THE ECONOMICS OF EARLY CHILDHOOD INVESTMENTS

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Contents

Executive Summary

Early childhood, beginning in infancy, is a period of profound advances in reasoning, language acquisition, and problem solving, and importantly, a child's environment can dramatically influence the degree and pace of these advances. By supporting development when children are very young, early childhood development and education programs can complement parental investments and produce large benefits to children, parents, and society.

An analysis by the President's Council of Economic Advisers describes the economic returns to investments in childhood development and early education. Some of these benefits, such as increases in parental earnings and employment, are realized immediately, while other benefits, such as greater educational attainment and earnings, are realized later when children reach adulthood. **In total, the existing research suggests expanding early learning initiatives would provide benefits to society of roughly $8.60 for every $1 spent, about half of which comes from increased earnings for children when they grow up.**

- **High-quality early education for all would narrow the achievement gap. Dozens of preschool programs have been rigorously examined since the 1960s.** Overall, across all studies and time periods, early childhood education increases cognitive and achievement scores by 0.35 standard deviations on average, or nearly half the black-white difference in the kindergarten achievement gap. Since higher income children are currently more likely to have access to high-quality early education, expanding access to all would narrow the achievement gap.

- **Early childhood education can boost children's earnings later in life.** Long-term analyses suggest that early childhood education can increase earnings in adulthood by 1.3 to 3.5 percent. These earnings gains alone are bigger than the costs of such programs.

- **Earnings gains from increased enrollment in early childhood education would provide benefits that outweigh the costs of the program.** Researchers estimate the gain in income for recent statewide programs over a child's career to be $9,166 to $30,851, after taking out the cost of the program. If all families were able to enroll their children in preschool at the same rate as high-income families, enrollment would increase nationwide by about 13 percentage points and yield net present value of $4.8 billion to $16.1 billion per cohort from earnings gains alone after accounting for the cost of the program. In the long run, these earnings gains translate into an increase in GDP of 0.16 to 0.44 percent.

Parents recognize the importance of early childhood investments and, despite working longer hours for pay, both mothers and fathers are also spending more time interacting with their children. Early childhood education programs can strengthen parents' attachment to the labor force and increase their earnings potential by providing a safe and nurturing environment that furthers the education and development that parents are providing at home.

- **High-quality, affordable child care can help parents balance work and family responsibilities.** Studies show that providing better access to and lowering the cost of high-quality care can significantly increase mothers' employment rates and incomes. This increase in family income has been shown to improve children's outcomes as well.

Children who enter school at higher levels of readiness have higher earnings throughout their lives. They are also healthier and less likely to become involved with the criminal justice system. These positive spillovers suggest that investments in early childhood can benefit society as a whole.

- **Early childhood education can lower involvement with the criminal justice system.** Research shows that improving cognitive and socio-emotional development, investments in early childhood education may reduce involvement with the criminal justice system. Lower crime translates into benefits to society from increased safety and security as well as lower costs to the criminal justice system and incarceration.

- **Early childhood interventions can reduce the need for remedial education.** Research shows that benefits in children's development may also reduce the need for special education placements and remedial education, thereby lowering public school expenditures.

The estimated benefits to society from investing in early childhood education are large and go beyond the estimated increase in earnings for children as they become adults. While it is difficult to put a precise number on the sum total in gains to parents and society, research shows that gains that come from the benefits to children's employment and earnings far outweigh the costs.

Introduction

The last several decades have brought tremendous strides in our understanding of early childhood development. Researchers have established that early childhood, beginning in infancy, is a period in which profound advances take place in individuals' reasoning, language acquisition, and problem solving, and more importantly, that a child's environment can dramatically influence the degree and pace of these advances. By supporting development when children are very young, early childhood education programs can complement parental investments and produce large benefits to children, parents, and society.

Many parents understand that early childhood is a period of great opportunity for shaping a child's way of interacting with his or her world, and will influence a child's ability to navigate adulthood. Mothers and fathers alike now spend more time interacting with their children than they did 50 years ago and are directing more family resources to activities and consumption that enrich their child's learning. They are increasingly providing types of care that are likely to be particularly beneficial to their children's development, like reading, playing, and taking children to extra-curricular activities.[1] This increase in active caregiving among both mothers and fathers has occurred at the same time as there has been an increase in time spent working by mothers, and a rise in the proportion of households in which all parents are working.

Not only does high-quality early childhood education benefit a child's development, but it also helps support parents who are struggling to balance work and family obligations. The share of parents reporting work-family conflict has increased over the past 40 years,[2] and almost half of all working parents have turned down a job they felt would interfere with their family obligations.[3] While workplace supports such as paid leave and flexible scheduling are a crucial ingredient to help parents balance work and family, a safe, nurturing environment that supports their children's development is also important in supporting working families. By providing such care, early childhood education programs can strengthen parents' attachment to the labor force and increase their earnings potential. Higher labor force participation and earnings has potential benefits for children, such as higher health care expenditures, higher education spending, more consistently nutritious food and reduced household budgeting stress.

By both helping kids develop early foundational skills and by allowing more parents to actively pursue careers, investments in early childhood development provide benefits not just for children and their parents, but for society as a whole. Children who enter school at higher levels of readiness have higher earnings throughout their adult lives. They are also healthier and less

[1] CEA calculations using the American Time Use Survey from the years of 2002 to 2014. Earlier data comes from Bianchi et al. 2006.

[2] Horn (2012) using 2008 National Study of the Changing Workforce, Families and Work Institute; 1977 Quality of Employment Survey, U.S. Department of Labor.

[3] 49 percent of working parents have chosen to pass up a job they felt would conflict with family obligations (Nielson 2014).

likely to become involved with the criminal justice system. These positive spillovers suggest a role for government to support investments in early childhood development. The United States has recognized this, and over the past half century, we have made tremendous strides in expanding access to high-quality early childhood education. The Administration has supported expansions of home visiting programs shown to improve parenting behavior and children's outcomes in many low-income families. The Federal government currently invests over $5 billion annually to provide access to high-quality child care to nearly 1.5 million children through the Child Care and Development Fund (Office of Child Care 2014a,b). Head Start, established as part of the War on Poverty in 1964, and Early Head Start, established in 1994, collectively provide access to high-quality education for over 1 million low-income children ages five and under annually.

Preschool programs at the State level have further expanded access to early childhood education such that today over half of three- to four-year-olds are enrolled in either preschool or kindergarten. Today, 40 States and the District of Columbia have in place State-funded preschool programs, serving more than one-quarter of all four-year-olds in the 2012-13 school year. To further increase opportunities for all children to begin kindergarten school-ready, the Administration has proposed expanding high-quality preschool for all low- and middle-income four-year-olds, maintaining low-income families' access to affordable child care, and making effective home visiting programs for new parents more widely available.

This report describes the economic returns to investments in childhood development and early education. Reviewing recent research, it is clear that early education programs in general are good investments. In the short-run, programs have been shown to increase earnings and employment for parents. In the long-run, the programs can benefit participants and society by increasing the earnings and employment of participants, improving health, reducing anti-poverty spending, and reducing crime. Research shows that past early learning initiatives have provided total benefits to society, including reduced crime, lower anti-poverty transfers, and educational savings, of up to $8.60 over a child's lifetime for every $1 spent, and current programs will likely yield similar benefits.

I. Early Childhood Investments in the United States

Extensive literatures in economics, neuroscience, and psychology all conclude that early childhood investments can benefit children, parents, and society. Both researchers and parents understand that early childhood, beginning in infancy, is a period of profound opportunities to advance children's skills in reasoning, language acquisition, and problem solving. Accordingly, mothers and fathers alike now spend more time interacting with their children than they have in the last 50 years.

At the same time as mothers and fathers are increasingly taking more active roles in their children's lives, they are also working more. As parents balance competing responsibilities of work and family, access to high-quality child care and early education programs has become more critical. This section reviews the economics of early childhood investments, the types of investments serving young children and their families, and how investments in early childhood education have changed over the past 50 years.

Early Childhood Programs: From Home Visiting to Kindergarten

Advances in child development research demonstrate that the cognitive abilities and socio-emotional capabilities of young children change dramatically in the first few months and years of life. Infants have different developmental needs than preschoolers, and accordingly, early interventions take different forms depending on a child's age. This report reviews the evidence concerning the impacts of various early childhood investments across these different age groups.

Several types of public investments target child development from before children are born and throughout early childhood. Nurse home visiting programs rely on trained nurse educators to visit families during pregnancy and shortly after a baby is born to provide a range of health and parenting information. This includes parental observations and instruction, nutrition and wellness education, and psychological consultations. The goal of home visiting programs is to ensure a healthy, safe, and supportive environment in the first years of a child's life. Additionally, Early Head Start provides early, continuous, intensive, and comprehensive child development services to infants and toddlers and their families, as well as expectant families.

Child care is another major form of early childhood investment for young children. Child care takes many forms, from in-home care with a neighbor or relative, to professional in-home care, to center-based care. Child care is a critical mechanism for early learning and family work support. Some child care programs also provide structured education to help support a child's early cognitive and socio-emotional development. These programs, often referred to as early childhood education, can benefit children of all ages. This report reviews the evidence on several major early care and education programs, including home visiting and Early Head Start. Preschool programs, which this report defines as center-based education programs for three- and four-year-olds, include public programs such as Head Start and state-funded preschool programs, as well as private preschool programs. Preschool programs generally utilize trained teachers and a focused curriculum, vary in length and intensity, and may include supportive services such as

parent visits or health services. Almost all early childhood programs aim to build early cognitive or non-cognitive[4] skills that prepare children for kindergarten. In addition to fostering children's development and learning, these programs offer a safe and reliable setting for children. Once children enter elementary school, high-quality, full-day kindergarten can further help children's development.

Although each of these investments is targeted at children in a different stage of development, all have the potential to improve cognitive and socio-emotional outcomes for children by increasing the time, attention, and learning resources children receive in an early stage of development. Because parents often need to balance work and family responsibilities, most of the programs we review also have the potential to enable parents to participate in the labor force by providing a source of care for their children. These increases in parental earnings in turn increase the amount of resources available to children, and can contribute to further improvements in child development.

The Economics of Investing in Young Children

Early childhood investments take many forms, including increasing the amount and quality of parental and caregiver time, attention, and education and training; providing and improving instructional materials, providing child care curricula, and modifying parental habits and behaviors. Regardless of the exact form of the investments, there are several channels through which early childhood investments are believed to benefit children. Some of these are direct, in which investments in children improve their outcomes. Others work indirectly, for example by helping parents to increase their labor force attachment, which then indirectly benefits children through higher household income.

Benefits to Children

Researchers have outlined three main theories that point to early childhood as a particularly important time to invest in children. First, investments made when children are very young will generate returns that accrue over a child's entire life. Since the benefits are realized over a longer time horizon the earlier in life they are made, early childhood interventions are likely to generate substantial benefits – both to the affected child and to his or her community.[5]

A second reason that early childhood investments benefit children's development may be that the flexibility and capacity for change in cognitive functioning and brain development is the greatest for young children, and these changes can have lasting effects on behavior throughout life (Knudsen et al. 2006). Work at the intersection of economics, neuroscience, and child development shows that characteristics that are often assumed to be hereditary, such as IQ, can be influenced by environmental factors in early childhood.[6] Under this model, not only do earlier

[4] This refers to skills that are not direct measurements of cognition, including socio-emotional and behavioral skills.
[5] This is a central tenet of the human capital model in economics; see Becker (1962) and Ben-Porath (1967).
[6] See (Jensen 1980), National Scientific Council on the Developing Child (2007).

investments generate benefits over a long time period, but each dollar invested produces greater impacts since children's brains are developing most rapidly when they are young.

Third, early investments can have large impacts if early skills serve as a multiplier, or complement, for later skills.[7] For example, it may be that the extent of skill acquisition in early elementary school depends on the degree of skills attained before entering kindergarten, and skills learned in adolescence depend on mastery of these elementary skills. Under this "skill begets skill" model, early investments in child development can enhance the productivity of future investments in human capital. Since early education may serve as a complement for later skills gained in high-quality elementary and later education, it is important for children to have access to high-quality education at all ages in order to maximize the benefits of early education. A continuum of high-quality education ensures that early investments can be strengthened and built upon in later years (Currie and Thomas 2000).

Research is ongoing to more fully understand the mechanisms through which early childhood investments benefit children. As such, it is premature to conclude that any one of the models above is the sole channel through which benefits arise.

