additional discount rate for the utility of the next generation. Essentially,  $\theta$  weights the value functions of a parent and all descendants in the parent's overall utility function.

Because it is often prohibitively difficult to obtain an analytical solution to overlapping-generations models in this class, we do not attempt to do so here. We will, however, briefly discuss how this type of model might serve as the basis for considering CIs in the context of economic growth.

First, because parents place some weight on the value functions of future generations, parents care about the future consumption and human capital paths of all their descendants. Thus their equilibrium investment decision rules  $x^*$  depend on how those decisions affect all future consumption and human capital states, which are inextricably tied to the economic growth enjoyed by future generations. To the extent that modifications to this model incorporate the effect of human capital on technological innovation or increased productivity, the process through which investment in human capital affects future economic growth can be estimated.

In addition, the effects of government interventions, such as CIs, can be estimated through modifications to the model. Here, we view government transfers as exogenous changes in the overall income of an individual, but the model could be modified to restrict government transfers to those intended for human capital investment or even to specific programs. With a well-calibrated model, policy simulations can be performed to estimate the effects of specific

changes to the budget constraints of parents. As previous studies have found, the model predicts that ECIs have significant effects on future human capital development and subsequent economic growth.

Even if some parents are not altruistic and do not care about future generations (in this case,  $\theta=0$ ), individuals will still have an interest in investing in at least some nonzero level of childhood human capital. When non-altruistic individuals become older adults, there will be children transitioning into adulthood. To the extent that the overall growth of the economy will be affected by the labor supply and rate of technological innovation of this cohort of children, the non-altruistic older adults will prefer that the new young adults have a larger stock of human capital, including better health and more knowledge.

#### **IV. CRITERIA FOR CANDIDATE PROGRAMS**

We have argued that CIs viewed in the context of human and health capital models may significantly and positively affect economic growth. Because CIs, and especially ECIs, condition all future gains in human and health capital, they are more likely to yield a high economic return. How can a policymaking body or a private organization decide which CI to invest in if it seeks to affect economic growth, among other things? Because it is prohibitively expensive to fund every program to its fullest extent, in this section we offer criteria to help identify candidate programs that show promise in being applicable to macroeconomic forecasting via human and health capital models.

Fundamentally, a successful CI implementation and evaluation must be designed so that causal mechanisms are identifiable and researchers can be confident that confounding effects such as omitted variables or selection effects do not bias their results. Our review looks for CIs that most closely achieve this identifiability. Randomization into a treatment group across as

many characteristics as possible or appropriate is the most important criterion. To the extent that a CI uses a truly random sample, we can be confident that there are no selection issues affecting comparisons between treatment and control groups.

Next, the control groups must be constructed so that the relevant characteristics of the CI are accurately distinguished. In some cases, there may be effects linked to the treatment group which are secondary to the intent of the CI but are actually the major drivers of the results. For example, a well-constructed control group might consist of children admitted to a CI but simply put on a waiting list for a year. In this case, both the treatment and control groups experience the same anticipation of participation, so the anticipation effect is effectively controlled for. This allows the researchers to be more confident that their analysis focuses on specific features of the CI.

Many of the CIs that have been implemented and evaluated have been targeted toward disadvantaged populations. In program design, then, one potential concern is that the overrepresentation of children from these groups may bias the results. This may be the case when viewing the results of an evaluation in the context of a group that is of a different composition than those in the evaluation, or in the context of the population as a whole. But if the results are valid for the population represented by the sample, (for example, children living in single parent families with low incomes), there should be no difficulty in extending the CI to similar populations. Since one of the drivers behind such investments is to equalize children's opportunities despite differences in parental income, there is clearly value on equity grounds in focusing on disadvantaged groups.

Sample collection criteria were also important in our consideration of CIs. The most important consideration is sample size. A larger sample yields more statistical power and allows

the researcher to estimate the level of program effects with higher precision. With small samples, it is often difficult to reject the hypothesis that a CI had no effect on the population, even if there were effects. Thus we regard CIs with particularly small sample sizes cautiously.

A related concern to sample size is sample attrition. In evaluations, the response to follow-up interviews varies widely. There are general reasons: after long periods of time people may be hard to track down because they have moved or otherwise become unreachable. There are reasons more damaging to the evaluations: some participants may intentionally avoid interviews or in other cases intentionally pursue them. Problems such as the increased difficulty of contacting individuals who have engaged in criminal activity may be particularly damaging in some studies. In general, we view smaller attrition rates as unambiguously better, and so rank studies with lower attrition rates more favorably. Additionally, we account for situations in which researchers attempted to show that attrition did not affect the sample composition in important characteristics, or in which researchers suspected that attrition affected the sample in specifically predictable ways.

Attrition is only one of the ways in which sample selection may be introduced into an evaluation, so we are also cautious about other sample selection possibilities when considering CIs. The program designers or participants may have engaged in sample selection in the initial recruiting process, the subsequent baseline evaluation, or both. For example, a disadvantaged population may have been specifically targeted through the recruitment process, as we discussed earlier. But as long as the selection process is explicit and any further extensions of the CI take this into account, there should be no unexpected effects on the expanded population. Selection processes involving participants may include a failure to participate among those who are recruited. This kind of selection is not traditionally taken into account when attrition effects are

considered because it does not bias estimation per se, but if it is strong enough it can produce unexpected effects when the CI is extended to larger (or other) populations.

Next, we present special considerations that are particularly important in the context of economic growth. In employing models of economic growth, as for cost-benefit analyses, the longer the duration of follow-up, the better. Many of the economic returns to CIs, and especially ECIs, occur relatively far in the future. For example, major determinants of economic growth include the labor supply decisions of workers as well as the rate of technological innovation, both of which most often occur in adulthood. In the case of some ECIs, these returns may only be directly measurable up to 20 years after the program itself is implemented. So economists rely on techniques to forecast specific program effects into the future in order to then estimate their benefits or effects on economic growth.

In the context of human and health capital models, measurement duration is particularly important. Because the dynamic process of human and health capital development is complex, a model is often more successfully estimated with longitudinal data. In these situations, it is very important to estimate the model accurately before making meaningful forecasts about economic growth. As a result, we weight measurement duration as a highly significant criterion in applying economic growth analysis to CIs.

Outcome relevance is also an extremely important consideration in the context of human and health capital models. Some outcomes are much more readily related to human or health capital than others. For example, cognitive test scores are often viewed as reasonable proxies for human capital, since they capture both heritable features and investment in a child. Social or psychological outcomes may be more difficult to employ in human or health capital frameworks. Outcomes that are more directly linked to human or health capital development are considered

here as more conducive to economic growth research than those that are more indirect and that may introduce error.

Finally, we consider general features of a CI that may influence its replicability. For example, results from a study that is restricted to one location may not be as generalizable as studies performed in multiple locations, because the location may have idiosyncratic characteristics that can introduce special effects into the evaluation. Another example of this is person-specific effects: a CI evaluation that consists of a reasonable sample size but nonetheless depends on the specific characteristics of a few individuals (such as home visiting nurses, for example) may warrant caution.

In sum, these criteria are consistent with many sets of criteria used in past evaluations of CIs. Yet as we have emphasized, there are special considerations necessary when researchers think in the context of economic growth.

## **V. SAMPLE CIs**

Here we discuss a selection of CIs that we find to be well suited for further research in the context of economic growth, including further evaluation and forecasting via economic models. Using the criteria discussed in the last section, we studied almost 200 CIs that have been implemented and evaluated in experimental or quasiexperimental settings. (A full list of the CIs is available in Wolfe and Tefft, 2005.) We assembled our master list of CIs by consulting other researchers and through topical and categorical literature searches.

