

Preschool Education and Its Lasting Effects: Research and Policy Implications

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Executive Summary

Over the last several decades, participation in center-based preschool programs has become much more common, and public support for these programs has grown dramatically. Nevertheless, participation remains far from universal, and policies vary across states, as well as across options such as private child care, preschools, Head Start, and state pre-K. Since policy makers typically have more alternatives than money, they face key questions about the value of preschool education, whom it should serve or subsidize, and which program designs are best. This brief reviews the research regarding the short- and long-term effects of preschool education on young children's learning and development. A detailed and comprehensive assessment of evidence yields the following conclusions and recommendations:

Conclusions

- Many different preschool programs have been shown to produce positive effects on children's learning and development, but those effects vary in size and persistence by type of program.
- Well-designed preschool education programs produce long-term improvements in school success, including higher achievement test scores, lower rates of grade repetition and special education, and higher educational attainment. Some preschool programs are also associated with reduced delinquency and crime in childhood and adulthood.
- The strongest evidence suggests that economically disadvantaged children reap long-term benefits from preschool. However, children from all other socioeconomic backgrounds have been found to benefit as well.
- Current public policies for child care, Head Start, and state pre-K do not ensure that most American children will attend highly effective preschool programs. Some attend no program at all, and others attend educationally weak programs. Children from middle-income families have least access, but many children in poverty also lack preschool experiences.
- Increasing child care subsidies under current federal and state policies is particularly unlikely to produce any meaningful improvements in children's learning and development. Given the poor quality of much child care, it might instead produce mild negative consequences.

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- Increasing public investment in effective preschool education programs for all children can produce substantial educational, social, and economic benefits. State and local pre-K programs with high standards have been the most effective, and such programs need not be provided by public schools. Public schools, Head Start, and private child care programs have produced similar results when operating with the same resources and standards as part of the same state pre-K program.
- Publicly funded pre-K for all might produce a paradoxical but worthwhile effect in terms of educational gains. Disadvantaged children benefit (in comparison to their gains with targeted programs), but so do more advantaged children. Accordingly, while such universal programs may result in higher levels of achievement for the disadvantaged, they might leave a larger achievement gap. If a universal preschool program substantially increased the enrollment of disadvantaged children, however, the achievement gap might also be reduced. .

Recommendations

- Policy makers should not depart from preschool education models that have proven highly effective. These models typically have reasonably small class sizes and well-educated teachers with adequate pay.
- Teachers in preschool programs should receive intensive supervision and coaching, and they should be involved in a continuous improvement process for teaching and learning.
- Preschool programs should regularly assess children's learning and development to monitor how well they are accomplishing their goals.
- Preschool programs, in order to produce positive effects on children's behavior and later reductions in crime and delinquency, should be designed to develop the whole child, including social and emotional development and self-regulation.
- Because an earlier start and longer duration does appear to produce better results, policies expanding access to children under 4 should prioritize disadvantaged children who are likely to benefit most. More broadly, preschool education policy should be developed in the context of comprehensive public policies and programs to effectively support child development from birth to age 5 and beyond.

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Introduction

Rapidly evolving preschool education poses challenges for local, state, and federal education policy. In 1960, just 10% of the nation's 3- and 4-year-olds were enrolled in any type of classroom. Less than a half century later, nearly three-quarters of children enroll in a preschool classroom at age 4 and about half do so at age 3.¹ These trends have been accompanied by growth in private preschool education and child care, state-funded pre-K, preschool special education, and the federal Head Start program.² Public programs currently enroll about half of those in programs at ages 3 and 4. Children are therefore served by programs that vary widely in enrollment, program design and operation, and this is true across and even within states. Issues of quality also arise out of this miscellany. A recent study in California, for example, revealed that state pre-K offered the highest educational quality, but that educational quality averaged across all programs, public and private, was relatively low.³

This policy brief summarizes research regarding the short- and long-term effects of preschool education, with particular attention given to what is known about influences on program effectiveness. This information is relevant to public policy makers who must decide whether and how much to support various types of preschool programs, what standards to set for public programs, and how much funding to allocate.

A Brief Survey of the Preschool Landscape

Nationally, the largest public investments in early education are for child care subsidies, state pre-K, Head Start, and preschool special education. About 75% of the nation's 4-year olds attend a preschool center, as do 50% of 3-year-olds.⁴ About half of all 4-year-olds, but fewer than 20% of all 3-year-olds, are in public programs, while about 35% of both age groups enroll in private preschool options.

The federal Head Start program serves comparatively few children: 11% of 4-year-olds and 8% of 3-year-olds. In 2006-2007, the federal government spent about \$6.2 billion on Head Start (and nearly \$700 million on Early Head Start, which serves children younger than 3). State pre-K programs enroll 22% of 4-year-olds and 11% of 3-year-olds. As these figures suggest, far fewer 3-year-olds overall enroll in public programs—8% in Head Start, as noted above, and an additional 3% in

state pre-K. Nationwide in 2006-2007, 38 states and the District of Columbia funded pre-K programs, spending more than \$3.7 billion on them. Generally, the federal government is not a major funder of state pre-K, although local education agencies have supplemented state funding.

Head Start and most state pre-K programs have eligibility requirements based on family income. Head Start limits eligibility to children in families whose income is below the Federal Poverty Level (FPL), or who are eligible for public assistance, with exceptions for homeless children and some others.⁵ Some states use the FPL or some multiple of it, while others use a percentage of the state median income (SMI).⁶ Several states have committed to provide access for all 4-year-olds: Florida, Georgia, Illinois, Iowa, New York, Oklahoma, and West Virginia. However, only Oklahoma is currently approaching universal enrollment.⁷ Generally, preschool enrollment rates are lowest for children in families whose income is above the poverty line but in the lower half of income distribution.

Children who attend preschool programs have widely varying experiences.⁸ Public programs vary considerably in operating schedules, teacher qualifications, class size and ratio, auxiliary services (such as health and social services, or parenting education), monitoring and accountability, actual teaching practices, and effects on children's learning and development. Teacher qualifications in state pre-K programs range from little more than a high school diploma to a four-year college degree with specialized training in early childhood education. Head Start has national standards for program structure and operation. Private programs vary greatly as well. State child care regulations are weak everywhere, but many centers exceed standards, even as others violate them.⁹ With programs varying so greatly, widely varied effects on children are to be expected.

Effects across All Types of Programs: An Overview

A substantial body of research establishes that preschool education can improve the learning and development of young children. Many studies have investigated the immediate effects of preschool education for children during their first five years of life. Some have compared the outcomes for preschool education against other options: outcomes for a true control group having no preschool education; outcomes for typical experience (which includes child care outside the home); and outcomes for more or less well-defined alternatives (for example, outcomes for preschool education programs using different curricula). With such a large number of studies, meta-analysis is a useful tool to summarize findings. As a statistical procedure, meta-analysis can provide a transparent, quantitative summary of findings that is easy to interpret. However, since meta-analysis offers little nuance concerning the details, strengths and weaknesses of each included study, it is also useful to consider a detailed

review of the most rigorous and relevant individual studies. The following discussion includes both approaches.

Multiple meta-analyses conducted over the past 25 years have found preschool education to produce an average immediate effect of about half (0.50) a standard deviation on cognitive development.¹⁰ This is the equivalent of 7 or 8 points on an IQ test, or a move from the 30th to the 50th percentile for achievement test scores. For the social and emotional domains, estimated effects have been somewhat smaller but still practically meaningful, averaging about 0.33 standard deviations.¹¹ To put these gains in perspective, it's important to realize that on many measures, a half standard deviation is enough to reduce by half the school readiness gap between children in poverty and the national average.

Dozens of studies have examined preschool education's long-term effects, providing information on effects into elementary school and beyond.¹² Recent meta-analyses of these find that preschool education has significant lasting effects on cognitive abilities, school progress (grade repetition, special education placement, and high school graduation), and social behavior.¹³ Estimated effects decline as students move from immediate experience to elementary school, to adolescence, and to adulthood follow-up. Thus, long-term effect sizes (reported as standard deviation units for each measure) are smaller, and are roughly 0.10 to 0.20 for cognitive abilities, 0.15 for school progress, and 0.15 to 0.20 on social behavior including delinquency and crime.¹⁴

These effect size estimates are averages across studies that vary widely in rigor and program types included. There is also some variation in populations served, although most studies have focused on economically disadvantaged populations. The strongest studies, which are randomized trials, have examined programs ranging from intensive "model" programs for children from birth to age 5 to typical Head Start centers.¹⁵ The largest estimated effects have been reported by these more rigorous studies. Also, programs focused directly on educating the child had greater effect than multi-purpose programs delivering a mix of services to children and families.¹⁶ Thus, the average effect sizes across all studies summarized by meta-analysis are significantly smaller than the average effect sizes found for well-implemented, intensive educational programs. For a more finely grained picture, then, this review turns now to the results of specific studies.