Benefits to Parents

Access to high-quality care for young children can help parents increase their employment and earnings. Parents who have child care options are better able to work, and to work more hours. In the short-term, this enables parents to work more and provide additional income for their families, ultimately benefitting the children. In the longer-run, this increased attachment to the labor force and increased work experience translate into long-term earnings benefits for parents who have the opportunity to send their kids to high-quality preschool. Many studies show that providing better access to and lowering the cost of high-quality child care can significantly increase mothers' employment rates and incomes, and this increase in family income can improve children's outcomes.[8] Additionally, programs with parent support components, such as home visiting, have a number of other benefits for parents, including increased confidence and reduced stress, potentially improving the overall well-being of the family by extension (Heckman et al. 2014).

Benefits to Society

In addition to benefiting children and parents, the benefits of early education extend to society as a whole. These spillover benefits, what economists call positive externalities, include reductions in crime, and lower expenditures on health care and on remedial education.

By improving cognitive and socio-emotional development, investments in early childhood education may reduce involvement with the criminal justice system. Lower crime translates into benefits to society in the form of lowered costs of the criminal justice system and incarceration,

[7] Cunha et al. (2006); Cunha and Heckman (2007).
[8] Karoly et al. (1998); Barnett and Masse (2007); Temple and Reynolds (2005).

as well as reductions in victimization costs.[9] Likewise, these benefits in children's development may also reduce the need for special education placements and remedial education, thereby lowering public school expenditures.[10]

Some early childhood investments, such as Early Head Start, Head Start, and maternal home visiting programs, which offer access to immunizations, health services, or parenting education, have also been shown to improve the health of program participants (Olds et al. 1998). These health improvements benefit not only recipients, but also society, through lower expenditures on emergency care and health insurance.

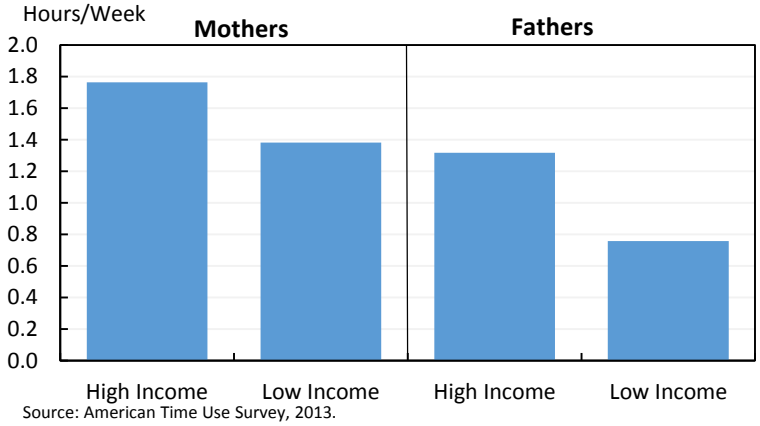
Inequalities in Parental Time, Resources and Education

Today, parents of all income levels are spending more time with their children than previous generations.[11] This additional time, particularly time spent playing and engaging in a child's development, is important for early cognitive development. For example, research demonstrates that reading to children is crucial for early language acquisition and communication skills.[12] While parents across the income distribution have increased the amount of time spent with their children, inequalities persist in parental resources, earnings, and education. This inequality during early childhood also affects adult outcomes, and is one reason suggested for the high correlations of income across generations (Solon 1992). For instance, when mothers obtain more education, it improves birth outcomes for their children (Currie and Morretti 2003).

Parents in the top income quintile now spend seven times more on enrichment activities and materials for their children—such as books, computers, summer camps, and music lessons—than families in the bottom income quintile (Duncan and Murnane 2011). Moreover, as income inequality has grown, so has inequality in child-related expenditures. The gap is also reflected in the total time spent with children and in the types of activities on which that time is focused. In particular, as shown in Figure 1, high income parents spend more time on educational activities with their children.

[9] Heckman et al. (2010b); Currie (2001); Reynolds et al. (2001).
[10] Anderson (2014); Reynolds et al. (2001, 2002); Belfield et al. (2006); Heckman et al. (2010b); Carneiro and Ginja (2014).
[11] Ramey and Ramey (2010); Bianchi (2010).
[12] Shonkoff and Phillips (2000); Tamis-LeMonda, et al. (2004).

Figure 1: High Income Parents Spend More Time on Educational Activities with their Children



Source: American Time Use Survey, 2013.

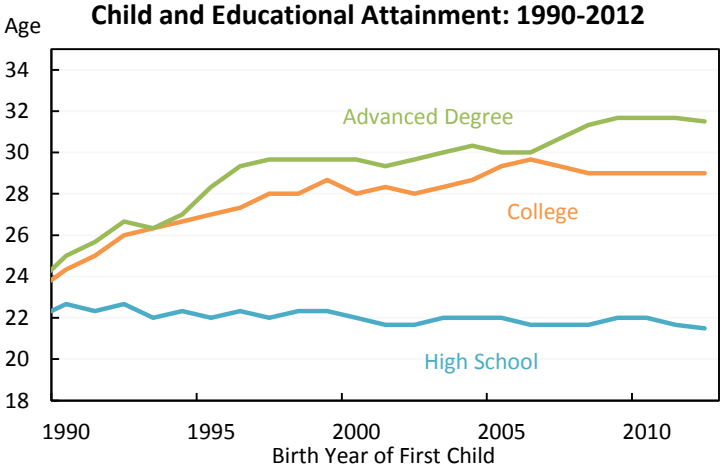
Note: High income refers to top quartile while low income refers to bottom quartile. Includes time spent helping students with homework, attending school meeting, reading to or with children, and other activities assosicated with chilren's education.

While parents of all levels of education are spending more time with their children, the largest increases in parental time have occurred among parents with higher levels of education (Ramey and Ramey 2010). In addition to spending more time with their children, highly-educated parents are spending time on activities, such as playing with young children and encouraging older children's extra-curricular activities that are particularly likely to support children's development (Ramey and Ramey 2010). For example, highly-educated parents spend more time on developing their children's reading and problem solving skills in preschool, and spend more time on extra-curricular activities for older children. In contrast, parents with less than a college degree are less likely to adapt their time use patterns with children to developmental stages.[13] Differences in parental inputs are reflected in a gap in children's vocabulary by parents' educational attainment: highly-educated mothers tend to engage in more complex talk with their children and spend more time reading, and at 2 and 3 years old, their children have more expansive vocabularies than children whose exposure to books and language was lower (Vernon-Feagans et al. 2012). The Administration has proposed expanding parental education and supports, including maternal home visits, which may help reduce the inequality in young children's vocabulary.

Demographic changes are also contributing to greater resource inequality between children born to parents with more and less education. Although average ages at first marriage have converged across women and men of different education levels, ages at first birth have not. While women with a high school degree have their first child around age 22, similar to 20 years ago, women with a college degree or higher tend to first give birth when they are in their late 20s and early 30s (Figure 2). As a result, parents with less education, and therefore lower average lifetime earnings, also tend to have children earlier in their careers when their earnings are low. The gap in age at first birth has increased between low- and highly-educated women, further contributing to the gap in family resources experienced by children born to more and less educated parents.

[13] Kalil, Ryan, and Corey (2012); Kalil (2014).

Figure 2: Median Age at First Birth by Birth Year of First Child and Educational Attainment: 1990-2012



Note: Three-year centered moving averages are shown.
Source: Current Population Survey, Fertility and Marital History Supplement, 2012

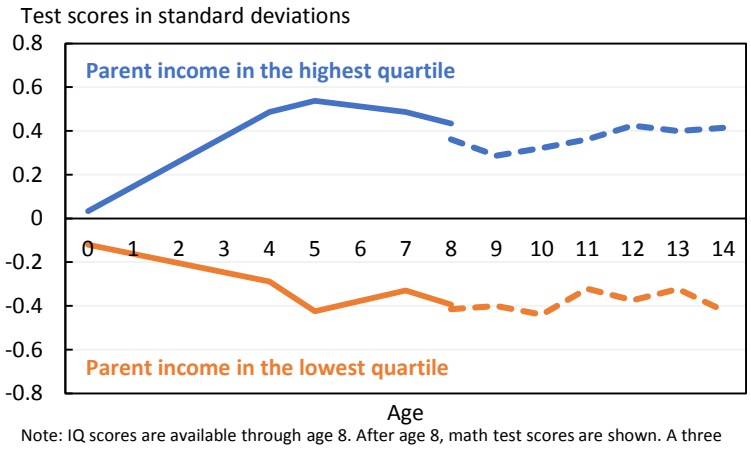
Lower-income families also tend to have more children. For example, women below the Federal Poverty Level are expected to have one more child than those at 300 percent of the poverty level or higher.[14] Other demographic forces behind the increasing disparity in resources available to children include high rates of divorce and nonmarital childbearing among low-income parents (McLanahan 2004), as well as close timing of births (Buckles 2008). All of these factors tend to reduce the amount of family resources, both financial and non-financial, that are available for each child during his or her early years.

Inequality in family financial and non-financial resources all contribute to achievement gaps that manifest very early in a child's life. Disparities in cognitive, social, behavioral, and health outcomes between children from lower- and higher-income families, are evident in children as young as nine months of age and grow as children age (Halle et al. 2009). As shown in Figure 3, most of the income achievement gap emerges before age 5, remaining relatively level throughout elementary school and beyond. Some researchers argue that these gaps have grown over the past 50 years (Reardon 2011) but this remains an active area of research.[15]

[14] National Health Statistics Report (2012) using the National Survey of Family Growth, 2006-2010.

[15] There is some disagreement on the comparability of achievement gaps across studies over time. While some studies suggest gaps in test scores across socioeconomic groups stabilize from primary school (Reardon 2011; Heckman 2006), others argue that differences in academic achievement based on standardized test scores are not comparable over time (Nielsen 2014).

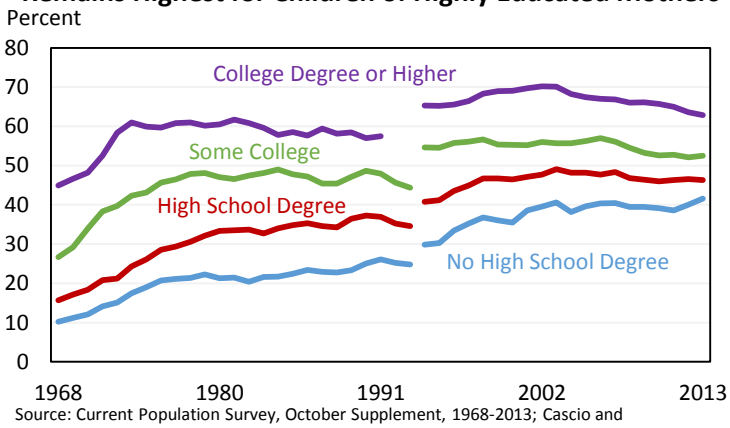
Figure 3: Achievement Gap Grows Throughout Childhood



Note: IQ scores are available through age 8. After age 8, math test scores are shown. A three year moving average is used for math scores.
Sources: 2013 U.S. Collaborative Perinatal Project (solid lines); NLSY79 Child and Young Adult Supplement (dashed lines).

Inequality in early child development is reflected in, and exacerbated by, differences in access to and utilization of early care and education programs by income and educational attainment. Participation in early childhood education is high among children from highly-educated and high-income families. About 60 percent of three- and four-year-olds whose mothers have a college degree are enrolled in preschool, compared to about 40 percent of children whose mothers did not complete high school. Although preschool attendance has increased for all education groups since the 1970s, children of less-educated mothers are still less likely to attend preschool, likely due to the significant cost burden of high-quality early childhood care. These gaps in preschool access exacerbate differences in childhood development outlined earlier.

Figure 4: School Enrollment Among 3 and 4 Year-Olds Remains Highest for Children of Highly Educated Mothers



Source: Current Population Survey, October Supplement, 1968-2013; Cascio and Schanzenbach (2013); CEA calculations.
Note: Enrollment data include preschoolers and kindergarteners. Data show 3-year centered moving averages. Breaks in series are due to 1994 CPS redesign.

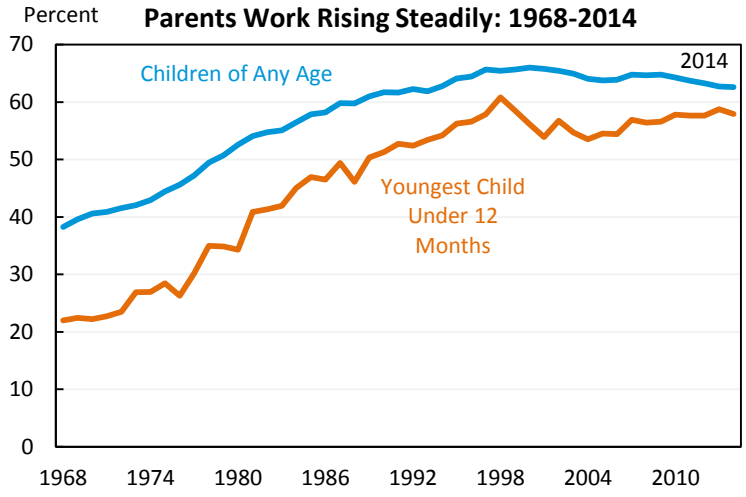
While the majority of children with working parents have some regular child care arrangement, these arrangements can be a large burden on working families' budgets. The Department of Health and Human Services defines affordable child care as costing no more than 10 percent of

family income. Lower-income families are less likely to have affordable care: among families with child care expenses and working mothers, families below the Federal Poverty Level paid an average of 30 percent of their income in child care costs, compared to 8 percent among non-poor families (Census Bureau 2013).