Generally speaking, the breadth of CIs available for study is very large, and this allowed us to select high-quality programs as examples. As already noted, we intentionally selected examples from a diverse range of categories, including Preschool, Health, Home Visiting, Juvenile Justice, Mentoring, School (other than Preschool), and Job Training. Finally, to

facilitate exploration of studies that have previously received less attention, we excluded some studies that have already undergone substantial scrutiny either in the context of economic growth or in general terms—for example, the Head Start, Perry Preschool, and Carolina Abecedarian programs.

Our findings are summarized Tables 1 and 2. In this section, we discuss the most promising programs, listed in Table 1.

**Table 1: Most Promising Childhood Intervention Programs**

<b>Program</b>	<b>Category</b>	<b>Description</b>		<b>Outcomes</b>	<b>Follow-Up</b>	<b>Replicable</b>	<b>Relevance</b>
<b>Nurse Family Partnership</b>	Home Visiting	The program provides nurse home visits and referral services for mothers and children until the child is two years old. The study with the longest measurement duration was administered in Elmira, NY. Women were recruited if they had no previous live births, and most participants were young, unmarried, or of low socioeconomic status.	500 women were recruited, and 400 enrolled. Participants were randomized into 4 treatment groups. The attrition rate was 22%.	Participants reported fewer arrests, convictions, violations of probation, lifetime sex partners, cigarettes smoked per day, and fewer days of alcohol consumption in the last 6 months. Effects were greatest among mothers with low socioeconomic status.	15 years.	There may be issues with respect to the specific implementation processes by nurses.	Relevant. There is a large number of significant outcomes, and the follow-up duration extends well into high school.
<b>Chicago Child-Parent Center program</b>	Preschool	A non-randomized group of children who lived in a set of low income areas were invited to participate in a program that included education, family and health services. The program began at ages 3 to 4 and included services to age 6 with some continuing to age 9. The matched group lived in other low income areas of Chicago where CPC was not offered and primarily consisted of full day kindergarten.	There were 989 participants in CPC. 550 participated in other related but less ambitious programs.	Some outcomes include grades and other achievement measures, parental involvement, arrests, grade retention, special education, completion of high school, and post-secondary education. In nearly every case, CPC participants performed significantly better.	Ongoing, and this study evaluates through age 23.	Likely to be replicable, but the a random design would have increased confidence.	Very relevant. Measurement duration extends into the adult wage earning period, and there are many measures to base further analysis on.
<b>Class Wide Peer Tutoring</b>	School	Participant children are recruited within classrooms for a peer tutoring process with rewards for progress. Those included in the evaluations were from grades 1-6 in inner city low income neighborhoods. The program has also been tested with children with learning disabilities and children in higher income areas.	Sample size groups for the evaluations range from 4 to more than 400.	Students who started the program in first grade performed significantly better on national standardized tests for math and reading. Other outcome measures include time spent on task, grades received, and other standardized test outcomes.	Evaluators claim that results persist for at least three years.	This program appears to be easily replicable and is of very low cost. The main issue of replicability is in establishing the pairing mechanism.	Relevant. Measurement outcomes are evaluated only a few years past elementary school, but the measured variables are important.

<b>Healthy Kids</b>	Health	Healthy Kids provides health insurance coverage to children in Santa Clara County with household income below 300% of FPL and who are ineligible for the major state health insurance programs. More than 80% of the population served is Latino. The data for the analysis is drawn from a survey of program participants over a single year. Recent enrollees are used as a comparison group to measure the program's effects.	Total sample size is 1,235, and 89% of enrollees contacted for the survey responded.	The results show that the program reduces unmet need, improves access to health care, and improves health care usage.	Effectively one year.	Difficulties in replicability may arise from the fact that the program was administered in a single county. Also, the results may only generalize to similar populations.	Somewhat relevant. The outcomes measured only relate to economic growth through improved health. Also, the measurement duration is short.
<b>Big Brothers, Big Sisters</b>	Mentoring	This is a nationwide mentor program that matches adult volunteers with children who tend to be from single parent families. The study population were 959 10-16 year olds who applied to the program in 1992 and 1993; half were assigned to the treatment group while half were assigned to a waiting list.	The study chose 1,138 youth to be in the study, 84.3% completed both surveys. 487 were in the treatment group of whom 378 were matched. More than half are minorities, almost all lived with one parent.	Findings are based on self reports. Those paired were 46 percent less likely to initiate drug use, 27 percent less likely to initiate alcohol use, one-third less likely to hit someone, skipped half as many days of school and showed modest gains in school achievement.	18 months.	Yes, the program is in many cities and has a long history.	Somewhat relevant. The outcome measures themselves are tertiary to economic growth, while the measurement duration may in some cases extend close to working age.
<b>Career Academies</b>	Job Training	This program seeks to keep students in high school and prepares them for the transition to further education and employment. The study was conducted at nine high schools located in urban, low income areas nationwide. Participants were selected for the study by lottery.	A total of 1764 students completed the program and 1458 (83%) completed the follow-up survey. Only 55% of students finished the program, with varied dropout rates. Conditional on completion, attrition was relatively low.	Men in the treatment group earned significantly higher wages. The effect was concentrated among members who were at high or medium risk of dropping out of high school upon enrollment.	Four years after the participant's scheduled graduation from high school.	The study was implemented at sites that had already implemented Career Academies for 2 previous years. This may have introduced some selection bias.	Very relevant. Wage data is clearly important for economic growth analysis.

<b>Job Corps</b>	Job Training	Over a 13 month period in 1994-5, applicants nationwide were randomly assigned to a treatment group that could enroll in Job Corps and control group in which members could not (they could receive other services, however.) Most applicants are high school dropouts, most are minorities and about a quarter had an arrest record. The program offers residential and non-residential settings, providing education and vocational services, counseling, and medical care.	9,400 were in the treatment group and 6,000 in the control group. Follow-up interviews had an 80% response rate.	Outcome measures include hours of additional education, obtaining of a GED degree, literacy tests scores, earnings, cash welfare assistance, and arrests. Significant differences in crime account for a substantial share of benefits of the program.	Outcomes were measured at 12, 30, and 48 months.	This is a nationwide program. The authors claimed that the program had similar impacts across sites.	Very relevant. Measurement duration extends into adult wage earning period, and there are many measures to base further studies on.
------------------	--------------	---	--	--	--	--	---

## **Nurse Family Partnership**

In an attempt to improve prenatal care and the health and caretaking of infants, the Nurse Family Partnership assigns nurses to visit the homes of disadvantaged women who are new mothers or are pregnant. This form of intervention strives to assist women at the very early stages of their child's development. The program has been implemented for evaluation at multiple sites, including Memphis, Tennessee; Elmira, New York; and Denver, Colorado. Because an extended follow-up is particularly important in the context of economic growth, we focus on the Elmira site, at which we can view outcomes 15 years after birth (Olds et al., 1998). (For information about the Memphis and Denver sites, see Olds et al., 2004, and Olds et al., 2002.)

To collect sample data, the researchers recruited women who were less than 25 weeks pregnant and who had no previous live births. Most of the women were young, married, and of low SES. Between April 1978 and September 1980, 400 women were enrolled in the program out of the 500 who were invited to participate.

After a baseline interview, the women were randomly assigned to one of four treatment groups structured so that there was a range in the intensity of intervention. The intention was to recover incremental effects as the programs were modified. The first group, with 94 participants, acted as a baseline control group; the children were screened at 1 and 2 years and referred for care only if necessary. The second group, with 90 participants, received the same treatment as the first group, but they also received free transportation for medical care until the child was 2 years old. The third group, with 100 participants, received the same treatment as the second group, but they also received nurse home visits during pregnancy. Finally, the fourth group, with 116 participants, received the same treatment as the third group, but the nurse made visits until

the child was 2 years old. Although dividing the sample into four groups weakens the statistical power of the analysis, it is useful to examine incremental gains in order to determine the important features of a program.