Child Care Effects

Ordinary child care is found to have the smallest initial effects on children's learning and development. Typically, family day care homes show no effect on cognitive development, while child care centers produce small short-term effects (0.10 to 0.15) on cognitive and language development.¹⁷ Several non-experimental studies in the United States and Canada have found center-based child care to produce small negative

effects on social-emotional development and behavior—in particular, increased aggression.¹⁸ There is some evidence that negative effects increase with number of years in care, but lessen when children attend higher quality programs.¹⁹ Higher program quality (defined in terms of standards and observed practices) is also associated with larger gains in cognitive and language abilities.²⁰ In addition, some studies, but not all, find larger benefits for children from economically disadvantaged families.²¹ These findings are from non-experimental studies, however; effects may be influenced by unobserved differences between children and families who do and do not use child care.²² Finally, evidence suggests that child care subsidies increase employment for mothers of young children.²³

Given the small initial effects of child care, it is not surprising that the estimated long-term effects are small as well. Some children might benefit from long-term increases in family income due to increases in maternal employment, though work could lead mothers to reduce time with their young children, perhaps partially offsetting income benefits. The methodologically strongest long-term study of child care's effects in the United States finds that both positive and negative effects tend to decline over time. Persistent effects are few. Greater child care quality is associated with higher vocabulary scores through grade 5 (an effect size of 0.06), and more time in center-based care increases teacher-reported behavior problems through grade 6 (an effect size of 0.08).²⁴ The weaker Early Childhood Longitudinal Study Kindergarten Cohort of 1998 (ECLS-K) studies find that center-based programs have small residual effects on reading and math test scores until the end of third grade (about 0.05 standard deviations).²⁵

Head Start Effects

Two recent randomized trials and a regression-discontinuity study (a rigorous alternative) have assessed the short-term effects of one year of Head Start.²⁶ The strongest study to date is the Head Start Impact Study (HSIS) of a large sample of children across the country randomly assigned to attend Head Start or not at ages 3 and 4.²⁷ The estimated cognitive effects of nine months of Head Start range from 0.05 to 0.25 standard deviations. Effects tend to be smaller for cognitive measures of broad domains and larger for measures of limited sets of literacy skills and knowledge more easily taught and mastered in a brief time.²⁸ No evidence was found of any negative effects on socio-emotional development, and behavior problems and hyperactivity were significantly reduced (0.13 to 0.18 standard deviations) for 3-year-olds. Access to dental care was improved and child health, as reported by parents, was modestly improved (0.12 standard deviations) for 3-year-olds. An earlier, smaller, randomized trial of Head Start for 4-year-olds in one region of the country found larger effects on cognitive development. For example, on the Peabody Picture

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Vocabulary Test (PPVT), gains were 0.32 standard deviations (compared to HSIS's 0.05 to 0.12). The study also found a very large effect on dental care as well as positive effects on health care.²⁹

Another recent rigorous study of Head Start's initial effects employed a quasi-experimental, regression-discontinuity design in Tulsa, Oklahoma. For one year of Head Start at age 4, this study found effects of 0.33 to 0.55 standard deviations on literacy and math assessments. Of note, the Tulsa Head Start programs are not typical. All lead teachers in Tulsa Head Start had four-year college degrees and early childhood teacher certification, and they received public school salaries and benefits. While it would therefore be inappropriate to generalize these results to Head Start overall, these findings increase concerns that the Head Start Impact Study (HSIS) might underestimate potential effects.

One reason for these concerns about HSIS is the influence of "crossovers" – children whose experience didn't actually correlate with study design. At age 4, only 86% of the treatment group actually attended Head Start, and conversely, 18% of the control group found their way into a Head Start program elsewhere.³⁰ Adjustments for crossovers in the study yield estimates of 0.08 to 0.36 on cognitive outcomes for children who actually attended Head Start.³¹ Even this finding is open to some question, however, since much of the "no treatment" control group attended programs other than Head Start: at least 22% of 3-year-olds and 30% of 4-year-olds in the control group attended other center-based programs.³² A similar concern exists about the earlier, smaller randomized trial discussed above, in which over a third of the control group similarly attended another child care program. Overall, it seems reasonable to conclude that one year of Head Start has initial effects on cognitive abilities that are at least in the range of 0.10 to 0.30 standard deviations.

Several researchers have used data from the Early Childhood Longitudinal Study Kindergarten Cohort of 1998 (ECLS-K) to estimate the effects of Head Start.³³ Although the ECLS-K provides a large and diverse sample and several family background measures for use as statistical controls, the data set has significant limitations including reliance on parent reports to identify Head Start participation, and the lack of pre-tests for behavior and academic skills, to control for pre-existing differences between children in the control and Head Start cohorts. These studies find that for children entering kindergarten, Head Start has no significant effects on cognition and negative effects on socio-emotional development and behavior as children enter kindergarten. It is important to note that the findings from these studies are precisely the opposite of the findings of the national randomized trial. A reasonable conclusion is that the ECLS-K findings differ because of the biases introduced by their weaker research designs, casting doubt on their longer-term findings as well.³⁴

Some studies using survey data have employed approaches specifically designed to address problems in selection bias. These have

found positive Head Start effects on achievement, producing estimates of initial impacts approximating those from randomized trials.³⁵ Several have also looked at longer-term effects. A series of studies comparing children within the same family who did and did not attend Head Start (as reported by parents) found effects on achievement at kindergarten entry that were similar for all ethnic groups. Nevertheless, later effects appear to vary by ethnicity. They found lasting effects on achievement test scores and grade retention for white and Hispanic children, but not for African-American children. Grade repetition for Hispanic children age 10 and older was found to be substantially reduced.³⁶ In addition, they found that Head Start increased high school graduation rates by 22 percentage points for white children and decreased arrest rates by 12 percentage points for African-American children.³⁷ However, other researchers suggest that the methods and data employed in these ESCL-K studies may introduce biases that could account for some of the variations in outcomes by ethnicity.³⁸

One study, which approximates a randomized trial, relies on an historical discontinuity in Head Start funding across counties to estimate Head Start's effects on children's health and on their educational attainment.³⁹ It finds that Head Start decreased mortality among children ages 5 to 9 from causes plausibly affected by Head Start health services; in addition, it increased high school graduation and college attendance.⁴⁰ Based on the health effects found in this study, an increase in Head Start enrollment from 12,000 to 30,000 per 100,000 children can be expected to result in one or two fewer deaths. Although no effects were found on eighth grade test scores, the significance intervals are so wide that the modest positive effects found in other studies can not be ruled out. The significant long-term effects are found for boys and girls and for blacks as well as whites. However, the estimates apply to children who attended Head Start in the 1960s and 1970s, and it is possible that today's Head Start has smaller or larger effects.⁴¹

State and Local Pre-Kindergarten Effects

Two studies of preschool education that began in the 1960s stand out. They were well-implemented, randomized trials of public school programs.⁴² The two programs studied, which are discussed briefly below, differ from typical state and local pre-K programs in scale and in the extent of oversight, supervision, and teacher support. Both employed public school teachers who received intensive coaching and supervision, regular in-depth discussion, and feedback regarding teaching practices. Other preschool programs with strong evidence of effectiveness have also had such teacher support, and it has been suggested that strong teacher support is likely to be important to replicating positive results.⁴³ Teachers in both programs also conducted home visits. Among numerous other studies of preschool interventions, only the two discussed below employed

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a true experimental design to investigate the persistent effects of preschool education provided by public schools.⁴⁴

The High/Scope Perry Preschool program randomly assigned 128 disadvantaged minority children to either a half-day preschool program with home visits by the teachers or a control group.⁴⁵ Children attended the preschool program for two school years beginning at age 3 (except for a few who entered at age 4). Classes and ratios were much better than is typical of most public programs: 12 or 13 children with two teachers. This staffing made the Perry program considerably more expensive than the typical public education pre-K program. However, initial effects on language and general cognitive abilities after two years were impressive: about 0.90 standard deviations, which is about the size of the typical black/white test score gap.

The Perry study followed 123 children from preschool well into adulthood. Researchers' ability to study nearly the entire original group over time allows confidence in long-term findings. The initial cognitive advantage from the preschool program was seen to decline over time, partly because the public school experience appeared to help the control group catch up once they entered kindergarten.⁴⁶ While there was no persistent effect on IQ, the study found a persistent effect on achievement tests through middle school, a finding consistent with results from the meta-analysis of all relevant research literature. In addition, the preschool group had better classroom and personal behavior as reported by teachers, less involvement in delinquency and crime, fewer special education placements, and a higher high school graduation rate.⁴⁷ Through age 40, the program was associated with increased employment and earnings, decreased welfare dependency, and reduced arrests. Long-term effect sizes are in the range from 0.30 to 0.50 standard deviations. High school graduation increased from half to two-thirds, the number of arrests by age 27 fell by half, and employment at age 40 showed an increase of 14 percentage points.⁴⁸

Another study of public school preschool education was conducted by the Institute for Developmental Studies (IDS). It included a larger sample of 402 children who were randomly assigned to the public program or to a control group.⁴⁹ Children entered the preschool program at age 4 and attended for one year, and afterward entered an IDS kindergarten program. A teacher and an aide staffed each preschool classroom of 17 children. Estimated effects at the end of pre-K were just over 0.40 standard deviations on measures of cognitive and language abilities; an estimated effect of about 0.20 on these abilities persisted through at least third grade. The IDS study also provides follow-up analyses that indicate persistent effects to adulthood on achievement, educational attainment, and employment. However, the study suffers from severe attrition, which limits the confidence that can be placed in those very long-term findings.⁵⁰

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A third randomized trial deserving mention examined the effects of one-year of a half-day university preschool program on 291 children from advantaged backgrounds. This study experienced higher attrition than the others, with only 196 (67%) of the original group remaining in the study at second and third grade follow-up. Moreover, this study had no tests of children's abilities prior to program entry. Attrition rates in treatment and control groups were apparently not affected by children's gender, IQ, or social competence. The average IQ of children in the study was 130, which indicates very high abilities—the 97th percentile. No significant program effects were found on IQ (although the estimated effect is 3 points, or 0.20 standard deviations), but significant effects were found on measures of social competence and school readiness.⁵¹ For second and third grade, the study found statistically significant gains on achievement tests for boys, but not girls. The estimated effect size for boys on the total achievement battery was 0.82 standard deviations.⁵²

There are no randomized trials of large scale, state-funded pre-K programs. However, recent studies have employed a regression-discontinuity design (RDD) that emulates the results of a randomized trial under reasonable assumptions.⁵³ These RDD studies make use of the birth date cut-off for school entry to compare two groups of children who both enter the program (thereby avoiding the selection bias problem) a year apart, but who differ in age by only one day.⁵⁴ Such studies of the universal pre-K program in Tulsa, Oklahoma, provide credible estimates of short-term effects on subgroups, as well as for children generally. These studies find effects on literacy and math achievement of 0.36 to 0.99 standard deviations.⁵⁵ These positive effects are found for boys and girls, for white, black, Hispanic, and Native American children, and for children who do and do not qualify for free and reduced-price lunches.⁵⁶ Effect sizes are, however, somewhat larger for minority children (ranging from 0.40 to 1.3).⁵⁷

The RDD approach also has been used to estimate the initial effects of one year of state pre-K on children's cognitive abilities in Arkansas, California, Michigan, New Jersey, New Mexico, Oklahoma, South Carolina, and West Virginia.⁵⁸ The average effect sizes across these eight states were 0.23 for general cognitive and language ability, 0.31 for math, and 0.79 for print awareness.⁵⁹ Effects on a test of general cognitive and language abilities can be directly compared to those in the Perry and IDS studies. The average initial effect size for one year of these state pre-K programs is about half that of IDS and one-quarter that of Perry, with the top-performing state pre-K programs approaching IDS effectiveness. These eight state programs are not necessarily representative, but they do provide a broad sample what state pre-K can produce on a large scale.