Changes in Work and the Need for High-Quality Early Care and Education

The need for high-quality, affordable early care and education has become especially important as most parents are working today. As female labor force participation has increased over the past 40 years, the fraction of households in which all parents work, and all parents work full-time, has increased (Figure 5). Currently, all parents work in the majority of households, including those with infants.

Figure 5: Percent Households with Children in Which All Parents Work Rising Steadily: 1968-2014



Source: Current Population Survey, ASEC; CEA calculations.

This trend highlights the necessity of affordable, accessible, high-quality child care that helps parents meet their work and family responsibilities. Having high-quality early care and education enables parents to increase their employment and earnings knowing their children are being well cared-for during the hours they are at work. The existing literature confirms that lower child care costs boost maternal employment. Although estimates vary, most studies find that a 10 percent reduction in child care costs increases maternal employment 0.5 to 4 percent.[16] Single mothers' work decisions appear particularly responsive to changes in child care costs.

Increased attachment to the labor force and increased work experience translate into long-term earnings gains for parents. By increasing the amount of resources available to the family, these earnings gains can also improve childhood outcomes including their adult earnings capacity when

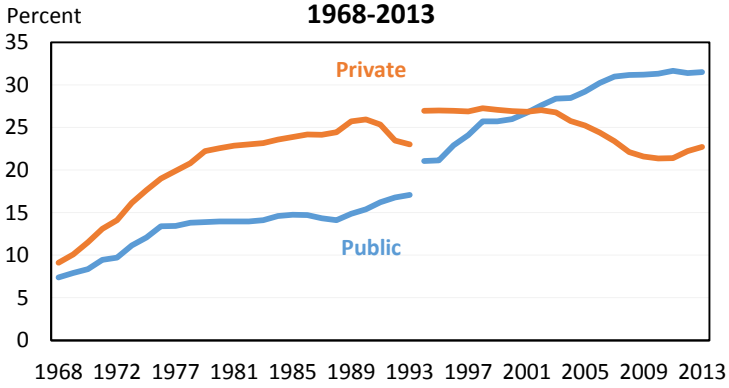
[16] See, for example, Herbst (2010); Baker et al. (2005); Connelly and Kimmel (2003); Anderson and Levine (2000).

children reach adulthood.[17] As mentioned above, these feedback effects can be an important additional channel through which early childhood programs improve child outcomes.

Utilization of child care and early education programs has expanded over time. For example, it is perhaps unsurprising that since most children live in a household where all parents work, the majority of children under five (61 percent) have some type of regular child care arrangement. These children spend a large amount of time in care: the average time spent in care was 33 hours a week among children under five with at least one child care arrangement (Census Bureau 2013).

Enrollment in both public and private preschool programs has also risen over the past 40 years for children across the income distribution. Today, about half of three- and four-year-olds are enrolled in public or private preschool, defined as center-based prekindergarten programs, Head Start, or child care, compared to less than one-fifth in 1970.[18] A large share of the enrollment growth over the last several decades was driven by public investments. The largest Federal investment in public preschool began with the creation and expansion of Head Start. Head Start was established to provide education, parental supports, and nutritional assistance to children from low-income families. Participation in Head Start has increased over the past 20 years, and today, Head Start serves nearly 1 million low-income three- and four-year-olds, in addition to nearly 110,000 children under age three through Early Head Start (Office of Head Start 2014).

Figure 6: Public School Enrollment Rising Among 3 and 4 Year-Olds While Private School Enrollment Levels Off: 1968-2013



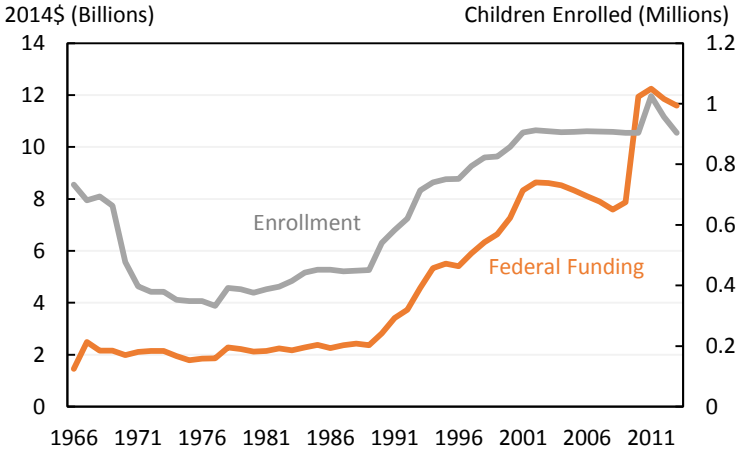
Source: Current Population Survey, October Supplement, 1968-2013; Cascio and Schanzenbach (2013); CEA calculations.
Note: Enrollment data include preschoolers and kindergarteners. Data show 3-year centered moving averages. Breaks in series are due to 1994 CPS redesign.

Over the past decade, states have also increased their investments in early childhood education by establishing and expanding their own preschool programs. Today, 40 states and the District of Columbia have established their own preschool programs, and as of the 2012-13 school year, these state programs serve more than one-quarter of all four-year-olds (Barnett et al. 2013).

[17] Duncan, Morris, and Rodrigues (2011); Duncan, Ziol-Guest, and Kalil (2010).
[18] In the Current Population Survey, children reported to be attending "nursery school" might be in day care centers, preschools, or Head Start programs, depending on how reference person interpreted "nursery school" (CPS School Enrollment Supplement File Technical Documentation).

Federal public preschool investments in Head Start have also expanded since the 1960s. Although inflation-adjusted investment began to fall in the early to mid-2000s, Head Start's funding was significantly boosted by the Recovery Act in 2010 and has remained high relative to its historical levels despite sequestration in 2013.

Figure 7: Head Start Enrollment and Funding Rising Consistently: 1966-2013



Source: U.S. Department of Health and Human Services, Office of Head Start.

II. The Impact Early Childhood Interventions on Children and Parents

As noted above, the early childhood years offer many opportunities for investing in children in ways that lead to better outcomes later in childhood and even into adulthood. We review evidence on the impacts of child care investments targeting kids in two age ranges: infants and toddlers (from birth to age three) and preschoolers (ages three to four).

Within the broad category of early childhood interventions, there are clear and important differences. Programs target children at different stages of development, and timing alone may lead to different impacts because of the developmental reasons mentioned above. Even within the same types of programs, programs may vary with respect to resource levels, teacher training requirements, and program duration, all of which may lead to further differences in effects. This report attempts to identify elements of program design that research has associated with larger or more lasting improvements in child outcomes. In doing so, we make an effort to understand the key ingredients behind "high-quality" early childhood programs, defined in this report as programs with features that have been shown to improve children's achievement and cognitive outcomes. In our review of the evidence we limit ourselves to studies that use either random assignment, or other highly credible research designs that plausibly identify causal impacts of the interventions of interest.

The Effects of Early Childhood Programs for Very Young Children

Maternal Home Visiting

Maternal home visits are usually targeted at infants and very young children, and provide health and child care education to support pregnant women and recent mothers. These voluntary programs can help parents raise healthy children in a positive environment. These programs can help mitigate inequality in family resources among infants, which contributes to the relatively high postnatal mortality rate in the United States (Chen, Oster, and Williams 2014). By improving health outcomes and improving family self-sufficiency, these programs can benefit children and parents in the long-run.

One well-established program, the Nurse Family Partnership, provides first-time, unmarried, low-income mothers with home visits during pregnancy through their child's second birthday. Program participants had more time between the birth of their first and second child, lower receipt of cash transfers, fewer arrests, lower rates of drugs and alcohol abuse, and lower rates of child abuse. These results held through the follow-up period, when children were 15 years old (Olds et al. 1998).

A recent reanalysis of the Nurse Family Partnership program found that cognitive abilities improved by age six among children whose mothers participated in the program, primarily due to an improved home environment and improvements in parenting behavior, as well as greater self-esteem and lower anxiety among mothers. These early cognitive gains translated into improved language and math abilities and fewer school absences at age 12 (Heckman et al. 2014).

More generally, a meta-analysis of home visiting programs found that these programs significantly improved parenting behavior and parenting attitudes, while increasing schooling enrollment among mothers (Sweet and Appelbaum 2004). Families with low birth-weight children saw the largest parenting and cognitive benefits, and programs that targeted teenage mothers were particularly effective in increasing maternal education. Another recent study found that Head Start programs that incorporated frequent home visiting were particularly effective at improving non-cognitive benefits compared to other Head Start programs (Walters 2014). Other models of home visiting programs are also showing promising results, with 16 models meeting the Department of Health and Human Services' criteria for evidence-based programs (Health Resources and Services Administration). Ongoing data collection will allow for further rigorous evaluation and help expand the knowledge base of the most effective components of home visiting programs.

Based on the large body of evidence showing the Nurse Family Partnership and similar home visiting programs' positive impacts on children's cognitive outcomes, federal support for home visiting programs began in 2008 and further expanded under the Affordable Care Act in 2010. This ACA expansion was recently extended with bipartisan support through March 2015, and the President proposed extending funding for another ten years in his 2013 State of the Union address.

Early Care and Education Programs for Infants and Toddlers

Parents are best able to work when they have access to stable, high-quality, affordable child care arrangements. Studies generally find that improving the affordability of child care increases employment. For instance, a universal subsidy that lowered the cost of child care to $5 a day in Quebec, Canada increased maternal labor force participation by about 8 percentage points.[19] Similarly, an evaluation of a near-universal child care program in the US during the 1940s substantially increased maternal employment (Herbst 2014). More recently in the US, child care subsidies that reduced the cost of child care by 10 percent increased employment among single women by 0.5 percentage points (Herbst 2010).

High-quality care can be a win-win for both children and parents by providing both the direct and indirect benefits described earlier. Specifically, child care may benefit children by increasing the likelihood that they are in safe and nurturing learning environments (Havnes and Mogstad 2011). By increasing the probability that mothers are working, increased child care access may also benefit children by increasing family resources, thereby reducing financial hardship and possibly parental stress (Forry 2009).

Researchers have examined programs targeted to very young children to analyze how these benefits unfold over a child's life. For example, in the Abecedarian Project (ABC), poor children born in North Carolina between 1972 and 1977 were randomly assigned to receive full-time, high-quality education from infancy through age five. Although the program served a relatively small

[19] Baker et al. (2005); Lefebvre and Merrigan (2008).

number of children (57), it is a landmark study for its rigor and detailed tracking of child and family outcomes over children's lives.

Children's gains from the Abecedarian Project persisted through adolescence and adulthood. At ages 8 and 12, program participants had higher cognitive scores and scored higher on math and reading achievement tests, and these achievement gains persisted through ages 15 and 21 (Ramey and Campbell 1984; Campbell and Ramey 1995). In addition, participants had higher high school graduation and college attendance rates, as well as more years of schooling. These achievement gains translated in to large earnings gains as participants entered the labor force. At age 30, participants had income gains of over 60 percent relative to the control group (Campbell et al. 2012). The benefits of Abecedarian also accrued to parents, as the program increased mothers' employment (Currie 2001) and increased maternal earnings by about $90,000 over the mother's career, almost twice as large as the earnings gains for participant children (about $50,000).[20] A recent study found that participants in the Carolina Abecedarian Project had better health, including lower blood pressure (Campbell et al. 2014).

The Infant Health and Development Program (IHDP) expanded the Abecedarian model to eight U.S. cities, targeting a sample of low birth weight, premature infants. IHDP significantly improved cognitive outcomes among a diverse group of students during the program and up to 15 years after completing the program.[21] Low-income children benefited the most from the program, and projections suggest that either a universal or income-based program similar to IHDP would essentially eliminate income-based gaps in IQ at age three and would substantially reduce IQ gaps at ages five and eight (Duncan and Sojourner 2012).