The children were assessed at different stages of their development, but the authors focus on the latest assessment at publication, a 15-year follow-up. Although the follow-up does not extend into the participants' wage-earning years in all cases, any lasting results, including higher wage rates and years of schooling identified by the researchers this long after the initial intervention are likely to be persistent and thus to have a direct effect on economic growth. In addition, the relatively low attrition rate of 22 percent adds to the strength of the results, especially considering the length of time during which there was potential for dropout.

A number of differences between the four groups were highly significant. Children whose families received visiting nurses reported fewer arrests, convictions, and violations of probation, but reported being stopped by police more frequently than did those children whose families did not receive visiting nurses (most of the offenses involved were minor). Children whose families received visiting nurses reported fewer sexual partners, lower rates of cigarette smoking, and fewer days of alcohol consumption. But children whose families were in the low SES group and received nurse visits reported more illegal drug abuse than those in the comparison group. Teachers reported no differences in the frequency or intensity of problem behavior between the groups. Finally, consistent with findings from other CIs, the families with low SES showed the greatest effects from the treatment across most variables. These significant differences in crime, health, and fertility outcomes can be linked to changes in economic growth through economic models, as discussed in earlier sections.

In drawing conclusions from the Elmira study one must be cautious about generalization to other areas or groups. Although effects were strong even after 15 years, the results were driven mostly by the low SES group, and the characteristics of the community, in a rural setting, must be taken into account. In part, the motivation for studying the program's effects at the other sites is to address these issues. Finally, an important concern that the authors do not address is the possibility that idiosyncratic characteristics of the nurses contributed at least somewhat to the effects. In other words, it might be useful to better understand how nurses interacted with families in order to replicate the program faithfully.

### **Chicago Child-Parent Center Program**

Aside from Head Start, the Chicago Child-Parent Center program (CPC) is the oldest federally funded preschool program in the country. The program was started in 1965 with the goals of improving the academic achievement of disadvantaged children and involving parents more in their children's education. CPC was more than just a preschool; it was a center-based intervention that included education, family, and health services for all participants.

Children entered CPC between the ages of 3 and 4, and services were usually offered until the age of 6, but they sometimes continued until age 9. For the preschool portion of the program, children attended half-day sessions during the 9-month school year, and beginning in kindergarten the program consisted of full-day participation during the school year. Key features of the program included smaller than normal class sizes, with 1–8 children in preschool classrooms and 1–12 children in kindergarten classrooms. Parents were encouraged to directly participate in the education process. Finally, children who participated in CPC were drawn from low-income, largely African American areas of Chicago.

Reynolds et al (2001) describes an evaluation of the effects of CPC, the Chicago Longitudinal Study (CLS), on a number of relevant outcomes. The original sample included 989 children who participated in the preschool, kindergarten, and school age phases of the 20 Child-Parent Centers in operation in the 1980's. Since most of the participants in CPC were from low-income areas, a matched comparison group was selected consisting of 550 students from 5 randomly chosen Chicago-area public schools that served similarly disadvantaged children. Clearly, this nonrandom assignment process may have introduced selection bias into the subsequent statistical analysis. For example, among low-income areas there may have been competition to live in districts that were served by CPC if it was believed that CPC was more successful at improving student achievement. Insofar as any important differences between the CPC group and the comparison group are controlled for by observable characteristics, however, there will be no selection bias.

The author describes the sample characteristics through the age 20 follow-up evaluation. At age 20, 1281 out of the original 1539 participants were evaluated for educational attainment, and an even larger number of juvenile court records were examined. These correspond to attrition rates of under 17 and 9 percent, respectively, low rates considering the length of time since the children had participated in the program. Indeed, the favorable combination of low attrition and extended follow-up adds confidence that program effects will persist. In addition, evaluations of this sample are ongoing, so there is promise that outcome measurements will extend well into participants' wage-earning years.

Reynolds et al (2001) reported some of the more relevant outcomes measured in the evaluation. For those children who participated in the CPC program, there was significantly

higher school achievement, fewer juvenile arrests, increased grade retention, and more favorable special education placement by age 18 than for those in the comparison group.

Overall, CPC is a program shown to have had significant benefits for its participants. Many of these benefits are directly relevant to economic growth analysis. Improved educational outcomes can lead to higher wages and greater productivity; reduced criminal activity has direct effects on both the participant's further education and career potential in addition to the emotional and economic well-being of potential victims. With appropriate caution because of the nonrandom design of the evaluation, we believe that the program results warrant further study.

### **Classwide Peer Tutoring**

The Classwide Peer Tutoring program (CWPT) was developed to engage elementary school children in classroom activities and to foster greater student achievement. Motivated by the fact that children who had more of an “opportunity to respond” in class tended to be more successful in school (Greenwood et al., 1989), the program seeks to maximize engagement by pairing students in a tutor-tutee relationship in which students administer questions to each other. Because daily and weekly winners are identified and rewarded in a competition between groups, the children are motivated to perform well.

Greenwood et al. (1989) evaluated the program using a random experimental design in which a treatment group was drawn from children in families with low socioeconomic status (SES). Those not selected for the treatment group served as the control group. In addition, the researchers identified a group of students in families with high SES to serve as a comparison group. The longitudinal evaluation followed children from the first to the fourth grades.

Children were selected from 25 schools in the metropolitan area of Kansas City, Kansas (although the faculties of two schools refused participation after being selected). The final

sample consisted of children attending nine different schools, three of them identified as high-SES and six as low-SES. Every student in all three high-SES schools received the standard teacher-designed programs, while some of the children in the low-SES schools participated in CWPT.

Baseline evaluations were given at the outset of the program (at the beginning of first grade) and follow-up evaluations were given after students completed fourth grade. Of the 416 students in the original sample, data were available for only 182, for very high attrition rates of 56 percent overall and 68 percent among the experimental group. Most of the attrition occurred because students relocated to schools other than the nine participating schools; the additional loss in the treatment group resulted when a school not included in the study was closed and some participating students were relocated to other schools to maintain a diverse population balance. These nonrandom selection processes might significantly affect the validity of the analysis results.

Outcome measures included standardized achievement tests relative to national averages. The researchers found significant differences between the treatment group and the control group, and the comparison group and the control group, but there were no significant differences between the comparison group and the treatment group. On average, the treatment group scored more than 10 percentage points higher than the control group on the achievement test.

The relationship between the program and economic growth models is somewhat promising. Achievement test scores provide a reasonable link to the human capital framework in the sense that higher wages are often correlated with greater educational achievement, and the measurement duration of four years is a significant period of time. However, the children were

last evaluated only in the fourth grade, well before any effects on economic growth might be realized.

As discussed, there are a few concerns about the replicability of the program. This evaluation of CWPT was administered only in the Kansas City metropolitan area and the treatment group was a subgroup of the overall population, limiting confidence that similar results would be obtained in other areas. Finally, the high rate of attrition calls the results into question. We cannot be certain whether the selection process affected the composition of students so as to bias the outcome.

### **Healthy Kids**

The Healthy Kids program was started in Santa Clara County, California, in 2001 to address gaps in health insurance coverage among low-income families. Although the state provided other health insurance programs, namely Medi-Cal and Healthy Families, there was still a perceived need for more coverage. The Healthy Kids program provides health, dental, and vision insurance coverage for children in families who earn below 300 percent of the Federal Poverty Line (FPL) and who are not eligible for the two state-funded programs. Since citizens below 250 percent of the FPL are eligible for at least one of the state-funded programs, the majority of the participants in Healthy Kids are not otherwise covered because of their immigration classification. Over 30,000 families have participated in the program since its inception.