Unfortunately, this particular RDD approach cannot be used to estimate long-term effects, so some studies have supplemented it with other research designs in order to compare children who attended state pre-K with similar children from the same localities who did not. There is

some evidence that this less rigorous study design underestimates the initial effects of pre-K, sometimes by as much as half.⁶⁰ Even so, they have found statistically significant effects persisting through kindergarten and first grade, although those effects may decline a bit over time.⁶¹ Also, these persistent gains are larger on broader domains of learning that are not quickly mastered.⁶² Children with two years of New Jersey's relatively intensive Abbott pre-K program starting at age 3 sustained cognitive gains through the end of kindergarten (0.42 effect size on the PPVT) that are comparable to end of kindergarten gains from the Perry Preschool program.⁶³

Other studies of state and local school pre-K programs provide additional evidence, including longer-term results, but unfortunately most used non-experimental research designs that offer less protection from selection bias.⁶⁴ Two of the methodologically stronger state evaluations used waiting lists to construct comparison groups (thereby creating a "control" group that is also characterized by parental interest in preschool education). A South Carolina study using a pre-test of children's abilities found a positive effect (0.33 standard deviations) on cognitive abilities at kindergarten entry, particularly for children whose classrooms had higher quality as measured by direct observation (0.44 standard deviations).⁶⁵ A New York study found initial positive effects on general reasoning, verbal concepts, and school-related knowledge and skills.⁶⁶ Both studies found some persistence of effects into the elementary school years; the New York study additionally found evidence of less retention in grade.

Several literature reviews have summarized long-term findings from the large body of research literature evaluating state and local pre-K programs using quasi-experimental methods. Such summaries find a mixed pattern of positive and null findings on achievement tests, but a more uniform pattern of significant reductions in special education and grade retention.⁶⁷ The substantially lower rates of grade retention and special education for children attending pre-K reported by several studies actually explains some of the null findings on achievement test scores. Most studies compare children in the control group with children receiving pre-K education within each grade level; such comparisons, however, do not take into account the absence of low-performing children from the control group who were retained in an earlier grade or moved into special education.⁶⁸

The most rigorous long-term, large-scale study of pre-K is the Child Parent Center (CPC) study.⁶⁹ Chicago's public schools operated the CPC program beginning in the late 1960s. CPC provides low-income children with a half-day preschool, kindergarten, and a follow-on elementary school component. Some 55% of CPC students attended CPC preschool for two-years beginning at age 3 (the remaining students attended the preschool for one year beginning at age 4). The preschool program had a certified teacher and an assistant in each classroom of 18 children, and a relatively strong parent outreach and support component.

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This program design is similar to “better” state programs in terms of basic design and cost. Multiple evaluations have been conducted on the CPC program, all finding positive effects on children’s learning. The most recent study constructed a comparison group at kindergarten entry drawn from children in similar neighborhoods, some attending the same elementary schools as the CPC children. Estimated effects on test scores at kindergarten vary from 0.35 to 0.77 standard deviations depending on the measure and analysis procedures (estimated effects of just one year of preschool attendance are about 0.20 to 0.65 standard deviations).⁷⁰

The CPC study has a relatively large sample and has maintained its sample integrity into adulthood; it estimates program effects on a broad range of outcomes through age 21. Because the half-day CPC program is broadly similar to the Perry Preschool program (albeit less intensive), it can be considered a replication of the Perry study, and the extent to which the CPC study’s findings confirm the long-term findings of the Perry Preschool study is important. The CPC study finds positive effects on the following outcomes: test scores through at least middle school, arrests for delinquency and crime, special education, and high school graduation. The estimated effects are remarkably similar to those in the Perry Preschool study, though sometimes smaller. In addition, it finds a significant reduction in grade retention.⁷¹ This pattern is what one would expect from a somewhat less intense dose of the same “treatment” in a different location. As in the Perry Preschool study, effects on cognitive abilities decline over time, but as late as eighth grade they are still nearly 0.20 standard deviations. The effects on schooling outcomes are substantial (effect sizes of 0.23 to 0.34) with a 15 percentage point reduction in grade retention, a 10 percentage point reduction in special education placements, and an 11 percentage point increase in high school graduation by age 20.

Additional estimates of the effects of state and local pre-K have been produced by other studies using the large national ECLS-K data set.⁷² Although the size and diversity of their samples are appealing, such studies have serious methodological limitations. As noted earlier, studies employing large national data sets have generally been found to produce more biased estimates than studies using smaller samples with local comparison groups.⁷³ Moreover, ECLS-K uses only parental reporting to identify the type of program, and parents were not asked if the program was a state or local education program. This is a serious problem for studies trying to look closely at state pre-K, which can encompass private centers, Head Start programs, and public school programs.⁷⁴ These studies find positive effects on cognitive development of just under 0.20 standard deviations and negative effects on social skills and behavior of 0.12-0.29 standard deviations. Longer-term, these studies find pre-K to reduce grade retention and to increase test scores in third grade by about 0.05 standard deviations.⁷⁵ When estimates are limited to preschool programs housed in the same elementary school a child attended for kindergarten, negative effects on social skills and behavior disappear.⁷⁶ As with Head Start,

comparison to the results of randomized trials suggests that the ECLS-K estimates are biased downward and assign an inaccurate negative in the social-emotional domain. Thus, the ECLS-K studies add to the evidence of persistent positive effects despite their short-comings, but their specific estimates should carry little weight in policy debates.

Perhaps because many preschool education programs have been half-day, few studies have estimated their effects on maternal employment. One study finds that public preschool programs and cheaper private programs increased employment of single and married mothers of 3- and 4-year olds and that public kindergarten increased employment of single and married mothers of 5-year-olds.⁷⁷ These estimated increases are large: from 6 to 15% for employment, hours, and earnings for mothers of 5-year-olds, and over 20% for mothers of younger children. Another study of the effects of public kindergarten on maternal employment finds smaller effects for single mothers and no effects for married mothers.⁷⁸ Neither study accounts for whether public kindergarten was part-day or full-day, a potential problem as half-day kindergarten might be expected have little or no effect on employment. A study of single mothers who had received public assistance in Massachusetts found that both the availability of Head Start and state funding for preschool education for low-income children increased maternal employment.⁷⁹ Studies of the effects of preschool education on maternal employment in other nations have also found positive effects.⁸⁰

International Evidence

Research in other countries confirms many of the U.S. findings regarding short- and long-term outcomes of pre-K. A randomized trial with long-term follow-up of high-quality half-day pre-K in Mauritius finds short-term improvements in children's learning and behavior, and reduced crime rates into adulthood.⁸¹ Rigorous quasi-experimental studies in Latin America find increased test scores through third grade, as well as decreased school failure, increased educational attainment, and positive effects on attention, class participation, and discipline.⁸² Several studies in the United Kingdom that are similar to the National Institute for Child Health and Human Development (NICHD) and ECLS-K studies in the United States find modest positive effects on cognitive development that persist for at least several years into school and mixed (but weak) effects on social development and behavior.⁸³ In the UK, entering school prior to age 5 has been linked with cognitive gains through age 16 and increased employment at age 33.⁸⁴ Both early schooling and preschool attendance were associated with increased wage rates (about 3%) at age 33.⁸⁵ Effects in these studies are similar for children from all economic strata.⁸⁶ A New Zealand study finds positive long-term effects on cognitive abilities and some protection from getting into trouble through age 16 for children from all backgrounds.⁸⁷ UK and New Zealand studies found larger gains when

programs contained more middle class families.⁸⁸ Finally, international comparisons find that increased duration of preschool education is associated with higher achievement test scores through age 15 and that very high participation rates are associated with less within-country inequality in test scores.⁸⁹

Effects of Very Early Educational Intervention

Researchers also have studied the effects of early education and child care beginning before age 3, sometimes during the first year of life. The Abecedarian study employed a randomized trial to evaluate the effects of a full-day (six to eight hours) year-round educational program from about four months of age to kindergarten entry. This study followed 111 children from program entry through age 21 with a largely intact sample.⁹⁰ The Abecedarian program produced large initial gains in IQ that have declined over time, with effect sizes of about 0.75 at age 4, 0.50 at age 5, and 0.33 at ages 15 and 21. Effects on reading and math achievement averaged about 0.40 standard deviations from ages 8 to 21, with only a very slight decrease in magnitude over time. The program had large effects on grade retention and special education, reducing each by 23 percentage points. The study reports no statistically significant effect on high school graduation, but high school graduations (excluding GED) through age 19 were 67% for the treatment group and 51% for the control group, a 16 percentage point difference. Attendance at a four-year college was significantly different, 36% for the program group versus 14% for the control group.⁹¹

There were broader effects, as well. At the young adult follow-up, the program group was more likely to have a skilled job, less likely to have become teen parents, and less likely to smoke marijuana. Effects were not found on social development or behavior during the program or in later delinquency and crime. However, control group involvement in crime and delinquency was low, making it difficult to improve on an already good outcome.⁹² A 16 percentage point difference in adult smoking is not statistically significant, but is similar to the observed difference in the Perry Preschool study. The program group also reported fewer depressive symptoms at age 21 (effect size of 0.42). Finally, the free child care appeared to have improved mothers' long-term employment opportunities and earnings.

Other randomized trials replicate or partially replicate the Abecedarian findings. The Project CARE study compared essentially the same program as Abecedarian to a home visiting model and a no-treatment control group.⁹³ This study is limited by a smaller sample size (only 16 children in the center-based program, with 14 included at long-term follow-up), and thus it has sometimes been combined with the Abecedarian data for analysis. The CARE study finds essentially the same pattern and magnitude of preschool effects on IQ over time. The home

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visitation program had no significant effects. Program effects on achievement and school progress have not been reported. However, young adult outcomes are quite similar for four-year college enrollment and highly skilled employment. When the data from the two studies are pooled, there is a statistically significant effect on years of education (effect size 0.43). CARE did not replicate findings regarding smoking or teen parenting.