While Head Start students are predominantly either three or four years old (at about 35 and 50 percent of enrollment, respectively), Head Start also serves younger children through Early Head Start (Office of Head Start 2013). Early Head Start provides services for at-risk pregnant women, new mothers, children ages zero to three, and their families, and focuses on positive parenting and home environments and children's developmental outcomes. Early Head Start served nearly 110,000 children ages two and younger in 2012-13 (Office of Head Start 2014). The Early Head Start Research and Evaluation Project randomly assigned children to receive Early Head Start services and tracked children's performance into elementary school. Children who participated in Early Head Start showed less aggressive behavior, greater vocabulary and language development, and higher cognitive skills upon the program's completion. These gains were especially pronounced among African-American children, for whom these gains persisted through elementary school. Parents who received Early Head Start services showed greater engagement during play and greater support for language and learning development at home (Faldowski et al. 2013). Other studies of Early Head Start have found similar results for cognitive development and language acquisition,[22] as well as for home environments.[23]

[20] Barnett and Masse (2007). Each of these figures is in 2014 dollars, with a 3 percent discount rate.
[21] Brooks-Gunn et al. (1994); Gross et al. (1997); McCarton et al. (1997); McCormick et al. (2006).
[22] Vogel et al. (2013); Vallotton et al. (2012); Chapin and Altenhofen (2010).
[23] Bradley, et al. (2011); Chazan-Cohen et al. (2009); Roggman et al. (2004).

Some research shows that subsidies for high-quality child care can also improve children's outcomes. Two studies from Norway demonstrate that child care subsidies can improve children's academic performance (Black et al. 2011) and, later in life, increase educational attainment, decrease receipt of cash transfers, and increase labor market participation (Havnes and Mogstad 2011). Likewise, expansions of child care through the Lanham Act in the United States increased children's educational attainment and earnings capacity, and these benefits were largest for the poorest children (Herbst 2014). It is important to note, however, that the quality of child care is likely important for children's outcomes. For example, low-quality care may explain why universal $5 per child care in Quebec was found to adversely affect children's behaviors,[24] and why some studies of U.S. child care subsidies also find negative effects on child achievement and behavioral outcomes.[25] These disparate results underscore the importance of not only the quantity, but quality, of care.

The Effects of Early Care and Education Programs for Preschool-Aged Children

A large literature indicates that preschool can benefit children's school readiness and increase earnings and educational attainment later in life. Preschool is one of the most studied interventions, with an unusually deep research base beginning with randomized evaluations of well-known, but small, programs like Perry Preschool and Abecedarian that began in the 1960s and whose participants' outcomes have been tracked well into adulthood. Much of what we know about the effects of larger-scale preschool programs comes from Head Start, the most widely available public preschool program for lower-income children. However, there is growing evidence from a number of new preschool programs, including state preschool programs in Georgia and Oklahoma and local initiatives in Chicago and Boston. Researchers have also collected results from numerous studies of smaller programs and used meta-analysis to discern general tendencies in impacts, thereby drawing more general conclusions from a large number of analyses.

The High/Scope Perry Preschool Study provided preschool to low-income African-Americans at high risk of failing in school in Ypsilanti, Michigan during the 1960s. Perry is one of the most well-known preschool interventions in part because it was evaluated using a randomized trial yielding highly credible results, and also because data on its participants have been routinely collected longer than most other evaluations on any subject—until participants were 39 to 41 years old (Schweinhart, Barnes, and Weikart 1993).

Perry increased IQ scores at school entry, and other gains persisted while students were in school and into adulthood (Schweinhart et al. 2005). Through age 15, participants demonstrated higher motivation, placed a higher value on schooling, did more homework, and demonstrated higher achievement (Schweinhart and Weikart 1981). The program group scored better on several

[24] Baker et al. (2005); Lefebvre et al. (2006).
[25] Bernal and Keane (2011); Herbst and Tekin (2010); Herbst and Tekin (2012).

cognitive and academic tests through age 27.[26] In addition to performing better on cognitive tests, educational attainment and labor market outcomes also improved among program participants. Participants' high school graduation rates rose by about 17 percentage points, and when they entered the workforce, Perry participants had earnings about 25 percent higher than their control group counterparts through age 40 (Heckman et al. 2010a). Other observations of Perry participants later in life found similarly large increases in earnings ranging from 19 percent to nearly 60 percent.[27]

A larger-scale early childhood education intervention in Chicago found similarly positive results in both the short-term and long-term. Since 1967, the Chicago Child-Parent Centers (CPC) have provided comprehensive early childhood education and family supports to low-income children and parents. At kindergarten entry, CPC preschoolers' cognitive readiness improved by about three months of learning. Math and reading achievement gains persisted through sixth grade (Reynolds 1995), and later evaluations found higher high school graduation and college attendance rates of CPC participants (Temple and Reynolds 2007). Due to the significant increases in educational attainment, participants in the CPC preschool program saw increases in annual earnings measured in their late 20s of about 7 percent.[28]

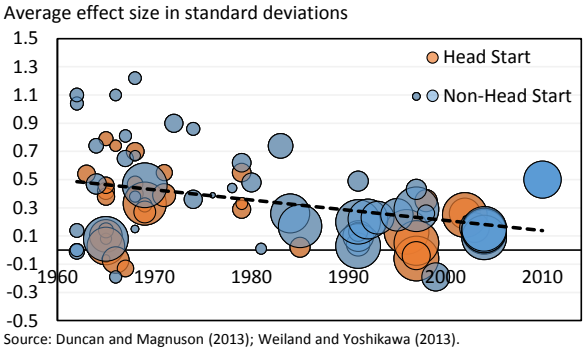
In addition to the programs highlighted above, dozens of other programs have been rigorously examined since the 1960s. This body of research shows that test score gains are not unique to well-known programs like Perry and Abecedarian. A meta-analysis by Duncan and Magnuson (2013) shows the distribution of the treatment effects of 84 programs, including Head Start, Abecedarian, and Perry. Overall, across all studies and time periods, early childhood education increases cognitive and achievement scores by 0.35 standard deviations on average, or nearly half the black-white difference in the kindergarten achievement gap (Duncan and Magnuson 2013). The estimated impacts in the studies considered in Duncan and Magnuson are illustrated in Figure 8, with bigger circles generally corresponding to studies that enrolled more children. The figure shows that most programs benefit children's cognitive development and achievement at the end of the program.

[26] Barnett (1996); Schweinhart (2003).

[27] Bartik (2014); Karoly (1998); CEA calculations based on the percent increase in earnings of students in the program relative to similar students who were not in the program.

[28] Reynolds et al. (2011); CEA calculations based on the percent increase in earnings of students in the program relative to similar students who were not in the program.

Figure 8: Most Early Childhood Programs Have Positive Cognitive and Achievement Impacts



Source: Duncan and Magnuson (2013); Weiland and Yoshikawa (2013).
Note: Circle sizes reflect the inverse of the squared study-level standard error. 74 of 83 studies showed positive effects, and CEA estimates that roughly 60 percent of estimates were statistically significant at the 10 percent level.

Figure 8 also illustrates that the positive effects of preschool are not confined only to small-scale boutique programs. Head Start, illustrated by the orange circles in the figure, has generally been shown to improve participants' test scores measured at school entry. While these gains in cognitive ability and achievement may fade out (see the box on fadeout) over time as children progress in elementary school,[29] Head Start appears to have direct impacts on longer term outcomes like higher educational attainment and earnings. For example, Deming (2009) found that Head Start increased high school graduation rates by 8.6 percentage points, increased college attendance rates by 6 percentage points, and reduced non-participation (in either education or employment) rates by 7 percentage points, with African-American participants experiencing the largest gains. Moreover, these increases in schooling translated into higher earnings: in their mid-20s, these participants' earnings were 5 to 20 percent higher than non-participants.[30]

Head Start has also been found to positively impact child outcomes beyond academic achievement and labor market success. In addition to providing early childhood education, Head Start offers parental support, nutritional assistance, and health services. These additional program components can also benefit children's development. For example, Ludwig and Miller (2007) find that Head Start substantially reduced child mortality rates. The impacts of Head Start programs also spill over into the home environment; a recent study found that Head Start substantially increased parents' involvement with their children, including time spent reading and doing math activities, during and even after enrollment (Gelber and Isen 2011). Researchers have concluded that adding all of these numerous benefits, the value of Head Start exceeds the program costs (Ludwig and Philips 2008).

The slight downward slope of the line in the figure shows that the magnitude of measured effects has slightly declined over time, with more recent studies showing slightly smaller impacts than earlier ones. This decline in average effect sizes over time may reflect either slightly less benefit

[29] Cicirelli (1969); McKey et al. (1985); Currie and Thomas (2000a, 2000b); Deming (2009); U.S. Department of Health and Human Services (2005, 2010).
[30] Garces et al. (2002); Bartik (2014).

from the particular programs being evaluated, or slightly better options for children outside of the studied programs, including time spent with parents and in other center-based care. As mentioned earlier, parents across the income spectrum are spending more time with their children (Ramey and Ramey 2010), and the share of children in center-based care has risen since the first programs were evaluated.[31] Today, children are more likely to receive intensive investments by parents and are more likely to attend an alternate center-based program if they are not selected for the "treatment" group of a randomized experiment. Changes in the baseline counterfactual are important for comparing treatment effects. For example, a recent study of Head Start found that the program impacts were smaller in areas where more control group children enrolled in center-based care (Walters 2014).

WHY DO TEST SCORE EFFECTS FADE EVEN THOUGH THERE ARE LONG-TERM BENEFITS?

Many early childhood programs produce significant test score gains immediately after the program. Some follow-up studies, however, find that these gains tend to fade over time as children progress through elementary school (Cicirelli 1969; McKey et al. 1985; Currie and Thomas 2000a, 2000b; Deming 2009; U.S. Department of Health and Human Services 2005, 2010). A meta-analysis of 62 high-quality studies of early childhood initiatives found that test score gains decline by about 0.03 standard deviations a year on average (Leak et al. forthcoming). There is significant debate about the underlying causes of "fade-out." In particular, some have suggested that preschool accelerates cognitive development that would have happened anyway, and that students who don't attend preschool eventually make up ground. Others have argued that low-quality schooling or teaching towards the lowest-achieving students in elementary school may slow growth that had been accelerated by early education programs (Currie and Thomas 2000).

Cascio and Staiger (2012) show that some of the fade-out may reflect a statistical illusion from rescaling test scores in terms of a student's achievement relative to their peers. As children progress in schooling, the range in achievement between the strongest and weakest-performing students increases. Therefore, a standard deviation on a standardized test in high school represents a greater difference in achievement than a standard deviation in elementary school. Because test scores are scaled and standardized, mechanically, the effect of early interventions will appear to have smaller impacts on achievement scores in later schooling years, even if there is no true fade-out.

Importantly, as this report describes, a growing evidence base shows that programs can generate substantial long-run gains in educational attainment, earnings, and crime reduction, even where there is fadeout in the interim (for example, see Heckman et al. 2010). The reemergence of long-run gains after test score fadeout has been found even for initiatives that take place after preschool (see, for example, Chetty et al. 2011 and Dynarski et al. 2013). This suggests that standardized tests may not fully capture all of the relevant aspects of human capital relevant for the longer-term outcomes that are the important goals of public investments. Research clearly demonstrates that while the skills measured by standardized tests may fade (or converge), other skills important for long-term outcomes do not.

[31] Current Population Survey, 1968-2013 from Cascio and Schanzenbach (2013); CEA calculations.

Early childhood programs, like many state preschool programs, can serve a broad population or a more narrowly-targeted population. Targeted interventions often focus on low-income children who are among the least likely to be enrolled in another preschool program without the intervention. Given that a universal program may provide services for children that would have been in private programs before, it is reasonable to expect that these programs would have smaller overall impacts. However, research shows that large state-run public preschool programs also generate large improvements in academic outcomes. Wong, Cook, Barnett and Jung (2008) examine five state-run pre-K programs and find large improvements on achievement test scores. Gormley et al. (2005) evaluate Oklahoma's preschool program in Tulsa and find that children's kindergarten achievement significantly improved. While it is too soon to directly estimate these programs' long term effects since the oldest participants have not yet entered the labor force, Hill, Gormley and Adelstein (2012) found some evidence of a persistent improvement in Tulsa's impacts through third grade, and a recent evaluation of Oklahoma and Georgia's state-run preschool programs found positive cognitive outcomes through fourth grade and persistent, though smaller effects, through eighth grade.[32] This suggests that even when there are children that switch from private programs—"crowd-out"—there are still gains, perhaps because families can use the savings to make other positive investments in their children.

[32] Gormley and Gayer (2005); Fitzpatrick (2008).

BENEFITS OF EARLY CHILDHOOD EDUCATION PROGRAMS FOR GOVERNMENT AND SOCIETY

Tax Revenue Increases and Transfer Payment Decreases Due to Higher Earnings
Increased child and maternal earnings and employment translate into increased tax revenue and lower transfer payments. Abecedarian participants' lifetime earnings increased by about $44,000, and their mothers' lifetime earnings increased by more than $79,000. These earnings gains reduced cash assistance payments by about $220 per participant, assuming a 3 percent discount rate (Masse and Barnett 2007; 2014 dollars). Likewise, the Chicago Child-Parent Centers, Abecedarian Project, and Perry Preschool all generated revenue increases and transfer payment decreases.