Many of the children participating in Healthy Kids are between 6 and 12 years old, and most of the remainder are less than 6 years old. Consistent with selection by immigrant status, more than 80 percent of the participants are Latino and live in non-English-speaking households. Most of the children live in two-parent households, the vast majority with at least one working

parent, suggesting that most of the participants' parents work in jobs that do not offer health benefits. Importantly, 63 percent of the children had no health insurance within the six months before enrollment, and 45 percent had never been covered.

Trenholm et al. (2005) report on a survey administered by Mathematica to evaluate the effects of the Healthy Kids program. The evaluation was not a random-assignment study, but instead compared two groups of participants separated by the timing of coverage. In particular, “established enrollee” children were participants who had been involved in the program for approximately one year and had completed renewal of coverage, and “recent enrollee” children were those who were interviewed at the time they became eligible for, but were not yet participating in, Healthy Kids. The former is an effective treatment group; the latter serves as the control group. Insofar as the sample was a random selection of participants from each of these groups, the design will yield reasonable estimates of the program effects so long as there were no significant, idiosyncratic year shocks. The total number of respondents was 1,235, and the survey response rate was high—89 percent.

In one significant, measured outcome, the Healthy Kids program reduced the proportion of children with unmet need in the preceding six months from 22 percent to 10 percent. This reduction was across all categories, including well-child visits, sick-child visits, specialty care, prescription medications, and dental care. Second, access to health care significantly improved; the proportion of children participating in Healthy Kids who had a usual source of primary care increased from 50 percent to 89 percent. There was an analogous increase for a usual source of dental care, from 29 percent to 81 percent. Finally, actual use of health care rose. The proportion of children who had received health care in the previous six months increased from 30 percent to

54 percent. Again, the gains were across all categories, including preventive, sick, and specialist visits. There were similar results for dental care use.

Overall, the evaluation of the Healthy Kids program shows convincing evidence of positive effects on health care outcomes and, therefore, economic growth. As discussed earlier, health is directly related to economic growth in the sense that lost work from illness results in lower productivity. A more indirect channel through which health affects economic growth is via lost school days due to illness which lowers human capital accumulation, in turn leading to lower productivity.

There are clearly some caveats in considering the program in the context of economic growth, however. First, the outcomes are effectively measured over only one year, a short time from which to draw any strong conclusions. Also, the population is a specific group that is not representative of the state or the nation as a whole, so any attempts to generalize the results to other groups or areas should be done so with caution. Yet the group for which the results are valid, the Latino immigrant population, is not a small group and it is growing. The increasing political importance of addressing this population's needs warrants a closer look at programs of this type.

### **Big Brothers Big Sisters of America**

Big Brothers Big Sisters (BBBS) is the oldest and one of the most well-known mentoring programs. At any given time, there are approximately 75,000 mentor-child matches nationwide. Local programs function as affiliates of the national program. Although the local programs are not funded directly by the central organization, it plays the important role of providing criteria and standards for the appropriate functioning of the local programs and the development of

matches. This consistency across programs is important if any experimental findings are to be generalizable.

For the most part, the programs recruit and screen youth and mentors who have an interest in forming a match. Then, based on background characteristics and stated preferences, the programs match youth and mentors. Mostly, the children are from disadvantaged families, often with a single parent. The matched youth and mentor will then meet approximately three or four times each month for at least a year.

Tierney and Grossman (1995) report on a study in which Public/Private Ventures selected eight BBBS programs nationwide for evaluations based on program size and geographic diversity. The sample consisted of 1,138 youth between the ages of 10 and 16 (mostly between 10 and 14). Most of the youth in the sample were from disadvantaged families and a slight majority was male, so the sample was an appropriate representation of the population in these characteristics.

After baseline interviews were completed, the youth were randomly assigned to either the treatment or control group. Participants in the treatment group were then immediately matched to mentors while those in the control group were placed on an 18-month waiting list for the program. Placement on a waiting list is a useful control for any effects that might be associated with a participant's anticipation of participating in a program. After 18 months, participants were administered a follow-up interview, with 959 youth completing it, implying an attrition rate of 15.7 percent.

Six general categories were studied in comparing the follow-up interview with baseline: antisocial behavior, academic performance, attitudes and behaviors, relationships with family members and friends, self-concept, and social and cultural achievement. The findings were based

on self-reports. Of particular note, the authors reported that participants were 46 percent less likely to initiate alcohol use, one-third less likely to hit someone, skipped half as many days of school, and showed modest gains in school achievement.

Overall, the evaluation was methodologically sound in its random design and relatively low attrition rate, and many of the measured outcomes were significant. But the outcome measures were only somewhat relevant to economic growth, and the duration of the follow-up was shorter than ideal. Although school achievement can be easily tied to human capital models, some other outcomes, such as alcohol use initiation and problem behavior, are only indirectly related. Because BBBS has proven its short-term success in a range of locations and in a number of categories, we believe that it deserves further study, with a focus on longer follow-up measurements.

### **Career Academies**

The Career Academies program seeks to maintain high school enrollment and prepare students for postsecondary education and employment. In particular, Career Academies programs foster goals through a career-oriented approach. The programs are implemented as a special curriculum in an existing high school, usually serving between 150 and 200 students from grades 9 through 12. In addition, relationships with area businesses are established to give the students hands-on experience. It is estimated that there are approximately 2,500 Career Academies nationwide.

Although the Career Academies program was established more than 30 years ago, there is an ongoing evaluation administered by MDRC (formerly the Manpower Research Demonstration Corporation), which started in 1993. Kemple and Scott-Clayton (2004) report on the progress of this evaluation. The study draws participants from nine nationwide high schools in medium- to

large-sized school districts, with particular attention to urban settings. The focus on low-income, ethnically diverse areas is intended to reflect the population of the program as a whole.

MDRC implemented a rigorous experimental design with randomized selection into treatment and control groups. To avoid selection issues, researchers used as the pool for randomization all of those who applied to the program in the first place. Those who were not randomly selected to participate were designated as the control group.

A total of 1,764 students completed the evaluation program and 1,458 completed the follow-up survey. For those who completed the program, this is an attrition rate of 17 percent, a relatively low level. However, only 55 percent of the students who initially enrolled in the program actually completed it. As a consequence, any gains found in the analysis may overstate the average effect on the population as a whole, because those who stayed in the program until the follow-up evaluation may differ from those who did not complete the program. But if the results are viewed as valid for the subpopulation who actually completed the program and with caution for those who did not complete it, there is no selection issue.

The follow-up survey was administered four years after a participant was scheduled to graduate from high school. This is a relatively long gap between the completion of the program and the follow-up survey, lending support to the possibility that the program's effects are lasting. In many cases, the follow-up period extended into a graduate's working career. This is important in that wage and labor supply data are directly relevant information in forecasting economic growth.

In general, many outcomes for men's labor market participation and wages were positive and significant for Career Academies participants. Over the period between program completion and follow-up, men in the treatment group earned an average of 18 percent more than men in the

control group, or a total of approximately \$10,000 over the period. This increase is accounted for by positive outcomes in both wages and labor supply.

In the entire sample, there were no positive labor supply and wage outcomes for women. However, when the researchers restricted their analysis to students who were at medium or high risk of dropping out of school, both men and women showed significant, positive earnings outcomes. These findings are consistent with trends in other studies in which more disadvantaged groups are often shown to benefit the most from a given program.

One caveat is that the evaluation was performed at schools where Career Academies had been implemented in the two preceding years. On the one hand, this increased the ability of teachers to administer the program with high fidelity, since they had already gained experience in the program. On the other hand, the results might not reflect the true initial effects of the program. If the program were expanded to new sites, the results reported here might not apply until after the first two years.