Another small-scale replication is a Milwaukee study of a program providing full-day educational child care to highly disadvantaged children from before age 1 through kindergarten. This study had only 53 children at start and 40 for longer-term follow-up, but it approximated a randomized trial. The study found large initial gains in IQ that declined when the control group entered school, but remained at about 10 points (0.67 standard deviations) through age 14. Effects on achievement test scores appeared to decline rapidly during the early school years. Though not statistically significant, the effect on reading achievement was an estimated 0.68 grade equivalent, or 10 percentiles. Math scores were essentially equal for the two groups by grade 4. However, there were half as many grade retentions (10 v. 5) and substantially fewer special education placements for the program group by grade 4. The subsequent absence of the additional retained and special education students from the control population may have adversely affected the achievement test comparisons.⁹⁴

A much larger, but less exact replication is the Infant Health and Development Program (IHDP), a multi-site randomized trial of home visitation for the first year followed by educational child care modeled on the Abecedarian program from ages 1 to 3. Children and families received no services after age 3.⁹⁵ All 985 children in the IHDP study were low birth weight (LBW), but the sample was divided into low and high LBW groups. The heavier low birth weight group is more socio-economically diverse and less educationally disadvantaged than samples in most other randomized trials.⁹⁶ At age 3, the treatment group had a higher IQ (10 points, effect size 2/3), fewer behavior problems, and a higher rate of maternal employment. The IQ gain was larger (14 points, 0.93) for the heavier LBW program group.⁹⁷

Although no effects persist beyond age 3 for the sample as a whole, long-term gains are found for the heavier LBW IHDP participants. They have cognitive advantages of about 0.30 to 0.45 standard deviations at ages 5 and 8, and higher math (but not reading) achievement at age 8.⁹⁸ At age 18, the heavier LBW program participants also had higher scores on one measure of cognitive ability and language (0.25), but not on IQ, as well as higher math achievement test scores (0.34) and less self-reported risky behavior.⁹⁹ No significant effects were found on grade retention, special education, high school graduation, or arrest rates. However, estimated effects for the heavier children were similar in size to estimated effects for the children in the Chicago Child Parent Center study for

special education (reduced from 24% to 17%) and for arrests (reduced from 26% to 21%).¹⁰⁰ In contrast to child effects, the maternal employment gain persisted only for the lighter LBW group.¹⁰¹

Multiple randomized trials have been conducted on early childhood interventions that seek to comprehensively intervene with parents and children beginning in the first years of life. These do not typically provide an intensive educational program to children. Overall, they have not produced the same magnitude of effects as programs focused on educating the child, and studies do not find substantive cognitive effects persisting to kindergarten entry. Examples include the Comprehensive Child Development Program (CCDP), Avance family support program, Child and Family Resource Program, New Chance, and Even Start.¹⁰² The recent large-scale multi-site randomized trial of Early Head Start (birth to age 3 programs delivering center-based and home visitation services) is perhaps the most positive. It found small effects on development (0.10 for cognitive and language abilities) for children age 3 and for parent outcomes.¹⁰³ At age 5, no effects persisted on cognition, language, or achievement; however, small improvements (0.10 standard deviations) were found for children's behavior problems, parenting, and maternal depression.¹⁰⁴

Implications for Policy Implementation

As described above, early care and education programs have positive effects on young children's cognitive and social development, and these effects can be substantial. Rigorous studies find not only immediate gains, but lasting benefits for learning and educational achievement, school progress and educational attainment, and social behavior, including delinquency and crime. The methodologically strongest studies find the largest effects, and the earliest and smallest studies have been replicated repeatedly and on a large scale. Research from other countries indicates that findings of long-term educational and social benefits generalize across a tremendous range of social, political, and educational environments. This evidence indicates that policies supporting the provision of effective preschool education can produce important improvements in children's learning and development. However, two policy questions immediately arise. Who should receive the programs? And, what characteristics should programs have in order to be effective?

In the United States, the question about who should receive programs translates to the question of whether programs should be targeted. One way to address the question is to ask what groups preschool is known to help. Positive effects have been found for boys and girls, children from all socio-economic strata, and children from all major ethnic backgrounds.¹⁰⁵ While the size of some effects varies with children's characteristics (including their family background), the largest and most rigorous studies do not consistently find that effects are limited to one

gender or only to children from low-income families. Larger effects do seem likely for children from disadvantaged backgrounds on threshold measures like grade repetition, special education placement, high school graduation, and criminal arrests. However, about 1 in 10 children from the middle 60% of the family income distribution repeats a grade and a similar fraction drops out of high school; due to their sheer numbers it is these middle-income children who account for most of the school failure problem.¹⁰⁶

Multiple benefit-cost analyses have been conducted on three of the intensive educational programs that have been studied long-term—Abecedarian, Perry Preschool, and CPC.¹⁰⁷ All three find that benefits substantially exceed costs. Thus, these programs not only achieve important educational goals, but are sound public investments even if they are far from optimal, or even if they serve populations with relatively less to gain than the cohorts studied in these three programs. The value of the benefits is so high that even if more advantaged children gained as little as one half—or even one tenth—of the benefits disadvantaged children gain, a one- or two-year preschool program for them would be a worthwhile public investment.

There are, of course, other reasons for preferring either a targeted or a universal program.¹⁰⁸ Some derive from political principles, like assertions that smaller government is preferable to a larger one, or that public education in a democracy should be equally available to all. Such philosophical issues are beyond the scope of this review. In addition, practical issues complicate the choice. Most targeted programs use family income to determine eligibility. However, family income presents a moving target due to the transience of poverty for many families. Many families move from one side of the cut-off to the other during the school year; some families manage to enroll their children despite having incomes above the cut-off; and others who qualify are not even identified as eligible. By the end of a program year, half of those enrolled may exceed the income cut-off.¹⁰⁹ Moreover, family income is far from a perfect indicator of who will benefit from preschool education. Others have suggested developing measures of “poor parenting” for use in targeting, but this seems even more intrusive and impractical than means-testing. In addition, the evidence reviewed here suggests that program effects on disadvantaged children may be larger when programs serve children from diverse backgrounds. If the primary concern about implementing a universal program is the cost of subsidies to higher-income families, the use of a sliding fee scale can reduce public cost while accommodating all children.

Regarding how children should be served, it is clear that all programs do not produce the same gains. Current child care policies and programs do not provide services of the educational intensity needed to produce substantial short-term gains, much less long-term gains. Moreover, there is reason for some concern that under current policies

child care has small negative effects on social and emotional development. These undesirable outcomes are an important concern because most young children who are in child care attend private programs with little or no quality assurance: at best, they are regulated and subsidized as child care—not education. Head Start and other public programs produce larger positive effects, and no negative effects. Although Head Start’s effects on learning may be smaller than those of many state and local pre-K programs, rudimentary calculations for Head Start based on research reviewed here suggest that it passes a cost-benefit test.¹¹⁰ The better state pre-K programs should pass as well. Private child care is not necessarily inferior: private child care centers operating under state pre-K standards with state pre-K funding can produce the same large positive effects as programs in public schools.¹¹¹

In general, research finds that the programs with the largest and longest lasting effects are the most educationally intensive and expensive. Additional guidance from research regarding program design is limited. Others things equal, programs that begin earlier appear to have greater long-term effects. Only programs that begin at age 1 or earlier have had persistent effects on IQ, but this does not necessarily translate into greater long-term benefits across the board. Programs starting in the first year of life and continuing to kindergarten may or may not have higher rates of return than programs starting at ages 3 or 4. Programs for infants and toddlers are much more expensive, and some quite expensive very early interventions largely failed, apparently because they did not deliver enough education.

Both half-day and full-day programs have produced strong results, but only full-day programs produce economic benefits from increases in parental employment. Employment and earnings benefits suggest the value of jointly developing child care and preschool education policies. Examples include extending the length of preschool education day to six or more hours, offering wrap-around child care in public pre-K, funding private child care centers to offer pre-K that meets high education standards, coordinating child care subsidies and public preschool funding, and connecting family home day care providers and public pre-K in ways that facilitate children’s participation in pre-K without disrupting (or even improving) their family home day care arrangements. As a bonus, one small randomized trial found that an extended day and extended year produced greater learning gains.¹¹²

Strong guidance regarding other issues of preschool program design is difficult to glean from existing research. Many studies have measured the associations between children’s learning and development and such program characteristics as teacher qualifications and training, teacher salaries, class size, and adult-child ratio.¹¹³ A number have failed to find relationships between any of the structural characteristics of programs and children’s learning.¹¹⁴ However, none have been randomized trials. The scant evidence from randomized trials that we do

have contradicts the results from weaker designs. The Tennessee class size experiment, for instance, found that smaller classes (around 15) led to greater learning gains in kindergarten.¹¹⁵ A randomized trial within the National Day Care Study found that smaller classes and better adult-child ratios produced more learning.¹¹⁶ As this review shows, weaker quasi-experimental designs often produce misleading results and can even get the direction of an effect wrong (e.g., finding a negative effect when the true effect is positive). Recent analyses call into question the validity of even sophisticated value-added studies as a means to address these questions.¹¹⁷

Until we have more randomized trials, policy makers would be well advised to use caution when departing from models demonstrated to be effective. The research literature does establish that programs with well-educated, adequately paid teachers, small classes (no more than 20 children), and reasonable staff-child ratios (less than 1:10) have repeatedly produced strong short- and long-term educational gains. Programs putting fewer resources into the classroom often have failed to achieve similar results.