Remedial Education and Education System Savings
Early childhood education can also benefit society by reducing the likelihood that students need remedial education. Remedial education can consist of repeated grades or specialized schooling, and the additional cost of this extra schooling can be expensive. Abecedarian participants experienced lower rates of grade retention and special education placements (Campbell and Ramey 1995; Temple and Reynolds 2007), saving more than $11,000 per participant through grade 12. Likewise, CPC lowered grade retention and special education placements through age 12 (Reynolds 1995; Reynolds and Temple 1995; Reynolds et al. 1995). Perry participants were less likely to be retained or place in special education classes (Temple and Reynolds 2005). Head Start results also indicate the program will reduce rates of special education and grade repetition (Currie 2001).

Reduced Involvement with the Criminal Justice System
Early childhood interventions can also reduce involvement with the criminal justice system. A number of programs with long-run follow-ups, such as Perry, CPC preschool, Abecedarian, and Head Start, found the programs reduced juvenile arrests and criminal records of participants (Anderson 2014; Reynolds et al. 2001, 2002; Belfield 2006; Heckman et al. 2010; Carneiro and Ginja 2014). Many cost-benefit analyses find that these cost savings are substantial, and often account for the single largest portion of the accrued benefits over time.

Improvements in Health
Early childhood interventions can also benefit society by improving health outcomes for participants, thereby reducing public expenditures on health care, or lowering insurance premiums for private health coverage. The CPC preschool program significantly reduced child maltreatment rates (Temple and Reynolds 2005). Head Start also improved participant health: Deming (2009) found that Head Start participants were 7 percentage points less likely to be in poor health, and over the longer-term, Head Start participants have fewer health problems and males had lower obesity rates at ages 12 and 13 (Carneiro and Ginja 2014).

The "Active Ingredients" in Successful Early Childhood Programs

Early childhood education takes many forms as programs differ in the student populations served, and in programmatic features like their curricula, teachers, class sizes, and program durations. As noted above, while generally positive, the gains from early childhood education programs vary widely even across centers implementing the same type of program like Head

Start (Walters 2014). This section summarizes what research shows about several policy options that might affect program quality and be associated with the biggest impacts on child outcomes.

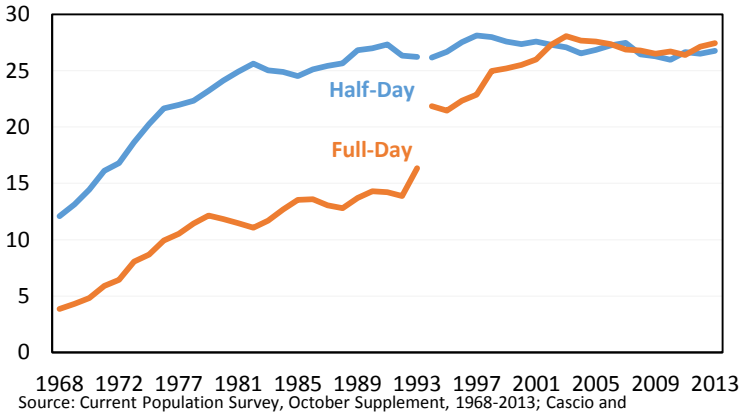
Curriculum

Early education curricula can focus on social and emotional development (non-cognitive skills), math and reading (cognitive skills) or a combination of both. Some researchers argue that early childhood education should focus on building reading and math skills since gaps between high- and low-income children at kindergarten and fifth grade are largest for cognitive skills. Moreover, early academic skills in math and reading are the most predictive of later academic achievement.[33] However, other researchers have argued that non-cognitive skills are at least as important for later life outcomes as cognitive skills (Heckman et al. 2006). These researchers argue that investments in both non-cognitive skills and cognitive skills are best made in early childhood (Heckman and Mosso 2014). Regardless of the curricula's focus, effective curricula can help build both cognitive and non-cognitive skills and the most effective programs build on previous skills, rather than repeating programming for children who enroll for subsequent years.

Program Duration

Some studies have shown that more hours of education when children are young can improve academic achievement and help increase parental labor force attachment. Full-day programs have become much more common since the mid-1990s, and in the last few years, full-day programs have become roughly as common as half-day programs (Figure 9). Just over half of three- and four-year-olds enrolled in preschool are in half-day programs, while almost a quarter of children in kindergarten are enrolled in half-day programs.[34]

Figure 9: Prevalence of Full-Day Enrollment Rises Among 3 and 4 Year-Olds: 1968-2013



Source: Current Population Survey, October Supplement, 1968-2013; Cascio and Schanzenbach (2013); CEA calculations.

Note: Enrollment data include preschoolers and kindergarteners. Data show 3-year centered moving averages. Breaks in series are due to 1994 CPS redesign.

Programs with longer school days can improve student outcomes by increasing the amount of learning time. In a randomized experiment, children in full-day preschool improved almost twice

[33] Duncan et al. (2007); Duncan and Magnuson (2009); Duncan and Magnuson (2011).

[34] CEA calculation using 2013 October Current Population Survey. Preschool includes three- and four-year-old children; kindergarten includes four- to six-year-old children.

as much on vocabulary and math tests as children in half-day programs over the course of the program (Robin et al. 2006). Likewise, an analysis of the different centers in the Head Start Impact Study found that full-day programs boosted cognitive achievement by 0.14 standard deviations above those in half-day programs (Walters 2014). A partial expansion of the Chicago Child-Parent Centers to full-day programs led to significant improvements in children's socio-emotional development, language and math skills, and physical health relative to children in the part-day CPC program (Reynolds et al. 2014). Likewise, Gibbs (2014) finds that full-day kindergarten, relative to half-day, improves literacy skills by approximately 0.3 standard deviation, with Hispanic students and students who began the year with low literacy skills experiencing the largest gains. This implies that more time in school would be especially beneficial for children who are farthest behind, and could help close the early achievement gap and improve students' outcomes later in life.

There is also some evidence that an expanded school day would boost the labor supply of parents of young children by helping parents obtain full-time employment. A study found that full-day kindergarten increased the probability that mothers worked full-time by 17 percent compared to half-day kindergarten (Cannon et al. 2006), with low-income mothers experiencing the largest increases in full-time employment.

Teacher Quality and Professional Development

Providing teachers with coaching or mentoring programs is one way to improve curriculum implementation and support high-quality student-teacher interactions and, as a result, improve student outcomes (Halle et al. 2011). Some of the most successful curricula include intensive professional development for teachers, which can include frequent coaching sessions with feedback and support from an expert teacher (Yoshikawa et al. 2014). The recent Boston preschool program, already shown to be effective in improving cognitive skills and executive functioning, uses a curriculum focused on building cognitive skills that is facilitated by intensive professional development. Teachers are provided with manuals on how to prepare and teach each daily lesson, and they receive educational supports to fully implement the curriculum, including materials and facilities for all activities and assistance from a full-time aide. Teachers and aides receive intense coaching and professional development, including training over the summer and several hours each month, working with coaches who are experienced in early childhood education (Duncan and Murnane 2014). This intensive professional development is one of the more unique elements of the highly successful Boston program, and a small body of literature suggests that this kind of coaching can be an important component of a highly successful preschool program. A number of other preschool curriculum interventions employ coaching as a strategy to improve the quality of teacher-child interactions.[35] Recent reviews of the literature on coaching have also found promising results, although few experimental studies have been conducted.[36]

[35] Bierman et al. (2010); Clements and Sarama (2008).
[36] Tout et al. (2011); Zaslow et al. (2010); Aikens and Akers (2011).

ADMINISTRATION PROPOSALS TO INCREASE INVESTMENTS IN EARLY EDUCATION

President Obama has proposed a comprehensive early learning agenda to ensure the best start in life for every American child. These proposals include expanding evidence-based home visiting programs, growing the supply of effective early learning opportunities for infants and toddlers, helping families afford high-quality child care, and providing high-quality preschool for every child.

The Administration's Preschool for All proposal, first proposed in 2013, would create a federal-state partnership to provide all low- and moderate-income four-year-old children with high-quality preschool, while also expanding these programs to reach additional higher-income children and to establish and expand full-day kindergarten programs. This landmark proposal is complemented by expansions to evidence-based, voluntary home visiting programs and the launch of a new Early Head Start- Child Care Partnership program to provide younger children a solid foundation in the earliest years of life. Home visiting programs provide a continuum of support for children before they enter preschool, by empowering parents and connecting families to services and educational supports that improve children's health, development, and ability to learn. Early Head Start-Child Care Partnership grants will support states and communities in expanding and enhancing learning opportunities for infants and toddlers, while supporting working families through full-day, full-year services. In addition, thirty-five states have submitted applications for Preschool Development Grants. These grants will enhance preschool program infrastructure and expand high-quality programs that can serve as a model for further expansion to four-year-olds from low- and moderate-income families.

Recognizing that high-quality child care is unaffordable for many families, the President has also proposed expanding access to high-quality child care through the Child Care and Development Fund and the Child and Dependent Care Tax Credit. The 2014 reauthorization of the Child Care and Development Block Grant Act, passed with bipartisan support, will ensure that the nearly 1.5 million children who currently receive care through the CCDF are cared for in safe and nurturing environments. In addition, President Obama's 2015 Budget proposed increasing the Child Care Tax Credit for families with young children, who face the highest child care costs. At the same time child care costs have increased faster than the cost of living, the existing Child Care Tax Credit has lost its purchasing power. About 1.7 million families would benefit from the proposed expansion in 2015, and these families would receive an average tax cut of $600.

III. Cost-Benefit Analysis of Preschool Programs

Researchers have applied cost-benefit analysis to numerous preschool programs in order to determine whether they provide a positive return on the initial investment. Across a range of programs, researchers have concluded that early education programs pay for themselves and generate a net return on investment.

In particular, several "model" programs begun in the 1960s and 1970s that targeted low-income students have been rigorously evaluated, and ongoing data collection efforts enable direct assessments of long-term benefits. After adding the benefits and costs over a child's lifetime for both the child and society, including higher levels of education, increased earnings in adulthood, improved health, reduced need for special education placements and remedial education, reduced crime, increased tax revenue, and lower spending for anti-poverty programs, researchers found that the benefits generated by these programs well exceed the costs.[37]

One recent study by Nobel Prize winner James Heckman and coauthors that stands out for its rigor found that for every dollar spent on the Perry Preschool program, the benefits totaled $7 to $10, with a baseline estimate of $8.60 (Heckman et al. 2010b). Participants' earnings, which were about 25 percent higher each year compared with nonparticipants, generated a sizable return over individuals' lifetimes. Non-earnings benefits of reduced transfer payments and remedial education expenditures alone generated a benefit of more than $4 for every dollar spent according to the Heckman estimates. Since participants were also less likely to be involved with the criminal justice system, this led to further benefits in the form of reduced victimization and less spending on police, courts, and prisons. The Heckman study argues that early education is one of the most cost-effective ways of reducing crime, and estimates that Perry saved an additional $3 to $8 in crime costs for every dollar spent. Other studies find similarly large overall benefits (earnings plus social benefits) from a variety of preschool programs, including Abecedarian and the Chicago Child-Parent Centers.[38] For example Masse and Barnett (2007) found that Abecedarian generates benefits of nearly $3 for each dollar spent, and Reynolds et al. (2011) found that the CPC preschool program generates nearly $11 for each dollar spent.

The following section reviews cost-benefit studies for larger-scale programs. While 40 states and the District of Columbia have state-sponsored preschool programs, Georgia and Oklahoma offer examples of high-quality preschool education with broad access, and are often viewed as models for the rest of the country. A number of studies have focused on the Tulsa school district, an early leader in universal preschool. These programs, along with Head Start, arguably provide the most relevant evidence on the likely effects of the President's proposed early learning initiatives.

[37] Rolnick and Grunewald (2003); Belfield et al. (2006); Heckman et al. (2010b).
[38] Reynolds et al (2002); Belfield and Schwartz (2006).

Estimating the Benefits of Spending on Early Childhood Programs

A number of researchers have examined more recent broad-based programs that have expanded access to a much larger group of children, including state preschool programs and Head Start. Many of these early evaluations have examined how the benefits from higher participant earnings compare with the cost of the early childhood program. Students that attended state preschool such as those in Georgia and Oklahoma are not yet old enough to directly measure earnings; however, researchers have used achievement gains to estimate that adult earnings for these children will likely increase by 1.3 to 3.5 percent (Cascio and Schanzenbach 2013).[39] Other studies have found similar estimates.[40] Summing the value of increased future earnings over the average participant's lifetime from these programs implies that there are substantial benefits for each child, likely at least $1.60 to $5.90 in benefits for every $1 spent. As evaluations of smaller programs like CPC have found benefits as high as $11 when including the non-earnings benefits, the range of benefits shown in Table 1 should be regarded as conservative estimates. For illustrative purposes, Table 1 shows the breakdown between earnings gains and other benefits from the Perry Preschool Program. Evaluation of this program finds $4.39 in benefits from earnings and another $4.20 from the additional benefits beyond earnings. That suggests that the benefit estimates using earnings alone may only capture half of the overall benefits. The results from each of the studies are summarized in Table 1.