Moreover, Career Academies modestly reduced the enrollment of participants in postsecondary education. Although the authors admit that this could in theory drive the finding of increased earnings, they claim that most of the difference in enrollments was due to a substitution of participation in short-term certification programs and that the four-year follow-up is a long enough period of time to account for this postsecondary enrollment difference in considering earnings.

Although the Career Academies program is not an ECI and so does not take full advantage of the cumulative process of human capital development, we find that it shows potential in measurements of economic growth because of its sound experimental design and outcome measures that are directly relevant to economic growth analysis. Since Career

Academies has been implemented in many locations nationwide, its extension into other areas is likely to be successful.

### **Job Corps**

Job Corps is a nationwide job training program designed to assist disadvantaged youths in their ability to establish careers and generally improve labor market outcomes. The program provides education and vocational training in a residential setting, recruiting over 60,000 new entrants each year. Because the program's size and residential nature was likely to have significant impact on participants and funding, the U.S. Department of Labor sponsored a study of its effectiveness (Burghardt and Schochet, 2001).

Using a random assignment design, the study selected a sample from all eligible applicants nationwide over a 13-month period in 1994 and 1995. Individuals in the treatment group were invited to enroll in Job Corps. Those in the control group were not allowed to enroll in Job Corps but were allowed to enroll in any other assistance program for which they were eligible. Estimates of the program's impact were found by comparing the performance of the treatment and control groups over the enrollment period.

Nearly three-quarters of those invited to enroll in Job Corps as a part of the evaluation did so. Most applicants were high school dropouts, most were minorities, and about a quarter had previously been arrested. The average length of stay in the program was 8 months, during which time most of the participants underwent both academic and vocational training. Although there is some variation in structure between Job Corps sites, the authors claim that overall there was a high degree of fidelity in implementation. As an example, approximately 90 percent of participants lived at Job Corps centers that provided additional counseling and medical care as necessary.

After accounting for those individuals who chose not to participate, the treatment and control groups consisted of 6,828 and 4,485 participants, respectively. This is a substantial sample and, because individuals were drawn from the population nationwide, suggests that the results possess a high degree of reliability. In addition, at the four-year follow-up 80 percent of the original sample responded—a relatively low attrition rate.

One of the outcomes more relevant to economic growth studied in the evaluation is the receipt of academic credentials. In particular, 42 percent of treatment group participants received a GED and 38 percent received a vocational certificate during the four-year follow-up period, compared to just 27 and 15 percent, respectively, of control group individuals. But Job Corps had no significant effect on enrollment or completion of post-secondary education.

Treatment group participants enjoyed better labor market outcomes than those in the control group. By the fourth year, members of the treatment group earned an average of \$211 weekly, compared to an average of \$195 for the control group. Contributing to the higher earnings, Job Corps had positive impacts on both employment rates and hours of work. All of these outcomes were significant at the 1 percent level. Moreover, treatment group participants earned an average of \$0.22 per hour more than those in the control group during the fourth year of the follow-up.

Other significant outcomes included reductions in the amount of public assistance (a difference of approximately \$640 per participant), reductions in arrest, conviction, and duration of incarceration, and crimes committed against participants. The effects on criminal activity were mostly confined to minor crimes, but the impact was nonetheless large.

All told, the study results are promising in the context of economic growth. Many of the variables, especially labor market outcomes and criminal activity, provide direct links to the

human capital literature. As mentioned previously, labor market outcomes and criminal activity have strong effects on economic growth in terms of increased productivity, more work days, and lower criminal justice and legal expenses. The four-year follow-up duration is significant in itself, but it is also helpful that the follow-up extends into actual labor market activity for many of the participants.

Finally, the authors looked at the varying effects of the study on different subgroups of the sample. For most of the relevant outcomes, the authors report that Job Corps had a relatively homogeneous effect on all groups, whether defined by race, sex, or age. Notable exceptions are the failure of Job Corps to improve the employment and earnings of Hispanic youths and of 18- and 19-year-olds, but the authors do not suggest any explanations for this. Given these caveats, the size and random assignment design of the evaluation suggest that findings may successfully be generalized to other areas or groups.

## **VI. CONCLUSION**

To increase future economic growth and reduce economic disparities, society clearly has an interest in investing in effective child interventions. A great deal of creativity and substantial investment of resources have gone into interventions that span activities such as prenatal care and nurse visitation programs, early preschool, nutritional supplements, subsidies for health insurance, mentoring programs, after school and summer programs, pregnancy prevention and other behavior modification programs, and job skills and training programs. Unfortunately, very few CIs have been evaluated so as to answer the question of whether an expansion to similar children, or more broadly, is likely to enhance the human capital of participants and the economic growth of society. One conclusion of our research, then, is to call for more thought and resources to be allocated to evaluation of CIs in the future.

We highlight a number of promising CIs that range from nurse visitation to mentoring and job training programs. We suggest that existing evaluations of these programs be used to calculate their potential contributions to economic growth. Interestingly, several of these programs rely on volunteers and so would require only limited public sector resources to be implemented more broadly, perhaps increasing the likelihood of a strong increment to economic growth.

In economic terms, investment in childhood programs has been shown to yield high returns, presumably because early gains in human and health capital translate into large returns down the road. Politically, arguments that favor investment range from the special assistance that interventions can provide for disadvantaged children to the value of a strong labor force in maintaining the health of our economy.

Within this ongoing discussion, our focus has been on the effects of childhood investments on economic growth. Society has much to gain from successful CI programs and much to lose from investing in ineffective ones. By suggesting tools for estimating specific effects and reviewing programs in order to recommend further investigation, we argue that research in this context is both feasible and likely to yield exciting results.

## VII. REFERENCES

1. Achenbach, T.M., Howell, C.T., Aoki, M.F., Rauh, V.A. (1993). Nine-year outcome of the Vermont intervention program for low birth weight infants. *Pediatrics*, 91, 45-55.
2. Aos, S., Lieb, R., Mayfield, J., Miller, M., Pennucci, A. (2004) *Benefits and costs of prevention and early intervention programs for youth*. Olympia: Washington State Institute for Public Policy.
3. Barnett, W. S. (1993). Economic evaluation of home visiting programs. *The Future of Children*, 3(3), 93–112.
4. Barnett, W. S. (1995). Long-term effects of early childhood programs on cognitive and school outcomes. *The Future of Children*, 5(3), 25–50.
5. Becker, G. (1964). Human capital: a theoretical and empirical analysis with special reference to education. New York: Columbia University Press.
6. Bhattacharya, J., Currie, J., and Haider, S.J. (2004). *Final Report: Evaluating the Impact of School Nutrition Programs*. United States Department of Agriculture.
7. Bierman, K.L., Coie, J.D., Dodge, K.A., Foster, E.M., Greenberg, M.T., Lochman, J.E., McMahon, R.J., Pinderhughes, E.E. (2004). The effects of the fast track program on serious problem outcomes at the end of elementary school. *J Clin Child Adolesc Psychol*, 33, 650-61.
8. Bitler, M. and Currie, J.M. (2004). *Does WIC work?: The effects of WIC on pregnancy and birth outcomes*. Santa Monica, CA: RAND Corporation.
9. Burghardt, J., Schochet, P., Johnson, T., Gritz, R. M., Glazerman, S., Homrighausen, J., and Jackson, R. (2001). *Does Job Corps work? Summary of the National Job Corps Study*. Princeton, NJ: Mathematica Policy Research.
10. Carneiro, P., Cunha, F., and Heckman, J. (2004). The technology of skill formation. 2004 Meeting Papers 681, Society for Economic Dynamics.
11. Carneiro, P. and Heckman, J. (2003). Human capital policy. In *Inequality in America: What Role for Human Capital Policies?* J. Heckman and A. Krueger, Eds., Cambridge, MA: MIT Press.
12. Chamberlain, P. and Reid, J.B. (1998). Comparison of two community alternatives to incarceration for chronic juvenile offenders. *J Consult Clin Psychol*, 66, 624-33.
13. Currie, J.M. (2001). Early childhood education programs. *Journal of Economic Perspectives*, 15(2), 213–238.