Of course, structure and resources alone are not sufficient for high levels of educational effectiveness. Careful attention must be paid to the how teachers actually teach, what children experience and learn in the classroom, the provision of supervision and coaching, and the engagement of teachers and those who support them in a continuous improvement process.¹¹⁸ A program's goals and implementation matter a great deal, though these are complex and not necessarily well-specified by the formal curriculum. Recent randomized trials comparing curricula produced few strong findings, with the most frequent result by far no significant difference. Nevertheless, several of these studies add to the evidence reviewed above that intentional focus on specific learning goals does matter.¹¹⁹ One of the most important matters in this respect is to pay attention to all of children's needs for learning and development. Healthy social and emotional development is as important in life as academic success. An intentional focus on enhancing social and emotional development is required for success in this domain, and curricula have been found to differ in their effectiveness in this domain.¹²⁰ Physical health and nutrition deserve attention, as well.¹²¹

Conclusions and Recommendations

A substantial body of research is available regarding the effects of preschool education on young children's learning and development, including long-term outcomes. Much of the evidence is from rigorous studies, and findings have been replicated with considerable variations in program design, populations served, and social context. These studies provide a sound basis for conclusions about the benefits of publicly funded preschool education, and they can help inform key decisions about

who to serve and how programs should be designed. Based on a detailed and comprehensive review of the evidence the following conclusions and recommendations are offered:

Conclusions

- Many different preschool programs have been shown to produce positive effects on children's learning and development, but those effects vary in size and persistence by type of program.
- Well-designed preschool education programs produce long-term improvements in school success, including higher achievement test scores, lower rates of grade repetition and special education, and higher educational attainment. Some preschool programs are also associated with reduced delinquency and crime in childhood and adulthood.
- The strongest evidence suggests that economically disadvantaged children reap long-term benefits from preschool. However, children from all other socioeconomic backgrounds have been found to benefit as well.
- Current public policies for child care, Head Start, and state pre-K, do not ensure that most American children will attend highly effective preschool programs. Some attend no program at all, and others attend educationally weak programs. Children from middle-income families have least access, but many children in poverty also lack preschool experiences.
- Increasing child care subsidies under current federal and state policies is particularly unlikely to produce any meaningful improvements in children's learning and development. Given the poor quality of much child care, it might instead produce mild negative consequences.
- Increasing public investment in effective preschool education programs for all children can produce substantial educational, social, and economic benefits. State and local pre-K programs with high standards have been the most effective, and such programs need not be provided by public schools. Public schools, Head Start, and private child care programs have produced similar results when operating with the same resources and standards as part of the same state pre-K program..
- Publicly funded pre-K for all might produce a paradoxical but worthwhile effect in terms of educational gains. Disadvantaged children benefit (in comparison to their gains with targeted programs), but so do more advantaged children. Accordingly, while such universal programs may result in higher levels of achievement for the disadvantaged, they might leave a larger achievement gap. If a universal preschool program substantially increased the enrollment of disadvantaged children, however, the achievement gap might also be reduced.

Recommendations

- Policy makers should not depart from preschool education models that have proven highly effective. These models typically have reasonably small class sizes and well-educated teachers with adequate pay.
- Teachers in preschool programs should receive intensive supervision and coaching, and they should be involved in a continuous improvement process for teaching and learning.
- Preschool programs should regularly assess children's learning and development to monitor how well they are accomplishing their goals.
- Preschool programs, in order to produce positive effects on children's behavior and later reductions in crime and delinquency, should be designed to develop the whole child, including social and emotional development and self-regulation.
- Because an earlier start and longer duration does appear to produce better results, policies expanding access to children under 4 should prioritize disadvantaged children who are likely to benefit most. More broadly, preschool education policy should be developed in the context of comprehensive public policies and programs to effectively support child development from birth to age 5 and beyond.

Notes and References

- ¹ Belfield, C. (2008). Unpublished analyses of enrollment in any type of center-based program for children who turned 4 (or 3) prior to September of the current school year using data from the National Household Survey of Education, 2005.
- ² Barnett, W.S., Hustedt, J.T., Friedman, A.H., Boyd, J.S., & Ainsworth, P. (2007). *The state of preschool 2007: State preschool yearbook*. New Brunswick, NJ: Rutgers, The State University of New Jersey, National Institute for Early Education Research.
- ³ Karoly, L.A., Ghosh-Dastidar, B., Zellman, G., Perlman, M., & Fernyhough, L. (2008). *Nature and quality of early care and education for California's preschool-age children: Results from the California Preschool Study*. Santa Monica, CA: Rand.
- ⁴ Belfield, C. (2008). Unpublished analyses of enrollment in any type of center-based program for children who turned 4 (or 3) prior to September of the current school year using data from the National Household Survey of Education, 2005. Some other analyses of NHES data report slightly lower rates of participation, but those lower rates are based on age in the spring of the year when the survey was conducted rather than whether children belong to the age 4 or age 3 birth cohort for school entry purposes.
- ⁵ Sec. 645. PARTICIPATION IN HEAD START PROGRAMS [42 U.S.C. 9840]. Retrieved July 18, 2008 from http://www.acf.hhs.gov/programs/ohs/legislation/HS_act.html#645
- ⁶ Barnett, W.S., Hustedt, J.T., Friedman, A.H., Boyd, J.S., & Ainsworth, P. (2007). *The state of preschool 2007: State preschool yearbook*. New Brunswick, NJ: Rutgers, The State University of New Jersey, National Institute for Early Education Research.
- ⁷ Barnett, W.S., Hustedt, J.T., Friedman, A.H., Boyd, J.S., & Ainsworth, P. (2007). *The state of preschool 2007: State preschool yearbook*. New Brunswick, NJ: Rutgers, The State University of New Jersey, National Institute for Early Education Research.
- ⁸ Karoly, L.A., Ghosh-Dastidar, B., Zellman, G., Perlman, M., & Fernyhough, L. (2008). *Nature and quality of early care and education for California's preschool-age children: Results from the California Preschool Study*. Santa Monica, CA: Rand.
- Early, D.M., Barbarin, O., Bryant, D., Burchinal, M., Chang, F., Clifford, R., Crawford, G., Weaver, W., Howes, C., Ritchie, S., Kraft-Sayre, M., Pianta, R., & Barnett, W.S. (2005). *Pre-Kindergarten in Eleven States: NCEDE's Multi-State Study of Pre-Kindergarten & Study of State-Wide Early Education Programs (SWEEP)*. Chapel Hill, N.C.: NCEDE.
- ⁹ Blau, D. (2007). Unintended consequences of child care regulation. *Labour Economics*, 14, 513-538.
- ¹⁰ Camilli, G., Vargas, S., Ryan, S., & Barnett, W.S. (in press). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*.
- Gorey, K. M. (2001). Early childhood education: A meta-analytic affirmation of the short- and long-term benefits of educational opportunity. *School Psychology Quarterly*, 16 (1), 9-30.
- Guralnick, M.J., & Bennett, F.C. (Eds.), (1987). *The effectiveness of early intervention for at-risk and handicapped children*. New York, NY: Academy Press.
- McKey, R.H., Condelli, L., Ganson, H., Barrett, B.J., McConkey, C., & Planz, M.C. (1985). *The impact of Head Start on children, families, and communities*. Washington, DC: Head Start Evaluation Synthesis and Utilization Project.
- Nelson, G., Westhues, A., & MacLeod, J. (2003). A meta-analysis of longitudinal research on preschool prevention programs for children. *Prevention and Treatment*, 6, 1-34.

Preschool education and its lasting effects

- Ramey, C.T., Bryant, D.M., & Suarez, T. M. (1985). Preschool compensatory education and the modifiability of intelligence: A critical review. In D. Detterman (Ed.) *Current topics in human intelligence* (pp.247-296). Norwood, NJ: Ablex.
- White, K., & Casto, G. (1985). An integrative review of early intervention efficacy studies with at-risk children: Implications for the handicapped. *Analysis and Intervention in Developmental Disabilities*, 5, 7-31.
- ¹¹ Camilli, G., Vargas, S., Ryan, S., & Barnett, W.S. (in press). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*.
- McKey, R.H., Condelli, L., Ganson, H., Barrett, B.J., McConkey, C., & Planz, M.C. (1985). *The impact of Head Start on children, families, and communities*. Washington, DC: Head Start Evaluation Synthesis and Utilization Project.
- White, K., & Casto, G.(1985). An integrative review of early intervention efficacy studies with at-risk children: Implications for the handicapped. *Analysis and Intervention in Developmental Disabilities*, 5, 7-31.
- ¹² Aos, S. , Lieb, R., Mayfield, J., Miller, M., & Pennucci, A. (2004). *Benefits and costs of prevention and early intervention programs for youth*. Olympia, WA: Washington State Institute for Public Policy.
- Barnett, W. S. (1998). Long-term effects on cognitive development and school success. In W. S. Barnett & S. S. Boocock (Eds.), *Early care and education for children in poverty: Promises, programs, and long-term results* (pp. 11–44). Albany, NY: SUNY Press.
- Karoly, L.A., Kilburn, M.R., & Cannon, J.S. (2005). *Early childhood interventions: Proven results, future promise*, MG-341. Santa Monica, CA: The RAND Corporation.
- ¹³Aos, S. , Lieb, R., Mayfield, J., Miller, M., & Pennucci, A. (2004). *Benefits and costs of prevention and early intervention programs for youth*. Olympia, WA: Washington State Institute for Public Policy.
- Camilli, G., Vargas, S., Ryan, S., & Barnett, W.S. (in press). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*.
- ¹⁴ Effect sizes are one way of facilitating comparisons across measures in which the size of the effect is portrayed relative to the amount of variation in the outcome in the population. There are multiple ways to calculate effect sizes, and these can produce potentially misleading differences across studies. When possible, this study reports effect sizes based on the population standard deviation for a measure rather than using standard deviations from particular study samples.
- ¹⁵ Consortium for Longitudinal Studies (Eds.), (1983). *As the twig is bent...lasting effects of preschool programs*. Hillsdale, NJ: Erlbaum.
- Love, J. M., Kisker, E. E., Ross, C. M., Schochet, P. Z., Brooks-Gunn, J., Paulsell, D., et al. (2002). *Making a difference in the lives of infants and toddlers and their families: The impacts of Early Head Start. Volume I: Final technical report*. Princeton, NJ: Mathematica Policy Research Inc.
- Puma, M., Bell, S., Cook, R., Heid, C., Lopez, M., Zill, N.,et al. (2005). *Head Start impact study: First year findings*. Washington, DC: US Department of Health and Human Services, Administration for Children and Families.
- Schweinhart, L.J., Montie, J., Xiang, Z., Barnett, W.S., Belfield, C.R., & Nores, M. (2005). *Lifetime effects: The High/Scope Perry Preschool study through age 40*. Ypsilanti, MI: High/Scope Press.
- Wasik, B.H., Ramey, C.T., Bryant, D.M., & Sparling, J.J. (1990). A longitudinal study of two early intervention strategies: Project CARE. *Child Development*, 61(6), 1682-1696.
- ¹⁶ Barnett, W.S. (2002). Early childhood education. In A. Molnar (Ed.), *School reform proposals: The research evidence*, (pp. 1-26). Greenwich, CT: Information Age Publishing.