Table 1: Summary of Cost-Benefit Studies

	Tulsa Full-Day Preschool	Tulsa Half-Day Preschool	Oklahoma & Georgia Preschool	Head Start	Perry Preschool
Year children entered program	2005	2005	1995/98	2002	1962
Value of earnings gains per child	$27,897	$16,683	$24,094	$14,459	$92,020
Value of total benefits per child					$180,257[b]
Cost of program per child	$9,118	$4,559	$4,086	$9,173	$20,948
Net benefit per child	$18,779	$12,124	$20,008	$5,286	$159,309[b]
Benefit to cost ratio (earnings only)	3.06	3.66	5.90	1.58[a]	4.39
Benefit to cost ratio (all benefits)	–	–	–	–	8.60[b]
Study	Bartik et al. (2012)	Bartik et al. (2012)	Cascio et al. (2013)	Duncan et al. (2010)	Heckman et al. (2010b)

Note: All figures in 2014 dollars. For the present value of earnings, all studies use a 3 percent discount rate and assume no real productivity growth except for Cascio and Schanzenbach (2013), who use a 3.4 percent discount rate and a 1.9 real productivity growth rate. Figures are middle estimates when studies present a range. In particular, the figures for Cascio and Schanzenbach (2013) are the average of estimates using 4th and 8th grade test scores.

[a] The estimate from Duncan et al. (2010) likely understates the increase in earnings due to Head Start. See text and footnote 41 for details.

[b] Includes benefits from earnings, reduced crime, reduced receipt of cash transfers, and educational savings.

[39] Studies generally use increases in test scores to predict the future increase in earnings using estimates from Chetty, Friedman, Rockoff (2013) or Krueger (2003).

[40] Bartik et al. (2012); Duncan et al. (2010).

In all of the studies of recent programs, the lifetime earnings gains from these programs well exceed the cost, implying a net benefit between $5,000 and $20,000 per child. In particular, studies find that universal state preschool yields a return of $3 to $6 for every $1 invested. Head Start also yields a positive return. Many studies have shown that Head Start leads to larger achievement gains than those used to calculate the earnings benefits in Duncan et al. (2010); using the average earnings impact from the 33 studies of Head Start featured in Duncan and Magnuson's (2013) meta-analysis implies a benefit-cost ratio about 50 percent higher than reported in the table above.[41]

While recent early childhood programs all show substantial benefits per dollar spent over a range of possible scenarios, it is important to keep in mind that students in recent programs are still relatively young and have not entered the labor market. Without direct information on participant earnings and other long-term benefits, there is some uncertainty regarding the exact level of total benefits that will accrue over children's lifetimes. Like Perry Preschool, the Chicago Child-Parent Centers, and Abecedarian, high-quality public preschool programs will likely reduce the need for remedial education, reduce crime, lower spending on anti-poverty programs, and improve health. These programs also provide child care, allowing parents, particularly mothers, to maintain their attachment to the workforce and increase earnings in both the short-term and through their careers, as mothers who are able to work while their children are young are more likely to work and earn more later in life.[42] In their study of Perry Preschool, Heckman et al. (2010b) account for some of these benefits and find that they are about as large as the earnings gains (Table 1). For this reason, the full benefit of universal early childhood education may be significantly larger than the estimates based solely on the earnings gains in the table above.

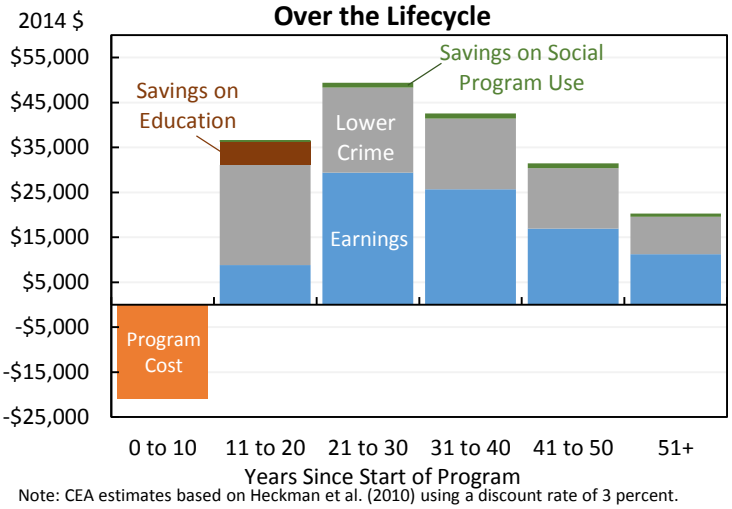
Early Childhood Education as a Long-Term Investment

Although studies find that early childhood education yields a large return, the payoff takes time to materialize as benefits are realized through behavior or earnings changes over an individual's lifecycle. When a child attends an early education program there is an upfront cost. Some benefits are realized immediately—for example, parents who choose to re-enter the labor force are able to earn higher wages right away. However, the majority of benefits, from reduced crime to higher earnings, accrue later in life. In the case of Perry Preschool, evidence on long-term outcomes suggests that the largest benefits were realized when children were in their late 20s (Figure 10).

[41] Duncan et al. (2010) use estimates of Head Start's test score impacts from Ludwig and Phillips (2007) to predict earnings. The test score impact they use, 0.12 standard deviations, is smaller than the average test score impact of Head Start in Duncan and Magnuson's (2013) analysis of 0.19 standard deviations (weighted by the precision of the estimate). Most of the average effect sizes for Head Start in Duncan and Magnuson (2013) are larger than 0.12 standard deviations (23 out of 33).

[42] For instance see Lefebvre, Merrigan, and Verstraete (2009) on dynamic labor supply effects.

Figure 10: Net Benefit Per Child of Perry Preschool Rises Over the Lifecycle



Note: CEA estimates based on Heckman et al. (2010) using a discount rate of 3 percent. Additional benefits, such as health benefits and maternal earnings, have not been quantified.

Although it took time for the benefits of Perry preschool to appear, the benefits quickly outweighed the initial cost in present value terms and continued to accrue throughout the child's lifetime. The net benefit continued to grow for the rest of the participant's life. The timing of benefits for modern universal programs will likely follow a similar lifecycle pattern.

Given the substantial benefits in the form of higher earnings, investing in early childhood education would likely boost GDP in the long-run. If all families enrolled their children in preschool at the same rate as high-income families, enrollment would increase by about 13 points.[43] Using estimates from the preschool programs in Georgia and Oklahoma alone, the earnings gains alone resulting from increased enrollment would raise the level of GDP by 0.16 to 0.44 percent per year in the long-run.[44] This is equivalent to adding between $28 and $74 billion per year based on current GDP.[45] This estimate does not include the gains to GDP that would result from earnings gains for parents and the many non-earnings benefits of quality preschool education, including expanded economic activity due to reduced crime and possible spillovers to other workers who did not directly benefit from the program.

[43] In 2013, about 71.7 percent of four-year-olds from families with income of $100,000 or more are in preschool, but only 59 percent of the overall population (Current Population Survey, October Supplement). Thus about 12.7 percent of each cohort would be affected.

[44] Cascio and Schanzenbach (2013) estimate that these programs increase earnings by 1.3 to 3.5 percent. The long-run here is defined as 60 years, by which point the labor force would reflect these higher levels of enrollment.

[45] Under this scenario, 12.7 percent of each cohort's earnings will increase by 1.3 to 3.5 percent per year, yielding an increase in aggregate earnings of 0.16 percent to 0.44 percent. Using 2013 GDP ($16.77 trillion), this yields an increase of $27.62 to $74.36 billion per year.

Conclusion

Parents and researchers understand that early childhood is a critical developmental period that affects outcomes far into adulthood. Parents are making more investments in their young children, in terms of both time and resources. Research is providing more insights into how to create strong foundations for children's development, as well as why the best investments work so well. Yet not all American families can access high-quality early childhood care. Expanding access to high-quality care can help parents give children the start in life they desire for them. Greater access can also help parents work, leading to higher household incomes with which to invest in their children.

As this report has demonstrated, high-quality early childhood education programs offer long-term benefits that far outweigh costs. Interventions that occur very early in childhood, like home visiting programs for mothers with new infants, as well as high-quality early care and education, improve kindergarten readiness, which itself predicts success in later schooling. Studies in the U.S. and a number of other countries show that access to quality child care can help mothers participate in the labor force and, when subsidies for care are available, can boost family income.

High-quality preschool programs for three- and four-year-old children can also build a strong skills foundation for school, as well as help meet child care needs of working parents. This programming already exists in 40 States and the District of Columbia, though less than one third of four-year-olds have access to state preschool programs and the characteristics of programs vary across states. Researchers estimate that the skills gains demonstrated in these large public programs, such as those in Oklahoma and Georgia, will lead income gains of 1.3 to 3.5 percent each year when children are adults. Over a child's career this implies higher earnings in net present value of $9,166 to $30,851 after subtracting out the cost of the program. If we expand access throughout the country and all families were able to enroll their children in preschool at the same rate as high-income families, enrollment would increase nationwide by about 13 percentage points and yield net present value of $4.8 billion to $16.1 billion per cohort from earnings gains alone after accounting for the costs of the program. In the long run, these earnings gains translate into an increase in GDP of 0.16 to 0.44 percent.

The later life earnings gains for children who enroll in preschool programs have been shown to far exceed their cost.

When we invest in early childhood programs, it is not just enrolled children and their families who benefit. The research highlighted here suggests that the investments we make in children today could benefit our economy in the long-run by expanding our skilled workforce and increasing their earnings. Higher adult earnings for participating children means society gets all the benefits of a better educated, higher earning population in the future—including lower transfer payments, reduced involvement with the criminal justice system, healthier citizens, and a larger revenue base. Expanding access to quality early childhood programs offers a win-win-win opportunity for program participants, their parents, and society as a whole. It's time to build

on demonstrated successes in this area and make them more widely available so more American families and communities can benefit.

References

Aikens, Nikki, and Lauren Akers. 2011. “Background Review of Existing Literature on Coaching.” Mathematica Policy Research.

Anderson, Michael L. 2014. "Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects." *Journal of the American Statistical Association* 103, no. 484: 1481-1495.

Anderson, Patricia M. and Philip B. Levine. 2000. “Child Care and Mothers’ Employment Decisions.” In *Finding Jobs: Work and Welfare Reform*, pp. 420-462. Russell Sage Foundation.

Baker, Michael, Jonathan Gruber, and Kevin Milligan. 2005. “Universal Childcare, Maternal Labor Supply, and Family Well-being.” Working Paper 11832. Cambridge, Mass.: National Bureau of Economic Research (December).

Barnett, W. Steven. 1996. *Lives in the Balance: Age-27 Benefit-Cost Analysis of the High/Scope Perry Preschool Program.* Ypsilanti, MI: High/Scope Press.

Barnett, W. Steven and Leonard N. Masse. 2002. “A Benefit Cost Analysis of the Abecedarian Early Childhood Intervention.” National Institute for Early Education Research.

Barnett, W. Steven, and Leonard N. Masse. 2007. “Comparative Benefit-Cost Analysis of the Abecedarian Program and its Policy Implications.” *Economics of Education Review* 26, no. 1: 113-125

Barnett, W. Steven, Megan E. Carolan, James H. Squires, Kristy C. Brown. 2013. “The State of Preschool 2013.” National Institute for Early Education Research.

Bartik, Timothy J. 2014. “From Preschool to Prosperity: The Economic Payoff to Early Childhood Education.”

Bartik, Timothy J., William Gormley, and Shirley Adelstein. 2012. "Earnings benefits of Tulsa's pre-K program for different income groups." *Economics of Education Review* 31, no. 6: 1143-1161.

Becker, Gary S. 1962. “Investment in Human Capital: A Theoretical Analysis.” *Journal of Political Economy*, 70(5): pp .9-49.

Ben-Porath, Yoram. 1967. “The Production of Human Capital and the Life Cycle of Earnings.” *Journal of Political Economy*, 75(4): 352-365.

Belfield, Clive and Heather Schwartz. 2007. "The Cost of High-Quality Pre-School Education in New Jersey." *Education Law Center.*

Belfield, Clive R., Milagros Nores, Steve Barnett, and Lawrence Schweinhart. 2006. "The High/Scope Perry Preschool Program Cost–Benefit Analysis Using Data from the Age-40 Followup*." Journal of Human Resources* 41, no. 1: 162-190.