14. Decker, P.T., Mayer, D.P., and Glazerman, S. (2004). *The effects of Teach for America on students: findings from a national evaluation*. Mathematica Policy Research, Inc.
15. Dent, C.W., Sussman, S., Stacy, A.W., Craig, S., Burton, D., and Flay, B.R. (1995). Two-year behavior outcomes of Project Towards No Tobacco Use. *J Clin Consult Psychol*, 63, 676-677.
16. Dunifon, R. and Kowalski-Jones, L. (2003). The influences of participation in the National School Lunch Program and food insecurity on child well-being. *Social Service Review* (March).
17. Evans, R. III, Gergen, P.J., Mitchell, H., Kattan, M., Kercsmar, C., Crain, E., Anderson, J., Eggleston, P., Malveaux, F.J., and Wedner, H.J. (1999). A randomized clinical trial to reduce asthma morbidity among inner-city children: Results of the National Cooperative Inner-City Asthma Study. *Pediatrics*, 135(3), 332-338.
18. Greenwood, C.R., Delquadri, J.C., and Hall, R.V. (1989). Longitudinal effects of classwide peer tutoring. *Journal of Educational Psychology*, 81, 371-383.
19. Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy*, 80(2), 223-255.
20. Grunewald, R. and Rolnick, A. (2005). *A proposal for achieving high returns on early childhood development*. Minneapolis, MN: Federal Reserve Bank of Minneapolis.
21. Henry, G.T., Henderson, L.W., Ponder, B.D., Gordon, C.S., Mashburn, A.J., and Rickman, D.K. (2003). *Report of the findings from the Early Childhood Study: 2001-02*. Andrew Young School of Policy Studies, Georgia State University.
22. Jemmott, J.B., Jemmott, L.S. and Fong, G.T. (1998). Abstinence and safer-sex HIV risk-reduction interventions for African American adolescents: a randomized controlled trial. *JAMA*, 279, 1529-1536.
23. Karoly, L. and Bigelow, J. (2005). *The economics of investing in universal preschool education in California*. Santa Monica, CA: RAND Corporation.
25. Karoly, L., Greenwood, P., Eviringham, J., Hoube, J., Kilburn, M., Rydell, C., Sanders, M., Chiesa, J. (1998). *Investing in our children: what we know and don't know about the costs and benefits of early childhood interventions*. Santa Monica, CA: RAND.
26. Kemple, J. J. and Scott-Clayton, J. (2004). *Career Academies: impacts on labor market outcomes and educational attainment*. New York: Manpower Demonstration Research Corporation.
27. Korenbrot, K.C. Risk reduction in pregnancies of low income women. (1984). *Mobius*, 4(3), 34-43.

28. Krueger, A.B. (1999). Experimental estimates of education production functions. *Quarterly Journal of Economics*, 114, 497-532.
29. Levenstein, P., Levenstein, S., Shiminski, J.A., Stolzberg, J.E. Long-term impact of a verbal interaction program for at-risk toddlers: An exploratory study of high school outcomes in a replication of the Mother-Child Home Program. (1998). *Journal of Applied Developmental Psychology*, 19(2), 267-286.
30. Love, J.M., Kisker, E.E., Ross, C.M., Schochet, P.Z., Brooks-Gunn, J., Paulsell, D., Boller, K., Constantine, J., Vogel, C., Fuligni, A.S., and Brady-Smith, C. (2002). *Making a difference in the lives of infants and toddlers and their families: The impacts of Early Head Start*. Washington, DC: U.S. Department of Health and Human Services.
31. Maxfield, M., Schirm, A., and Rodriguez-Planas, N. (2003). *The Quantum Opportunity Program Demonstration: Implementation and short-term impacts*. Mathematica Policy Research, Inc.
32. McCarton, C.M., Brooks-Gunn, J., Wallace, I.F. (1997). Results at age 8 years of early intervention for low birth weight premature infants: The Infant Health and Development Program. *JAMA*, 277, 126-132.
33. Mincer, J. (1974). *Schoolings, experience, and earnings*. NBER, distributed by Columbia University Press.
34. Olds, D., Hill, P., and Rumsey, E. (1998). *Prenatal and early childhood nurse home visitation*. Juvenile Justice Bulletin No. NCJ-172875. Washington, DC. Office of Juvenile Justice and Delinquency Prevention.
35. Olds, D., Kitzman, H., Cole, R., Robinson, J., Sidora, K., Luckey, D.W., Henderson, C.R. Jr., Hanks, C., Bondy, J., and Holmberg, J. (2004). Effects of nurse home visiting on maternal life-course and child development: age-six follow-up of a randomized trial. *Pediatrics*, 114, 1550–1559.
36. Olds, D., Robinson, J., O’Brien, R., Luckey, D., Pettit, L., Henderson, C., Ng, R., Sheff, K., Korfmacher, J., Hiatt, S. and Talmi, A. (2002). Home visiting by paraprofessionals and by nurses: a randomized, controlled trial. *Pediatrics*, 110(3), 486–96.
37. Reynolds, A.J., Temple, J.A., Robertson, D.L., and Mann, E.A. (2001). Long-term effects of an early childhood intervention on educational achievement and juvenile arrest: A 15-year follow-up of low-income children in public schools. *JAMA*, 285(18), 2339-46.
38. Rolnick, A. and Grunewald, R. (2003). Early childhood development: economic development with a high public return. *The Region*, December, 2003.

39. Rossman, S.B. and Morley, E. (1995). *The National Evaluation of Cities in Schools: Executive Summary*. Washington DC: The Urban Institute.
40. Tierney, J.P., Grossman, J.B., and Resch, N.L. (1995). *Making a Difference: An Impact Study of Big Brothers Big Sisters*. Philadelphia: Public/Private Ventures.
41. Trenholm, C.A., Howell, E., Hughes, D., and Orzol, S. (2005). *Santa Clara Healthy Kids Program reduces gaps in children's access to medical and dental care*. Mathematica Policy Research, Inc.
42. Wolfe, Barbara and Nathan Tefft. 2005. *Child Interventions that May Lead to Increased Economic Growth: A Report to The Pew Charitable Trusts*. Philadelphia, PA.

## VIII. APPENDIX: TABLE 2

**Table 2: Promising Childhood Intervention Programs**

<b>Program</b>	<b>Category</b>	<b>Description</b>	<b>Sample</b>	<b>Outcomes</b>	<b>Follow-Up</b>	<b>Replicable</b>	<b>Relevance</b>
<b>OB Access Project</b>	Health	The OB Access Project was a comprehensive prenatal care program designed to improve health outcomes (specifically, birthweight) for infants of at risk mothers. The program was administered in 13 counties in California between 1979 to 1982.	There were 5,244 births in the experimental group with an equal number of matched, non-randomly assigned births in the comparison group. This is a large sample, although a randomized structure would have yielded more reliable results.	The experimental group showed a significantly lower rate of low and very low birthweights.	There was effectively no follow-up since the evaluation was performed at birth.	The large size of the sample lends itself toward replicability, although the non-random design may limit the results.	Somewhat relevant. Birthweight must be connected through other variables to predict future economic growth effects.
<b>Vermont Intervention Program</b>	Health	The program was designed to assist mothers of low birth weight infants, consisting of hospital and home sessions. Low weight Infants born in the Medical Center Hospital in 1980 and 1981 were randomly assigned to either the experimental or control low birth weight group. A normal birth weight group was formed by recruiting infants born immediately after a low birthweight baby.	There were 24 children in the LBWE group, 31 in the LBWC group, and 36 in the NBW group. At age 9, 86.7% of the original group were given follow-up tests, a low attrition rate.	Infants in the low birth weight experimental group were found to be no different from the normal birthweight control group and significantly better off than the low birthweight control group. Outcome measures include cognitive scores, academic achievement, and behavior.	Follow-up evaluations were done at age 9. The authors note a general trend toward a widening of the gap between LBWE and LBWC.	Because the analysis was performed at a single hospital with a relatively small sample, generalizability may be questionable.	Relevant. The outcome measures can be related to economic growth, and the follow-up period was long.