Preschool education and its lasting effects

- Camilli, G., Vargas, S., & Ryan, S., & Barnett, W.S. (in press). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*.
- ¹⁷ Bernal, R., & Keane, M.P. (2006). *Child care choices and children's cognitive achievement: The case of single mothers*. (Working paper 06-09). Evanston, IL: Institute for Policy Research, Northwestern University. Bernal and Keane find negative effects of informal care in contrast to positive effects of center based care for children of poorly educated mothers, in particular.
- NICHD Early Care Research Network (2002). Early child care and children's development prior to school entry: Results from the NICHD Study of Early Child Care. *American Educational Research Journal*, 39(1), 133-164.
- ¹⁸ Baker, M., Gruber, J. & Milligan, K. (2005). Universal childcare, maternal labor supply, and family well-being (NBER Working Paper No. W11832). Retrieved July 20, 2008 from <http://ssrn.com/abstract=875708>
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, 26, 33-51.
- NICHD Early Child Care Research Network (2003). Does amount of time spent in child care predict socioemotional adjustment during the transition to kindergarten? *Child Development*, 74(4), 976-1005.
- ¹⁹ NICHD Early Child Care Research Network (2003). Does amount of time spent in child care predict socioemotional adjustment during the transition to kindergarten? *Child Development*, 74(4), 976-1005.
- Love, J.M., Harrison, L., Sagi-Schwartz, van Ijzendoorn, M.H., Ross, C., Ungerer, J.A., et al. (2003). Child care quality matters: How conclusions may vary with context. *Child Development*, 74(4), 1021-1033.
- ²⁰ Burchinal, M.R., & Cryer, D. (2003). Diversity, child care quality, and developmental outcomes. *Early Childhood Research Quarterly*, 18, 401-426.
- McCartney, K., Dearing, E., Taylor, B.A., & Bub, K.L. (2007). Quality child care supports the achievement of low-income children: Direct and indirect pathways through caregiving and the home environment. *Journal of Applied Developmental Psychology*, 28, 411-426.
- NICHD Early Child Care Research Network & Duncan, G.J. (2003). Modeling the impacts of child care quality on children's preschool cognitive development. *Child Development*, 74, 1454-75.
- Peisner-Feinberg, E.S., & Burchinal, M.R. (1997). Relations between preschool children's child-care experiences and concurrent development: The Cost, Quality, and Outcomes Study. *Merrill-Palmer Quarterly*, 43(3). 451-477.
- Ruopp, R., Travers, R.J., Glantz, F., & Coelen, C. (1979) *Children at the center: Final report of the National Day Care Study, Vol. 1*. Cambridge, MA: Abt Associates.
- Vandell, D.L. (2004). Early child care: The known and unknown. *Merrill-Palmer Quarterly*, 50(3), 387-414.
- ²¹ Caughy, M.O., DiPietro, J.A., & Strobino, D.M. (1994). Day-care participation as a protective factor in the cognitive development of low-income children. *Child Development*, 65, 457-471.
- NICHD Early Child Care Research Network & Duncan, G.J. (2003). Modeling the impacts of child care quality on children's preschool cognitive development. *Child Development*, 74, 1454-75.
- ²² Larzelere, R.E., Kuhn, B.R., & Johnson, B. (2004). The intervention selection bias: An under-recognized confound in intervention research. *Psychological Bulletin*, 130(2), 289-303.
- Shadish, W.R., Cook, T.D., & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin.

Preschool education and its lasting effects

- ²³ Blau, D., & Currie, J. (2006). Pre-school, day care, and after-school care: Who's minding the kids? In E. Hanushek & F. Welch (Eds.), *Handbook of the economics of education, Volume 2* (1163-1277). New York, NY: North-Holland Publishing Co.
- Blau, D., & Tekin, E. (2007). The determinants and consequences of child care subsidies for single mothers in the USA. *Journal of Population Economics*, 20, 719-741.
- Lefebver, P., & Merrigan, P. (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.
- Tekin, E. (2007). Child care subsidies, wages, and employment of single mothers. *Journal of Human Resources*, 42(2), 453-487.
- ²⁴ Belsky, J., Vandell, D.L., Burchinal, M., Clarke-Stewart, K.A., McCartney, K., Owen, M.T., et al. (2007). Are there long-term effects of early child care? *Child Development*, 78(2), 681-701.
- ²⁵ Limitations of the ECLS-K data include reliance on parental report rather than observed program participation and lack of a pre-test to adjust for differences in child abilities prior to the program. The types of programs are inferred from parental word choice as parents were not asked to distinguish child care from other types of programs except Head Start. Thus, child care is less accurately distinguished from other programs in the ECLS-K studies, which might account for differences from the NICHD results.
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, 26, 33-51.
- Magnuson, K.A., Ruhm, C. & Waldfogel, J. (2007). The persistence of preschool effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly*, 22, 18-38.
- Magnuson, K.A., Meyers, M.K., Ruhm, C.J., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Educational Research Journal*, 41(1), 115-157.
- ²⁶ The regression-discontinuity design is a set of approaches to creating equivalent groups using a known assignment rule so as to permit unbiased estimates of program effects under reasonable assumptions. Cook, T. (2008). Waiting for life to arrive: A history of the regression-discontinuity design in Psychology, Statistics and Economics. *Journal of Econometrics*, 14, 636-654.
- ²⁷ Puma, M., Bell, S., Cook, R., Heid, C., Lopez, M., Zill, N., et al. (2005). *Head Start impact study: First year findings*. Washington, DC: US Department of Health and Human Services, Administration for Children and Families.
- ²⁸ The demographic composition of the samples is somewhat different at age 3 than at 4. Thus, any difference in outcomes could be due to factors other than age.
- ²⁹ Abbott-Shim, M., Lambert, R., & McCarty, F. (2003). A comparison of school readiness outcomes for children randomly assigned to a Head Start program and program's waiting list. *Journal of Education for Students Placed at Risk* 8(2), 191-214. This study employed random assignment to treatment and wait-list groups, so that a small number of children migrated from the wait-list into Head Start.
- ³⁰ Ludwig, J., & Phillips, D. (2007). The benefits and costs of Head Start. *Social Policy Report*, 21(3), 3-13.
- ³¹ Ludwig, J., & Phillips, D. (2007). The benefits and costs of Head Start. *Social Policy Report*, 21(3), 3-13.
- ³² At age 4 in particular some of the control group children may have attended a state pre-K program and that might be expected to result in even greater underestimation of Head Start's effects given the greater effectiveness of state pre-K compared to ordinary child care.
- Ludwig, J., & Phillips, D.A. (2007). *The benefits and costs of Head Start*. (NBER Working Paper 12973). Cambridge, MA: National Bureau of Economic Research.

Preschool education and its lasting effects

- Puma, M., Bell, S., Cook, R., Heid, C., Lopez, M., Zill, N., et al. (2005). *Head Start impact study: First year findings*. Washington, DC: US Department of Health and Human Services, Administration for Children and Families.
- ³³ Magnuson, K., Meyers, M., Ruhm, C., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Education Research Journal*, *41*, 115-157.
- Magnuson, K., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, *26*, 33-51.
- Loeb, S., Bridges, M., Bassok, D., Fuller, B., & Rumberger, R.W. (2007). How much is too much? The influence of preschool centers on children's social and cognitive development. *Economics of Education Review*, *26*, 52-66.
- ³⁴ Larzelere, R.E., Kuhn, B.R., & Johnson, B. (2004). The intervention selection bias: An under-recognized confound in intervention research. *Psychological Bulletin*, *130*(2), 289-303.
- ³⁵ Currie, J., & Thomas, D. (1995). Does Head Start make a difference? *American Economic Review*, *85*, 341-364.
- Currie, J. & Thomas, D. (1999). Does Head Start help Hispanic children? *Journal of Public Economics*, *74*, 235-262.
- Such studies have their own limitations relating to measurement error and untenable assumptions that may be more damaging for estimating long-term than short-term effects. For example, parents may equalize investments in children over time so that if one attends Head Start while another does not parents may compensate the child who did not attend Head Start in other ways as opportunities arise later.
- ³⁶ Currie, J., & Thomas, D. (1995). Does Head Start make a difference? *American Economic Review*, *85*, 341-364.
- Currie, J. & Thomas, D. (1999). Does Head Start help Hispanic children? *Journal of Public Economics*, *74*, 235-262.
- ³⁷ Garces, E., Thomas, D., & Currie, J. (2002). Longer term effects of Head Start. *American Economic Review*, *92*(4), 999-1012.
- ³⁸ Barnett, W.S., & Camilli, G. (2002). Compensatory preschool education, cognitive development, and "race." In J. M. Fish (Ed.), *Race and intelligence: Separating science from myth* (pp. 369-406). Mahwah, NJ: Erlbaum.
- Ludwig, J., & Phillips, D.A. (2008). Long term effects of Head Start on low-income children. *Annals of the New York Academy of Sciences*, *40*, 1-12.
- ³⁹ Ludwig, J., & Miller, D.L (2007). Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *Quarterly Journal of Economics*, *122*, 159-208. Essentially, the regression discontinuity design constructs groups for comparison that differ in their degree of Head Start funding based on a historical artifact that is unrelated to characteristics of the children and communities in which they live that might affect child outcomes.
- ⁴⁰ The study does not find effects on mortality related to causes that are unlikely to have been affected by Head Start health services, nor does it find effects on cohorts not likely have benefited from the temporary differential in Head Start spending for some counties that is used to estimate effects. This increases confidence that the regression-discontinuity design is producing valid estimates.
- ⁴¹ Inescapably, long-term effect estimates always apply to a program as it existed many years ago. This need not mean that the estimates cannot be validly applied to current programs. Consistency of findings across several decades strengthens the basis for generalization. Head Start today is a better funded program with more highly qualified staff and stronger performance standards than in the 1960s and 1970s .