Bernal, Raquel and Michael P. Keane. 2011. "Child Care Choices and Children’s Cognitive Achievement: The Case of Single Mothers." *Journal of Labor Economics,* 29(3): 459-512.

Bianchi, Suzanne M. 2010. “Family Change and Time Allocation in American Families.” Alfred P. Sloan Foundation.

Bianchi, Suzanne M., John P. Robinson, and Melissa A. Milkie. 2006. *The Changing Rhythm of American Family Life.* New York: Russell Sage Foundation.

Bierman, Karen L., Robert L. Nix, Celene E. Domitrovich, Janet A. Welsh, and Scott D. Gest. 2010. “Fostering School Readiness with Preschool Interventions that Promote Social-emotional Learning and Language Skills: The Head Start REDI Project.” Human Capital Research Collaborative Fall Conference, Health and Early Childhood Development: The Impact of Health on School Readiness and Other Education Outcomes.

Black, Sandra E., Paul J. Devereux, and Kjell G. Salvanes. 2011. "Too Young to Leave the Nest? The Effects of School Starting Age." *The Review of Economics and Statistics,* 93(2): 455-467.

Brooks-Gunn, Jeanne et al. 1994. "Early Intervention in Low-birth-weight Premature Infants: Results Through Age 5 Years from the Infant Health and Development Program." *Journal of the American Medical Association,* 272(16): 1257-1262.

Buckles, Kasey. 2008. “Understanding the Returns to Delayed Childbearing for Working Women.” *American Economic Review,* 98(2): 403-407.

Campbell, Frances A. and Craig T. Ramey. 1995. “Cognitive and School Outcomes for High-Risk African-American Students at Middle Adolescence: Positive Effects of Early Intervention.” *American Educational Research Journal,* 32(4): 743-772.

Campbell, Frances A., Elizabeth P. Pungello, Kristen Kainz, Margaret Burchinal, Yi Pan, Oscar Barbarin, Joseph J. Sparling, and Craig T. Ramey. 2012. “Adult Outcomes as a Function of an Early Childhood Educational Program: An Abecedarian Project Follow-Up.” *Developmental Psychology,* 48(4): 1033-1043.

Cannon, Jill S., Alison Jacknowitz, and Gary Painter. 2006. "Is Full Better than Half? Examining the Longitudinal Effects of Full-day Kindergarten Attendance." *Journal of Policy Analysis and Management,* 25(2): 299-321.

Carneiro, Pedro and Rita Ginja. 2014. “Long-Term Impacts of Compensatory Preschool on Health and Behavior: Evidence from Head Start.” *American Economic Journal: Economic Policy,* 6(4): 135-173.

Cascio, Elizabeth U. 2009. "Maternal Labor Supply and the Introduction of Kindergartens into American Public Schools." *Journal of Human Resources,* 44(1): 140-170.

Cascio, Elizabeth U. and Douglas O. Staiger. 2012. “Knowledge, Tests, and Fadeout in Educational Interventions.” Working Paper 18038. Cambridge, Mass.: National Bureau of Economic Research (May).

Cascio, Elizabeth U. and Diane Schanzenbach. 2013. “The Impacts of Expanding Access to High-Quality Preschool Education.” Brookings Papers on Economic Activity: 127-192.

Census Bureau. “Current Population Survey (CPS) School Enrollment Supplement File Technical Documentation.” http://www.census.gov/cps/methodology/techdocs.html.

Chen, Alice, Emily Oster, and Heidi Williams. 2014. “Why is Infant Mortality Higher in the US than in Europe?” Working Paper 20525. Cambridge, Mass.: National Bureau of Economic Research (September).

Chetty, Raj, John N. Friedman, and Jonah E. Rockoff. 2011. “The Long-term Impacts of Teachers: Teacher Value-added and Student Outcomes in Adulthood.” Working Paper 17699. Cambridge, Mass.: National Bureau of Economic Research (December).

Chetty, Raj, John N. Friedman, and Jonah E. Rockoff. 2013. “Measuring the Impacts of Teachers II: Teacher Value-added and Student Outcomes in Adulthood.” Working Paper 19424. Cambridge, Mass.: National Bureau of Economic Research (September).

Chetty, Raj, John N. Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach, and Danny Yagan. 2011. "How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project Star." *The Quarterly Journal of Economics* 126, no.4: 1593-1660.

Cicirelli, Victor G. 1969. *The Impact of Head Start: An Evaluation of the Effects of Head Start on Children's Cognitive and Affective Development*. Athens, Ohio, and New York: Ohio University Press and Westinghouse Learning Corporation.

Clements, Douglas H. and Julie Sarama. 2008. "Experimental Evaluation of the Effects of a Research-Based Preschool Mathematics Curriculum." *American Educational Research Journal* 45 no.2: 443-494.

Connelly, Rachel and Jean Kimmel. 2003. "The Effects of Child Care Costs on the Employment and Welfare Recipiency of Single Mothers." *Southern Economic Journal,* 69(3): 498-519.

Cunha, Flavio, James J. Heckman, Lance Lochner, and Dimitriy V. Masterov. 2006. "Interpreting the Evidence on Life Cycle Skill Formation." In *Handbook of the Economics of Education*, 698-747. 26th ed. Vol. 1. Elsevier B.V.

Cunha, Flavio and James Heckman. 2007. "The Technology of Skill Formation." *American Economic Review,* 97(2): 31-47.

Currie, Janet. 2001. "Early Childhood Education Programs." *Journal of Economic Perspectives,* 15(2): 213-238.

Currie, Janet and Duncan Thomas. 2000. "School Quality and the Longer-Term Effects of Head Start." *Journal of Human Resources,* 35(4): 755-774.

Currie, Janet and Duncan Thomas. 2000. "Does Head Start Make a Difference?" *American Economic Review,* 85(3): 341-364.

Currie, Janet and Enrico Moretti. 2003. "Mother's Education and the Intergenerational Transmission of Human Capital: Evidence from College Openings." *Quarterly Journal of Economics,* 118(4): 1495-1532.

Deming, David. 2009. "Early Childhood Intervention and Life-cycle Skill Development: Evidence from Head Start." *American Economic Journal: Applied Economics,* 1(3): 111-134.

Duncan, Greg J., Chantelle J. Dowsett, Amy Claessens, Katherine Magnuson, Aletha C. Huston, Pamela Klebanov, and Linda S. Pagani. 2007. "School Readiness and Later Achievement." *Developmental Psychology,* 43(6): 1428-1446.

Duncan, Greg J. and Katherine Magnuson. 2009. "The Nature and Impact of Early Achievement Skills, Attention and Behavior Problems." *Rethinking the Role of Neighborhoods and Families on Schools and School Outcomes for American Children.*

Duncan, Greg J. and Katherine Magnuson. 2011. "Introduction: The American Dream, Then and Now." In *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances*, pp. 47-69. Russell Sage Foundation.

Duncan, Greg J. and Katherine Magnuson. 2013. "Investing in Preschool Programs." *Journal of Economic Perspectives,* 27(2): 109-132.

Duncan, Greg J. and Aaron J. Sojourner. 2012. "Can Intensive Early Childhood Intervention Programs Eliminate Income-Based Cognitive and Achievement Gaps?"

Duncan, Greg J., Jens Ludwig, and Katherine Magnuson. 2010. "Child Development." In *Targeting Investment in Children: Fighting Poverty When Resources Are Limited*, pp. 27-58. University of Chicago Press.

Duncan, Greg J., Pamela A. Morris, and Chris Rodrigues. 2011. “Does Money Really Matter? Estimating Impacts of Family Income on Young Children’s Achievement with Data from Random-Assignment Experiments.” *Development Psychology,* 47(5): 1263-1279.

Duncan, Greg J., Kathleen M. Ziol-Guest, and Ariel Kalil. 2010. “Early-Childhood Poverty and Adult Attainment, Behavior, and Health.” *Child Development* 81, no. 1: 306-325.

Dynarski, Susan, Joshua Hyman, and Diane Whitmore Schanzenbach. 2013. “Experimental Evidence on the Effect of Childhood Investments on Postsecondary Attainment and Degree Completion.” *Journal of Policy Analysis and Management,* 32(4): 692-717.

Fitzpatrick, Maria D. 2008. "Starting School at Four: The Effect of Universal Pre-Kindergarten on Children's Academic Achievement." *The B.E. Journal of Economic Analysis and Policy,* 8(1).

Fryer Jr, Roland G. and Steven D. Levitt. 2013. “Testing for Racial Differences in the Mental Ability of Young Children.” *American Economic Review,* 103(2): 981-1005.

Garces, Eliana, Duncan Thomas, and Janet Currie. 2002. “Longer Term Effects of Head Start.” *American Economic Review,* 92(4): 999-1012.

Gelber, Alexander and Adam Isen. 2013. “Children’s Schooling and Parents’ Behavior: Evidence from the Head Start Impact Study.” *Journal of Public Economics* 101: 25-38.

Gibbs, Chloe R. 2014. "Experimental Evidence on Early Intervention: The Impact of Full-day Kindergarten." Working Paper

Gormley, William T. and Ted Gayer. 2005. "Promoting School Readiness in Oklahoma: An Evaluation of Tulsa's Pre-K Program." *Journal of Human Resources* 40, no. 3: 533-558.

Gormley Jr, William T., Ted Gayer, Deborah Phillips, and Brittany Dawson. 2005. “The Effects of Universal Pre-K on Cognitive Development.” *Developmental Psychology,* 41(6): 872-884.

Gross, Ruth T., Donna Spiker, and Christine W. Haynes. 1997. *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program.* Stanford University Press.

Halle, Tamara, Nicole Forry, Elizabeth Hair, Kate Perper, Laura Wandner, Julia Wessel, and Jessica Vick. 2009. *Disparities in Early Learning and Development: Lessons from the Early Childhood Longitudinal Study – Birth Cohort (ECLS-B)*. Washington, DC: Child Trends.

Halle, Tamara, Rachel Anderson, Amy Blasberg, Alison Chrisler, and Shana Simkin. 2011. *Quality of Caregiver-Child Interactions for Infants and Toddlers (QCCIIT): A Review of the* Literature, OPRE 2011- 25. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Havnes, Tarjei, and Magne Mogstad. 2011. "No Child Left Behind: Subsidized Child Care and Children's Long-run Outcomes." *American Economic Journal: Economic Policy*: 97-129.

Health Resources and Services Administration. “Home Visiting Models.” U.S. Department of Health and Human Services. http://mchb.hrsa.gov/programs/homevisiting/models.html.

Heckman, James J. 2006. “Skill Formation and the Economics of Investing in Disadvantages Children.” *Science,* 312(5782): 1900-1902.

Heckman, James J., David Olds, Rodrigo Pinto, and Maria Rosales. 2014. “A Reanalysis of the Nurse Family Partnership Program: The Memphis Randomized Control Trial.”

Heckman, James. J., Jora Stixrud, and Sergio Urzua. 2006. “The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior.” *Journal of Labor Economics,* 24(3): 411-482.

Heckman, James J., Seong Hyeok Moon, Rodrigo Pinto, Peter A. Savelyev, and Adam Yavitz. 2010a. "Reanalysis of the High/Scope Perry Preschool Program." *Quantitative economics*, 1(1), 1-46.

_____. 2010b. "The Rate of Return to the High/Scope Perry Preschool Program." *Journal of Public Economics,* 94(1): 114-128.

Heckman, James J. and Stefano Mosso. 2014. “The Economics of Human Development and Social Mobility.” *Annual Review of Economics,* 6(1): 689-733.

Herbst, Chris M. 2010. “The Labor Supply Effects of Child Care Costs and Wages in the Presence of Subsidies and the Earned Income Tax Credit.” *Review of Economics of the Household,* 8(2): 199-230.

Herbst, Chris M. 2014. “Universal Child Care, Maternal Employment, and Children's Long-Run Outcomes: Evidence from the U.S. Lanham Act of 1940.” IZA Discussion Paper No. 7846.

Herbst, Chris M. and Erdal Tekin. 2010. “The Impact of Child Care Subsidies on Child Well-being: Evidence from Geographic Variation in the Distance to Social Service Agencies.” Working Paper 16250. Cambridge, Mass.: National Bureau of Economic Research (August).

Herbst, Chris M. and Erdal Tekin. 2012. “Child Care Subsidies, Maternal Well-being, and Child-parent Interactions: Evidence from Three Nationally Representative Datasets.” Working Paper 17774. Cambridge, Mass.: National Bureau of Economic Research (January).

Hill, Carolyn, William Gormley, and Shirley Adelstein. 2012. "Do the Short-term Effects of a Strong Preschool Program Persist?" *Center for Research on Children in the United States*.