<b>IHDP</b>	Home Visiting	IHDP is a multisite randomized trial including center-based educational intervention, home-based family support services, and pediatric follow-up. Children were enrolled from Oct. 1984 to Aug. 1985 according to specific birth weight and gestational period requirements.	At baseline, 377 experimental group infants and 608 control group infants were included in the study. At follow-up, 89% of the infants were evaluated.	In the heavier LBW group there were some significant improvements over the control group, including IQ score and some cognitive achievement scores. The overall intervention group, however, fared worse than the control group on a physical functioning subscale.	Children were assessed 8 years after the intervention, which was at birth.	That only modest results were only found for a subset of low birthweight infants suggests the generalizability of the program extends to a small group.	Somewhat relevant. The outcomes can be used in economic growth studies, but the follow-up duration is short.
<b>Parent Child Home Program</b>	Home Visiting	PCHP was a literacy focused home intervention program designed to improve outcomes for at-risk infants and toddlers. The evaluation was conducted with the children of low income and education parents in the Pittsfield, Massachusetts public schools.	The original sample consisted of five cohorts of 209 students, randomized between experimental and control groups, who were age two between 1976 and 1980. Only 123 students were available for follow-up, a relatively high attrition rate.	Students in the experimental group graduated from high school at a higher rate and dropped out a lower rate than those in the control group.	The long follow-up period provides confidence in the persistence of program effects.	The study was performed in a single district, so the results may not consistently generalize to other areas.	Relevant. To the extent that graduation rates are related to employment outcomes, the results are informative.
<b>Early Head Start Demonstration</b>	Preschool	Early Head Start is a program designed to promote child development and strengthen family and community relationships with respect to infants and toddlers. Eligible children were recruited under the	The original sample includes 1513 in the treatment group with 1488 in the control. Follow-up response rates were generally high.	There were significant differences in cognitive, language, and social-emotional development between experimental and control groups.	Up to 2 years after the study's end.	Since the fidelity of implementation was decided by each site, there were varying levels of actual implementation.	Somewhat relevant. The outcomes measured provide useful information, but the measurement duration is not long.

		normal recruitment standards for EHS, but were then randomly assigned to experimental and control groups.					
<b>Fast Track</b>	Mental Health	Fast Track is a multisite intervention that aims to reduce problem behavior in children. Screenings by parents and teachers identified at-risk children in kindergarten, and the highest at risk 15% of the children were invited to enroll. Interventions consisted of home visiting, academic tutoring, and social-skill training.	Enrolled students were randomized by elementary school (there were 54 of them), with a total of 445 children in the experimental group and 446 in the control group. By fifth grade, the last year of the program, 10% of the children were no longer participating.	Compared to the control group, the experimental group showed significant, if small, improvements in social competence and social cognition, involvement with deviant peers, and conduct problems in the home and community.	The follow-up evaluations were administered after fourth and fifth grade.	The screening process should be duplicated with high fidelity to avoid any selection issues with the sample.	Somewhat relevant. Most variables are loosely related to economic growth.
<b>Making Proud Choices</b>	Health	This is a safe-sex oriented intervention with the goal of reducing HIV transmission among low-income African Americans adolescents. The experimental group received education on HIV prevention while the control group received education on other non-sexually transmitted diseases such as cardiovascular disease.	The experimental group consisted of 218 adolescents while the control consisted of 214. There was a 5% attrition rate at the 12 month follow-up.	Members of the experimental group who reported sexual experience at baseline reported less sexual activity and less unprotected sexual activity at the 12 month follow-up.	There were follow-up surveys conducted at 3, 6, and 12 months.	Because the program was administered to a specific socioeconomic group in a single city, generalizability may be limited. Also, the results were only significant for specific methods of AIDS prevention.	Somewhat relevant. The outcome measures relate to economic growth only through fertility rates and health considerations, and the follow-up period is short.

<p><b>Multidimensional Treatment Foster Care</b></p>	<p>Juvenile Justice</p>	<p>The program aims to reduce behavior problems and delinquency among adolescent chronic offenders. The randomized study uses traditional group care facility treatments as a control. Participants were selected from a group of boys referred for community placement by the juvenile justice system and for whom parents gave consent.</p>	<p>37 participants were assigned to the MTFC condition while 42 were placed in the GC condition. There were no issues with attrition.</p>	<p>Boys in the experimental group had significantly fewer criminal referrals and more often were able to leave the program to live with family.</p>	<p>A 1 year follow-up was conducted.</p>	<p>Foster parents who were recruited for the program may have exerted more effort knowing that it was a demonstration trial. The small number of participants is problematic since the the foster parent sample may not be representative of its population.</p>	<p>Relevant. Criminal activity is useful in analysis, but the follow-up period is short.</p>
<p><b>NCICAS (National Cooperative Inner-City Asthma Study)</b></p>	<p>Health</p>	<p>The NCICAS was a multisite intervention to reduce asthma symptoms and hospitalization as a result of asthma. Participants were drawn from inner-city areas where at least 20% of the population was below the FPL and were required to meet certain conditions classifying their condition as asthma.</p>	<p>The experimental group numbered 515 while the control group was 518. However, the randomization occurred at the Asthma Study Unit level, which were groups of 6 or 8. Attrition was low, with more than 92% of the participants completing at least half of the phone interviews.</p>	<p>The experimental group showed significantly fewer symptom days and hospitalizations (the latter at the 10% level) than the control group.</p>	<p>The two year measurement duration (concurrent with the treatment) may be too short for potential analyses.</p>	<p>The results of this study are likely to be replicable on a large scale, assuming that there is an available pool of master's level social workers to administer it.</p>	<p>Somewhat relevant. The outcome measures are loosely related to economic growth, and the measurement duration is short.</p>

<p><b>TN-STAR (Tenn. Student Teacher Achievement Ratio)</b></p>	<p>School</p>	<p>Project STAR was designed to examine the effects of class size on student achievement. In 1985-1986, kindergarten students and teachers were randomly assigned to classes of varying sizes within their school. Students then remained in the same class type for four years.</p>	<p>Over all years, the sample included 11600 students from 80 schools. Attrition is an issue since half of the students present in kindergarten were missing in at least one subsequent year.</p>	<p>Outcomes were measured in terms of math, reading, and word recognition achievement tests at each grade level, appropriate for that grade level. There was a significant effect of class size on student achievement.</p>	<p>Outcome measurement was conducted only during the grades for which the program was implemented (4 years). Other researchers have conducted research with these data and found a higher probability of attending college.</p>	<p>The author argues that there should be no issues with replicability in terms of teacher performance. Also, the sample includes a large number of schools, so location may not be a large factor.</p>	<p>Somewhat relevant. The outcomes are relevant to economic growth, but greater follow-up is desirable..</p>
<p><b>Teach for America</b></p>	<p>School</p>	<p>TFA is designed to low-income communities improve academic achievement by assigning well educated teachers to community schools. The study evaluates outcome differences between TFA teachers and other teachers in the community through random classroom assignment.</p>	<p>The sample includes 100 classrooms and 2,000 students. The unit of observation is effectively the classroom.</p>	<p>Students of TFA teachers were shown to have significantly higher math achievement test scores after intervention than did the control group, but there was no effect on reading ability or other outcomes.</p>	<p>The analysis was done over the period of one school year.</p>	<p>Expanding TFA may dampen the measured effects because it is possible that the high mean academic achievement or strong motivation among current teachers would decrease.</p>	<p>Relevant. Achievement test scores can be related to economic growth, but the follow-up period was short.</p>