Preschool education and its lasting effects

- ⁴² Consortium for Longitudinal Studies (Eds.), (1983). *As the twig is bent...lasting effects of preschool programs*. Hillsdale, NJ: Erlbaum.
- ⁴³ Frede, E.C. (1998). Preschool program quality in programs for children in poverty. In: W.S. Barnett & S.S. Boocock (Eds.), *Early care and education for children in poverty* (pp. 77-98). Albany, NY: SUNY Press.
- ⁴⁴ Consortium for Longitudinal Studies (Eds.), (1983). *As the twig is bent...lasting effects of preschool programs*. Hillsdale, NJ: Erlbaum.
- ⁴⁵ Schweinhart, L.J., Montie, J., Xiang, Z., Barnett, W.S., Belfield, C.R., & Nores, M. (2005). *Lifetime effects: The High/Scope Perry Preschool study through age 40* (Monographs of the High/Scope Educational Research Foundation, 14). Ypsilanti, MI: High/Scope Press. Post-test data are available on 123 or 96% of the original sample. In a departure from random assignment, a small number of children whose mothers worked and had difficulty transporting children to the program were switched to from the preschool to the control group. Nevertheless, treatment and control children were comparable in other respects at entry. Statistical analyses indicate that this shift has no meaningful impact, but analyses adjusted for this in any case. Maternal employment is associated with better child outcomes in this sample.
- ⁴⁶ Berrueta-Clement, J.R., Scweinhart, L.L., Barnett, W.S., Epstein, A.S., & Weikart, D.P. (1984). *Changed lives: The effects of the Perry Preschool program on youths through age 19*. Ypsilanti, MI: High/Scope Press.
- ⁴⁷ Berrueta-Clement, J.R., Scweinhart, L.L., Barnett, W.S., Epstein, A.S., & Weikart, D.P. (1984). *Changed lives: The effects of the Perry Preschool program on youths through age 19*. Ypsilanti, MI: High/Scope Press.
- Schweinhart, L.J., Barnes, H.V., Weikart, D.P. (1993). *Significant benefits: The High/Scope Perry Preschool study through age 27*. Ypsilanti, MI: High/Scope Press.
- ⁴⁸ Schweinhart, L.J., Montie, J., Xiang, Z., Barnett, W.S., Belfield, C.R., & Nores, M. (2005). *Lifetime effects: The High/Scope Perry Preschool study through age 40* (Monographs of the High/Scope Educational Research Foundation, 14). Ypsilanti, MI: High/Scope Press.
- Karoly, L.A., Kilburn, M.R., & Cannon, J.S. (2005). *Early childhood interventions: Proven results, future promise*. Santa Monica, CA: Rand Corporation.
- ⁴⁹ Deutsch, M., Taleporos, E., & Victor, J. (1974). A brief synopsis of an initial enrichment program in early childhood. In S. Ryan (Ed.), *A report on longitudinal evaluations of preschool programs Volume 1: Longitudinal evaluations* (pp. 49-60). Washington, DC: Office of Child Development, US Department of Health, Education, and Welfare.
- Deutsch, M., Deutsch, C.P., Jordan, T.J., & Grallow, R. (1983). The IDS program: An experiment in early and sustained enrichment. In Consortium for Longitudinal Studies (Ed.). *As the Twig is Bent: Lasting Effects of Preschool Programs* (pp. 377-410). Hillsdale, NJ: Lawrence Erlbaum. The original sample included 503 children and 80% of these were tested after pre-K.
- ⁵⁰ Deutsch, M., Deutsch, C.P., Jordan, T.J., & Grallow, R. (1983). The IDS program: An experiment in early and sustained enrichment. In Consortium for Longitudinal Studies (Ed.). *As the Twig is Bent: Lasting Effects of Preschool Programs* (pp. 377-410). Hillsdale, NJ: Lawrence Erlbaum.
- The sample for the latest follow-up was only 154 children, and lasting effects were found for boys, but not girls.
- Jordan, T.J., Grallo, R., Deutsch, M., & Deutsch, C.P. (1985). Long-term effects of early enrichment: A 20-year perspective on persistence and change. *American Journal of Community Psychology*, 13(4), 393-415.
- ⁵¹ Larsen, J.M., Hite, S.J., & Hart, C.H. (1983). The effects of preschool on educationally advantaged children: First phases of a longitudinal study. *Intelligence*, 7, 345-352.

Preschool education and its lasting effects

- ⁵² Larsen, J.M., & Robinson, C.C. (1989). Later effects of preschool on low-risk children. *Early Childhood Research Quarterly*, 4, 133-144. Although not statistically significant, estimated effect sizes for girls appear to be in the 0.10 to 0.20 range for total achievement and even larger for language.
- ⁵³ Cook, T. (2008). Waiting for life to arrive: A history of the regression-discontinuity design in Psychology, Statistics and Economics. *Journal of Econometrics*, 14, 636–654.
- Cook, T.D., Wong, V.C., (In press). Empirical tests of the validation of the regression discontinuity design. *Annales d’Economie et de Statistique*.
- Hahn, H., Todd P., & van der Klaauw, W. (2001). Identification and estimation of treatment effects with a regression-discontinuity design. *Econometrica*, 69(3), 201-209.
- ⁵⁴ For a more detailed description of the application of this particular version of the RDD see: Wong, V.C., Cook, T.D. Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. *Journal of Policy Analysis and Management*, 27(1), 122-154.
- ⁵⁵ Gormley, W.T., Gayer, T., Phillips, D., & Dawson, B. (2005). The effects of universal pre-k on cognitive development. *Developmental Psychology*, 41(6), 872-884.
- Gormley, W.T., Phillips, D., & Gayer, T. (2008). Preschool programs can boost school readiness, *Science*, 320, 1723-24.
- ⁵⁶ Gormley, W.T., Gayer, T., Phillips, D., & Dawson, B. (2005). The effects of universal pre-k on cognitive development. *Developmental Psychology*, 41(6), 872-884.
- Gormley, W.T., Phillips, D., & Gayer, T. (2008). Preschool programs can boost school readiness, *Science*, 320, 1723-24.
- ⁵⁷ Gormley, W.T., Gayer, T., Phillips, D., & Dawson, B. (2005). The effects of universal pre-k on cognitive development. *Developmental Psychology*, 41(6), 872-884.
- Gormley, W.T., Phillips, D., & Gayer, T. (2008). Preschool programs can boost school readiness, *Science*, 320, 1723-24.
- ⁵⁸ Barnett, W.S., Howes, C., & Jung, K. (2008). *California’s state preschool program: Quality and effects on children’s cognitive abilities at kindergarten entry*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.
- Hustedt, J.T., Barnett, W.S., Jung, K., & Figueras, A. (2008). *Impacts of New Mexico PreK on children’s school readiness at kindergarten entry: Results from the second year of a growing initiative*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.
- Hustedt, J.T., Barnett, W.S., Jung, K., & Thomas, J. (2007). *The effects of the Arkansas Better Chance Program on young children’s school readiness*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.
- Wong, V.C., Cook, T.D. Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. *Journal of Policy Analysis and Management*, 27(1), 122-154.
- The New Jersey study sampled programs only in the 31 school districts providing the Abbott Pre-K program. For logistical reasons, the California study sampled programs in a three diverse regions: Los Angeles, Fresno, and Sacramento.
- ⁵⁹ The average across eight states was calculated using the more conservative estimates from Wong et al. (2008) plus estimates from the Arkansas, California, and New Mexico (averaged of two years) studies with each state weighted equally.
- ⁶⁰ Barnett, W.S., Howes, C., & Jung, K. (2008). *California’s state preschool program: Quality and effects on children’s cognitive abilities at kindergarten entry*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.

Preschool education and its lasting effects

- Frede, E.C., Jung, K., Barnett, W.S., Lamy, C.E., & Figueras, A. (2007). *The Abbott Preschool Program Longitudinal Effects Study*. Report to the New Jersey Department of Education. New Brunswick, NJ: NIEER.
- Hustedt, J.T., Barnett, W.S., Jung, K., & Thomas, J. (2007). *The effects of the Arkansas Better Chance Program on young children's school readiness*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.
- ⁶¹ Frede, E.C., Jung, K., Barnett, W.S., Lamy, C.E., & Figueras, A. (2007). *The Abbott Preschool Program Longitudinal Effects Study*. Report to the New Jersey Department of Education. New Brunswick, NJ: NIEER.
- Hustedt, J.T., Barnett, W.S., Jung, K., & Thomas, J. (2007). *The effects of the Arkansas Better Chance Program on young children's school readiness*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.
- ⁶² Frede, E.C., Jung, K., Barnett, W.S., Lamy, C.E., & Figueras, A. (2007). *The Abbott Preschool Program Longitudinal Effects Study*. Report to the New Jersey Department of Education. New Brunswick, NJ: NIEER.
- Hustedt, J.T., Barnett, W.S., Jung, K., & Thomas, J. (2007). *The effects of the Arkansas Better Chance Program on young children's school readiness*. New Brunswick, NJ: National Institute for Early Education Research, Rutgers University.
- ⁶³ Frede, E.C., Jung, K., Barnett, W.S., Lamy, C.E., & Figueras, A. (2007). *The Abbott Preschool Program Longitudinal Effects Study*. Report to the New Jersey Department of Education. New Brunswick, NJ: NIEER.
- ⁶⁴ Gilliam, W.S., & Zigler, E.F. (2001). A critical meta-analysis of all impact evaluations of state-funded preschool from 1977 to 1998: Implications for policy, service delivery and program evaluation. *Early Childhood Research Quarterly*, 15, 441-473.
- Gilliam, W., & Zigler, E. (2004). *State efforts to evaluate the effects of prekindergarten: 1977 to 2003*. Unpublished manuscript. NewHaven: Yale University Child Study Center.
- ⁶⁵ Barnett, W.S., Frede, E.C., Mobasher, H., & Mohr, P. (1987). The efficacy of public preschool programs and the relationship of program quality to efficacy. *Educational Evaluation and Policy Analysis*, 10(1), 37-49.
- ⁶⁶ Irvine, D.J., Horan, M.D., Flint, D.L., Kukuk, S.E. & Hick, T.L. (1982). Evidence supporting comprehensive early childhood education for disadvantaged children. *Annals of the American Academy of Political and Social Science*, 461, 74-80.
- ⁶⁷ Aos, S., Lieb, R., Mayfield, J., Miller, M., & Pennucci, A. (2004). *Benefits and costs of prevention and early intervention programs for youth*. Olympia: Washington State Institute for Public Policy.
- Gilliam, W.S., & Zigler, E.F. (2001). A critical meta-analysis of all impact evaluations of state-funded preschool from 1977 to 1998: Implications for policy, service delivery, and program evaluation. *Early Childhood Research Quarterly*, 15, 441-473.
- Barnett, W.S. (1998). Long term effects on cognitive development and school success. In W.S. Barnett and S.S. Boocock (Eds.) *Early care and education for children in poverty: Promises, programs, and long-term results*. (pp. 11-44) Albany, NY: SUNY Press.
- ⁶⁸ Barnett, W.S. (2004). Does Head Start have lasting cognitive effects? The myth of fadeout. In E. Zigler & S. Styfco (Eds.), *The Head Start debates* (pp. 221-249). Baltimore: Paul H. Brookes Publishing Co.
- Barnett, W.S. (1998). Long-term effects on cognitive development and school success. In W.S. Barnett & S.S. Boocock (Eds.), *Early care and education for children in poverty: Promises, programs, and long-term results* (pp. 11-44). Albany, NY: SUNY Press