Horn, Lisa. 2012. “Workplace Flexibility: The Next Imperative for Business Success and HR Leadership.” Society for Human Resource Management. http://hrprofessionalsmagazine.com/seminars/workplace-flexibility.pdf.

Jensen, Arthur Robert. 1980. *Bias in Mental Testing.* Free Press.

Kalil, Ariel. 2014. “Proposal 2: Addressing the Parenting Divide to Promote Early Childhood Development for Disadvantaged Children.” Hamilton Project, Policies to Address Poverty in America.

Kalil, Ariel, Rebecca Ryan, and Michael Corey. 2012. “Diverging Destinies: Maternal Education and the Developmental Gradient in Time with Children.” Demography 49: 1361–83.

Karoly, Lynn A., Peter W. Greenwood, Susan S. Everingham, Jill Houbé, and M. Rebecca Kilburn. 1998. *Investing in Our Children: What We Know and Don’t Know About the Costs and Benefits of Early Childhood Interventions.* Rand Corporation.

Knudsen, Eric I., James J. Heckman, Judy L. Cameron, and Jack P. Shonkoff. 2006. “Economic, Neurobiological, and Behavior Perspectives on Building America’s Future Workforce.” *Proceedings of the National Academy of Science,* 103(27): 10155-10162.

Krueger, Alan B. 2003. “Economic Considerations and Class Size.” *Economic Journal,* 113(485): F34-36.

Leak, James, Duncan, G., Li, Weilin, Magnuson, Katherine, Schindler, Holly S., Yoshikawa, Hirokazu, and Shonkoff, Jack P. forthcoming. “Timing in Early Childhood Education: How Program Impacts on Cognition and Achievement Vary by Starting Age, Program Duration, and Time Since the End of the Program.” Manuscript under review.

Lefebvre, Pierre and Philip Merrigan. 2008. “Child-care Policy and the Labor Supply of Mothers with Young Children: A Natural Experiment from Canada.” *Journal of Labor Economics,* 26(3): 519-548.

Lefebvre, Pierre, Philip Merrigan, and Matthieu Verstraete. 2006. "Impact of Early Childhood Care and Education on Children’s Preschool Cognitive Development: Canadian Results from a Large Quasi-experiment."

Ludwig, Jens and Douglas L. Miller. 2007. “Does Head Start Improve Children's Life Chances? Evidence from a Regression Discontinuity Design.” *Quarterly Journal of Economics,* 122(1): 159-208.

Ludwig, Jens and Deborah A. Phillips. 2008. "Long-term Effects of Head Start on Low-income Children." *Annals of the New York Academy of Sciences,* 1136(1): 257-268.

Martinez, Gladys, Kimberly Daniels, and Anjani Chandra. 2012. “Fertility of Men and Women Aged 15-44 Years in the United States: National Survey of Family Growth, 2006-2010.” Centers for Disease Control and Prevention. http://www.cdc.gov/nchs/data/nhsr/nhsr051.pdf.

Masse, Leonard N., and W. Steven Barnett. 2002. *A Benefit Cost Analysis of the Abecedarian Early Childhood Intervention.* New Brunswick, NJ: National Institute for Early Education Research.

Masse, Leonard N., and W. Steven Barnett. 2007. “Comparative Benefit-Cost Analysis of the Abecedarian Program and its Policy Implications.” *Economics of Education Review,* 26(1): 113-125.

McCarton, Cecelia M. et al. 1997. "Results at Age 8 Years of Early Intervention for Low-birth-weight Premature Infants: The Infant Health and Development Program." *Journal of the American Medical Association,* 277(2): 126-132.

McCormick, Marie C. et al. 2006. "Early Intervention in Low Birth Weight Premature Infants: Results at 18 Years of Age for the Infant Health and Development Program." *Pediatrics,* 117(3): 771-780.

McKey, Ruth H., Larry Condelli, Harriet Ganson, Barbara J. Barrett, Catherine McConkey, and Margaret Plantz. 1985. The Impact of Head Start on Children, Families and Communities: Final Report of the Head Start Evaluation, Synthesis and Utilization Project.

McLanahan, Sara. 2004. “Diverging Destinies: How Children are Faring under the Second Demographic Transition.” *Demography,* 41(4): 607-627.

National Scientific Council on the Developing Child. 2007. *The Timing and Quality of Early Experiences Combine to Shape Brain Architecture: Working Paper No. 5*. www.developingchild.harvard.edu

Nielsen, Eric. 2014. “The Income-Achievement Gap and Adult Outcome Inequality.” The Federal Reserve Board of Governors.

Nielson Holdings. 2014. “Harris Poll: Vast Majority of Americans Favor Flexible Workplace Policies.”

Office of Child Care. 2014a. “FY 2013 Preliminary Data Table 1 – Average Monthly Adjusted Number of Families and Children Served.” U.S. Department of Health and Human Services. http://www.acf.hhs.gov/programs/occ/resource/fy-2013-ccdf-data-tables-preliminary-table-1.

_____. 2014b. “FY 2014 CCDF Allocations (Including Realloted Funds).” U.S. Department of Health and Human Services. http://www.acf.hhs.gov/programs/occ/resource/fy-2014-ccdf-allocations-including-realloted-funds.

Offiec of Head Start. 2013. “Head Start Program Facts: Fiscal Year 2013.” U.S. Department of Health and Human Services. http://eclkc.ohs.acf.hhs.gov/hslc/data/factsheets/docs/hs-program-fact-sheet-2013.pdf.

_____. 2014. “Office of Head Start- Early Head Start Services Snapshot: National (2013-2014).” U.S. Department of Health and Human Services. http://eclkc.ohs.acf.hhs.gov/hslc/data/psr/2014/NATIONAL_SNAPSHOT_EHS.PDF.

Olds, David, Charles R. Henderson Jr., Robert Cole, John Eckenrode, Harriet Kitzman, Dennis Luckey, Lisa Pettitt, Kimberly Sidora, Pamela Morris, and Jane Powers. 1998. "Long-term Effects of Nurse Home Visitation on Children's Criminal and Antisocial Behavior: 15-Year Follow-up of a Randomized Controlled Trial." *Journal of the American Medical Association,* 280(14): 1238-1244.

Ramey, Craig T. and Frances A. Campbell. 1984. "Preventive Education for High-risk Children: Cognitive Consequences of the Carolina Abecedarian Project." *American Journal of Mental Deficiency* 88: 515-523.

Ramey, Garey and Valerie A. Ramey. 2010. “The Rug Rat Race.” *Brookings Papers on Economic Activity* 41, no.1: 129-199.

Reardon, Sean F. 2011. “The Widening Academic Achievement Gap between the Rich and the Poor: New Evidence and Possible Explanations.” In *Whither Opportunity? Rising Inequality, Schools, and Children’s Life Chances*, pp. 91-116. Russell Sage Foundation.

Reynolds, Arthur J. 1995. "One Year of Preschool Intervention or Two: Does it Matter?" *Early Childhood Research Quarterly,* 10(1): 1-31.

Reynolds, Arthur J. and Judy A. Temple. 1995. "Quasi-Experimental Estimates of the Effects of a Preschool Intervention Psychometric and Econometric Comparisons." *Evaluation Review,* 19(4): 347-373.

Reynolds, Arthur J. and Judy A. Temple. 2001. "Early Childhood Educational Intervention and Long-term Developmental Outcomes—Reply." *Journal of the American Medical Association,* 286(15): 1835-1836.

Reynolds, Arthur J. and Judy A. Temple. 2005. “Priorities for a New Century of Early Childhood Programs.” *Infants and Young Children,* 18(2): 104-118.

Reynolds, Arthur J., Majida Mehana, and Judy A. Temple. 1995. "Does Preschool Intervention Affect Children's Perceived Competence?" *Journal of Applied Developmental Psychology,* 16(2): 211-230.

Reynolds, Arthur J., Judy A. Temple, Dylan L. Robertson, and Emily A. Mann. 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." *Journal of the American Medical Association,* 285(18): 2339-2346.

Reynolds, Arthur J., Judy A. Temple, Dylan L. Robertson, and Emily A. Mann. 2002. "Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers." *Educational Evaluation and Policy Analysis,* 24(4): 267-303.

Reynolds, Arthur J., Judy A. Temple, Suh-Ruu Ou, Irma A. Arteaga, and Barry A.B. White. 2011. "School-Based Early Childhood Education and Age-28 Well-Being: Effects by Timing, Dosage, and Subgroups." *Science,* 333(6040): 360-364.

Reynolds, Arthur J., Brandt A. Richardson, Momoko Hayakawa, Erin M. Lease, Mallory Warner-Richter, Michelle M. Englund, Suh-Ruu Ou, and Molly Sullivan. 2014. "Association of a Full-Day vs Part-Day Preschool Intervention with School Readiness, Attendance, and Parent Involvement." *Journal of the American Medical Association,* 312(20): 2126-2134

Robin, Kenneth B., Ellen C. Frede, and William S. Barnett. 2006. "Is More Better? The Effects of Full-Day vs. Half-Day Preschool on Early School Achievement." National Institute for Early Education Research.

Rolnick, Art and Rob Grunewald. 2003. "Early Childhood Development: Economic Development with a High Public Return." *The Region,* 17(4): 6-12.

Schweinhart, Lawrence J. 2003. "Benefits, Costs, and Explanation of the High/Scope Perry Preschool Program."

Schweinhart, Lawrence J. and David P. Weikart. 1981. "Effects of the Perry Preschool Program on Youths through Age 15." *Journal of Early Intervention,* 4(1): 29-39.

Schweinhart, Lawrence J., Helen V. Barnes, and David P. Weikart. 1993. *Significant Benefits: The High/Scope Perry Preschool Study Through Age 27.* Ypsilanti, MI: High/Scope Press.

Schweinhart, Lawrence J., Jeanne Montie, Zongping Xiang, William S. Barnett, Clive R. Belfield, and Milagros Nores. 2005. "Lifetime Effects: The High/Scope Perry Preschool Study Through Age 40."

Shonkoff, Jack P. and Deborah A. Phillips. 2000. "From Neurons to Neighborhoods: The Science of Early Childhood Development." National Academic of Sciences National Research Council.

Solon, Garry. 1992. "Intergenerational Income Mobility in the United States." *American Economic Review,* 82(3): 393-408.

Sweet, Monica A. and Mark I. Appelbaum. 2004. "Is Home Visiting an Effective Strategy? A Meta-analytic Review of Home Visiting Programs for Families with Young Children." *Child Development* 75, no. 5: 1435-1456.

Tamis-LeMonda, Catherine, Jacqueline Shannon, Natasha Cabrera, and Michael Lamb. 2004. "Father and Mothers at Play with Their 2- and 3- Year-Olds: Contributions to Language and Cognitive Development." *Child Development,* 75(6): 1806-1820.

Temple, Judy A. and Arthur J. Reynolds. 2007. "Benefits and Costs of Investments in Preschool Education: Evidence from the Child–Parent Centers and Related Programs." *Economics of Education Review,* 26(1): 126-144.

Tout, Kathryn, Tabitha Isner, and Martha Zaslow. 2011. "Coaching for Quality Improvement: Lessons Learned from Quality Rating and Improvement Systems." Child Trends Research Brief.

U.S. Department of Health and Human Services, Administration for Children and Families. 2005. "Head Start Impact Study: First Year Findings."

U.S. Department of Health and Human Services, Administration for Children and Families. 2010. "Head Start Impact Study Final Report."

Vernon-Feagans, Lynne, Margaret Burchinal, and Irina Mokrova. 2012. "Diverging Destinies in Rural America." *Families in an Era of Increasing Inequality: Diverging Destinies, Vol. 5*.

Walters, Christopher. 2014. "Inputs in the Production of Early Childhood Human Capital: Evidence from Head Start." Working Paper 20639. Cambridge, Mass.: National Bureau of Economic Research (October).

Weiland, Christina, and Hirokazu Yoshikawa. 2014. “Does higher peer socio-economics status predict children’s language and executive function skills gains in prekindergarten?” *Journal of Applied Developmental Psychology,* 35(5): 422-432.

Yoshikawa, Hirokazu, Christina Weiland, Jeanne Brooks-Gunn, Margaret R. Burchinal, Linda M. Espinosa, William T. Gormley, Jens Ludwig, Katherine A. Magnuson, Deborah Phillips, and Martha J. Zaslow. 2014. “Investing in Our Future: The Evidence Base on Preschool Education.” *Society for Research in Child Development and Foundation for Child Development.*

Zaslow, Martha, Kathryn Tout, Tamara Halle, Jessica Vick Whittaker, and Bridget Lavelle. 2010. “Toward the Identification of Features of Effective Professional Development for Early Childhood Educators: Literature Review.” Child Trends Report for the U.S. Department of Education.