<p><b>Project TNT (Project Towards No Tobacco Use)</b></p>	<p>Health</p>	<p>The program seeks to prevent adolescent tobacco use through education. Junior high schools were recruited and randomly assigned to one of four experimental groups or the control group. 1 and 2 year follow-up surveys were conducted, including saliva tests for tobacco use.</p>	<p>A total of 6716 seventh-grade students were included at baseline, while 7219 students were included in the 2 year follow-up. 35% of the students that went through the program were not included in the latter number, suggesting a relatively high attrition rate. In addition, randomizing by school weakens the results.</p>	<p>Initiation of cigarette smoking and smokeless tobacco use as well as weekly frequency of both were examined. The more rigorous treatments showed significant differences from control.</p>	<p>Evaluations were administered after two years. It seems that attrition effects make further studies difficult.</p>	<p>The authors do not specify the regions in which the programs were administered, so it is difficult to say if the results would generalize to other areas.</p>	<p>Somewhat relevant. Outcomes are important only insofar as they affect health and consumption, and the follow-up period is short.</p>
<p><b>Quantum Opportunity Program</b></p>	<p>Mentoring</p>	<p>QOP is an after-school mentoring program for high school students providing supplemental education, developmental activities, and community service activities. The program targets students with low grades when beginning high school or who are at risk of dropping out. The evaluation took place between 1995 and 2001.</p>	<p>The total sample was 1,100 students randomly assigned to either treatment or control group. Attrition was not an issue.</p>	<p>Outcome measures included a significant increase in the likelihood of graduation and enrolling in post-secondary education or training. Outcomes that showed no significant difference were grades, achievement test scores, and risky behaviors.</p>	<p>During the fourth and fifth years of the program. The authors note that the evaluation is incomplete since many of the students had not yet graduated.</p>	<p>Replicability is likely an issue because implementation practices varied significantly between sites. Also, actual participation in QOP activities varied among youths.</p>	<p>Relevant. Outcomes related to education yielded mixed significant results, and the follow-up duration did not extend beyond the end of the program.</p>

<b>WIC</b>		<p>WIC, or the Special Supplemental Nutrition Program for Woman, Infants, and Children, provides vouchers for food and nutritional counseling. The study used data from the Pregnancy Risk Monitoring System on new mothers covered by Medicaid in 19 states, all of whom were eligible for WIC. They compare those who use WIC to those who do not in order to control for selectivity of the WIC user population.</p>	<p>60,731 observations from 19 states.</p>	<p>WIC participants were 6-7% more likely to use prenatal care in first trimester and were 2% less likely to have a child below the 25th percentile for gestational age if the child was premature or of low birth weight.</p>	<p>The follow-up measurement was at birth.</p>	<p>The data set is readily available so the study itself can be replicated.</p>	<p>The outcomes studied were limited. Also, the lack of data on when individuals began using WIC is problematic.</p>
<b>Georgia's Pre-K Program</b>		<p>Samples of three groups of children in Georgia were surveyed, including those in Georgia's Pre-K program, Head Start, and private preschool. Assignment to preschools was not random, and there was no comparison with children who did not go to preschool. Also, children from low income families in the Pre-K group were matched to children in the Head Start group</p>	<p>There were a total of 630 children included in the original sample, with 466 in the follow-up assessment. This implies an attrition rate of approximately 24%.</p>	<p>Children were assessed using tests of cognitive skill and language development. The Pre-K group caught up to privately schooled children and showed improvement beyond the Head Start group. The low income Pre-K group was significantly better prepared for kindergarten than the matched Head Start group.</p>	<p>The children were assessed upon entering kindergarten, directly after preschool.</p>	<p>The results here, although suggestive, may be difficult to replicate. The program design suggests possibilities for selection bias.</p>	<p>Somewhat relevant. The outcome measures are appropriate for economic growth analysis, but the short duration is a drawback.</p>

		for a separate comparison.					
<b>School Breakfast Program</b>		This is a program designed to improve the nutrition of low income, nutritionally needy children and indirectly enhance school performance. Free breakfast is provided to children in families below 130% of FPL and available at a subsidized rate to those in families up to 185% of FPL.	4,841 children ages 5-16 in NHANES III. The study consists of a difference in difference analysis using NHANES data, making use of fact that not all school districts offer SBP and it is not offered during the summer. Differences are across districts and seasons.	Outcomes include the Healthy Eating Index and nutritional status based on blood tests. SBP improves the quality of a child's diet, especially reducing fat intake and increasing fiber.	One time measure of diet and nutritional components via a blood sample.	The study can be replicated and the program is nationwide.	The short term nature of the study limits its relevance, as does the lack of any direct link to school performance or other more general measures of health.

<p><b>National School Lunch Program</b></p>		<p>SLP provides school lunches free to school-age children in families below 130% of FPL and at reduced prices up to 185% of FPL. Schools are reimbursed for the cost of lunches, including a subsidy for all lunches. Nearly all public and the vast majority of private schools offer lunches under this program.</p>	<p>The School Nutrition Dietary Assessment Studies (SNDA) conducted in 1991 to 1992 and seven years later aim to assess the dietary effect of SLP. Data were collected from school cafeteria managers. A study using the Child Development Supplement of the PSID studies take-up and influence on child well-being (Dunifon and Kowalski-Jones,2003). They use a sample of siblings age 6-12 in which there are differences in participation. 32 children of 266 were in families in which one child participated and the other did not.</p>	<p>Outcomes include dietary intake, the composition of school lunches for the SNDA, and child behavior indicators for the CDS-PSID study.</p>	<p>Folow-ups were administered at irregular intervals. The source of information does not provide actual consumption or resulting dietary intake but rather the composition of lunches offered. CDS has been conducted twice and could serve as a source of data on the program, but there may be selection issues.</p>	<p>The program is nationwide. A more important question might be whether or not the program leads to actual improved nutrition compared to no "free lunch," and whether this results in better school performance. The CDS-PSID study finds no evidence of improvements in child well-being.</p>	<p>The limited outcomes and lack of a comparison group limits the value of the studies.</p>
---	--	---	---	---	---	--	---

<p><b>Communi- ties In Schools</b></p>	<p>The program assists students in staying in school and graduating from high school. Specifically, the population served is at risk of dropout. The youths were not randomly assigned, and there was no specific control group for comparison. Instead, the authors compared outcomes with national averages.</p>	<p>The authors studied 30 CIS programs in 17 communities nationwide. They evaluated 659 youths who participated in the CIS program.</p>	<p>Absenteeism, GPA, dropout rates, and behavior measures were included in the assessment. For most of these measures, CIS students showed improvement.</p>	<p>The study period was up to 3 years.</p>	<p>Replicability is likely to be problematic with this program. Specifically, the lack of fidelity between implementations and the potential for strong selection bias cast doubt on both replicability and the validity of the results.</p>	<p>Relevant. The outcomes include variables relevant to economic growth analysis, and the study period was reasonably long to capture effects.</p>
--	--	---	---	--	--	--