Preschool education and its lasting effects

- ⁶⁹ Reynolds, A.J. (2000). *Success in early intervention: The Chicago Child-Parent Centers*. Lincoln: University of Nebraska Press.
- ⁷⁰ Reynolds, A.J. (2000). *Success in early intervention: The Chicago Child-Parent Centers*. Lincoln: University of Nebraska Press.
- ⁷¹ The CPC study is one of the few quasi-experimental studies of public pre-K and Head Start to ensure that children who have been retained in grade are properly reintegrated with their age cohort in the statistical analyses of test scores at each grade level, which may explain why it finds persistent effects on achievement tests when other, less careful studies do not.
- ⁷² Magnuson, K.A., Meyers, M., Ruhm, C., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Educational Research Journal* 41(1), 115-157.
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, 26, 33-51.
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). The persistence of effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly*, 22, 18-38.
- Similar findings emerge from research using Canadian national survey data where participation in “educational programs,” but not child care generally, is positively related to child development at ages 3 and 4. Lefebvre, P., & Merrigan, P. (2000). *The effect of childcare and early education arrangements on developmental outcomes of young children*. Working Paper No. 119. Center for Research on Economic Fluctuations and Employment, Université du Québec à Montréal.
- ⁷³ Glazerman, S., Levy, D.M., & Myers, D. (2003). Nonexperimental versus experimental estimates of earnings impacts. *Annals of the American Academy of Political and Social Science*, 589, 63-93.
- ⁷⁴ Researchers have essentially guessed that when parents call a program pre-K or preschool then it is public pre-K, and this seems likely to have a very high error rate. An alternative is to consider only programs reported to be in a public school to be state and local pre-K. This omits many public pre-K programs, but those that are included are likely to be correctly identified.
- ⁷⁵ Magnuson, K.A., Meyers, M., Ruhm, C., & Waldfogel, J. (2004). Inequality in preschool education and school readiness. *American Educational Research Journal* 41(1), 115-157.
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, 26, 33-51.
- ⁷⁶ Parents reporting that the program was in a public school, but not the one attended for kindergarten may simply have been wrong about the pre-K program being in a public school. Alternatively, there may be some kind of selection effect when children who change schools between pre-K and kindergarten are excluded from the pre-K group.
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). Does prekindergarten improve school preparation and performance? *Economics of Education Review*, 26, 33-51.
- Magnuson, K.A., Ruhm, C., & Waldfogel, J. (2007). The persistence of effects: Do subsequent classroom experiences matter? *Early Childhood Research Quarterly*, 22, 18-38.
- ⁷⁷ Gelbach, J. (2002). Public schooling for young children and maternal labor supply. *American Economic Review*, 92(1), 307-322.
- ⁷⁸ Cascio, E. (2006). *Public preschool and maternal labor supply: evidence from the introduction of kindergartens into American public schools*, (NBER Working Paper 12179). Cambridge, MA: National Bureau of Economic Research.
- ⁷⁹ Lemke, R.J., Witt, R., & Witte, A.D. (2007). The transition from welfare to work. *Eastern Economic Journal*, 33(3), 359-373.
- ⁸⁰ Berlinski, S. & Galiani, S. (2007). The effect of a large expansion of pre-primary school facilities on preschool attendance and maternal employment. *Labour Economics*, 14, 665-680.

Preschool education and its lasting effects

- Schlosser, A. (2006). *Public preschool and the labor supply of Arab mothers: Evidence from a natural experiment*. Working Paper. Jerusalem: Economics Department, Hebrew University.
- ⁸¹ Raine, A., Mellingen, K., Liu, J., Venables, P., Mednick, S.A. (2003). Effects of environmental enrichment at ages 3-5 years on schizotypal personality and antisocial behavior at ages 17 and 23 years. *American Journal of Psychiatry*, *160*(9), 1627-1635.
- ⁸² Berlinski, S., Galiani, S., & Gertler, P. (2006). The effect of pre-primary on primary school performance. Institute for Fiscal Studies, (Working Paper W06/04). London: Institute for Fiscal Studies, University of London.
- Berlinski, S. Galiani, S., & Manacorda, M. (2008). Giving children a better start: preschool attendance and schoolage profiles. *Journal of Public Economics*, *92*, 1416-1440.
- ⁸³ Goodman, A., & Sianesi, B. (2005). *Early education and children's outcomes: How long do the impacts last?* London: Institute for Fiscal Studies, University of London.
- Melhuish, E.C., Phan, M.B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008). Effects of home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues*, *64*(1), 95-114.
- Osborne, A.F., & Milbank, J.E. (1987). *The effects of early education: A report from the Child Health and Education Study*. Oxford: Clarendon Press.
- Sammons, P., Siraj-Blatchford, I., Sylva, K., Melhuish, E., Taggart, B., & Elliot, K. (2005). Investigating the effects of pre-school provision: Using mixed methods in the EPPE research. *International Journal of Social Research Methodology*, *8*, 207-224.
- Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2004). *The final report: Effective pre-school education. Technical paper 12*. London: Institute of Education, University of London.
- ⁸⁴ Goodman, A., & Sianesi, B. (2005). *Early education and children's outcomes: How long do the impacts last?* London: Institute for Fiscal Studies, University of London.
- ⁸⁵ Goodman, A., & Sianesi, B. (2005). *Early education and children's outcomes: How long do the impacts last?* London: Institute for Fiscal Studies, University of London.
- ⁸⁶ Goodman, A., & Sianesi, B. (2005). *Early education and children's outcomes: How long do the impacts last?* London: Institute for Fiscal Studies, University of London.
- Melhuish, E.C., Sylva, K., Sammons, P., Siraj-Blatchford, I., Taggart, B. Phan, M.B., & Malin, A. (2008). Preschool influences on mathematics achievement. *Science*, *321*, 1161-1162.
- Melhuish, E.C., Phan, M.B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008). Effects of home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues*, *64*(1), 95-114.
- Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2004). *The final report: Effective pre-school education. Technical paper 12*. London: Institute of Education, University of London.
- ⁸⁷ Hogden, E. (2007). *Early childhood education and young adult competencies at age 16*. New Zealand: Ministry of Education and New Zealand Council for Educational Research.
- ⁸⁸ Goodman, A.G, & Sianesi, B. (2005). *Early education and children's outcomes: How long do the impacts last?* London: Institute for Fiscal Studies, University of London.
- Hogden, E. (2007). *Early childhood education and young adult competencies at age 16*. New Zealand: Ministry of Education and New Zealand Council for Educational Research.

Preschool education and its lasting effects

- Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2004). *The final report: Effective pre-school education. Technical paper 12*. London: Institute of Education, University of London.
- ⁸⁹Fuchs, T., & Wossmann, L. (2006). *Governance and primary school performance: International evidence*. Munich: Ifo Institute for Economic Research, University of Munich.
- Rindermann, H. & Ceci, S.J. (2008). *Education policy and country outcomes in international cognitive competence studies*. Graz, Austria: Institute of Psychology, Karl-Franzens-University Graz.
- Schutz, G., Ursprung, H.W., & Wossmann, L. (2008). Education policy and equality of opportunity. *Kyklos*, 61, 279-308.
- Wossmann, L., Ludemann, E., Schutz, G., & West, M.R. (2007). *School accountability, autonomy, choice, and the level of student achievement: International evidence from PISA 2003*. (Education Working Paper No. 13). Paris: OECD Directorate for Education.
- ⁹⁰ The study randomly assigned 123 families. Only 111 children in 109 families participated in the study as 12 dropped after assignment, primarily because 8 decided not to send their children to the child care program. This differential attrition may have produced differences between the groups, though these appear to have been very slight, about one maternal IQ point and a half year of maternal education (no statistically significant differences were found in family background). As will be seen, these slight differences could not account for either the pattern or magnitude of estimated program effects.
- Campbell, F.A., & Ramey, C.T. (2007, December). *Carolina Abecedarian Project*. Paper presented at the Conference on Critical Issues in Cost Effectiveness in Children's First Decade, Minneapolis, MN.
- ⁹¹ Barnett, W.S., & Masse, L.N. (2007). Comparative benefit-cost analysis of the Abecedarian program and its policy implications. *Economics of Education Review*, 26, 113–125.
- Campbell, F.A., & Ramey, C.T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal*, 34(4), 743-772.
- Campbell, F.A., Ramey, C.T., Pungello, E.P., Sparling, J.J., & Miller-Johnson, S. (2002). Early childhood education: Young adult outcomes from the Abecedarian Project. *Applied Developmental Science*, 6, 42-57.
- McLaughlin, A.E., Campbell, F.A., Pungello, E.P., & Skinner, M. (2007). Depressive symptoms in young adults: The influences of the early home environment and early educational child care. *Child Development*, 78(3), 746-756.
- Ramey, C.T., Campbell, F.A., Burchinal, M., Skinner, M.L., Gardner, D.M., & Ramey, S.L. (2000). Persistent effects of early childhood education on high-risk children and their mothers. *Applied Developmental Science*, 4(1), 2-14.
- ⁹² After entry to school, teachers reported that children in the earliest cohorts were somewhat more aggressive. As a result, changes were made to the curriculum, and children from later cohorts were not reported to be more aggressive, nor were any later negative effects found for the entire program group.
- ⁹³ Campbell, F.A., Wasik, B.H., Pungello, E.P., Burchinal, M., Barbarin, O., Kainz, K. et al. (In press). Young adult outcomes from the Abecedarian and CARE early childhood educational interventions. *Early Childhood Research Quarterly*.
- ⁹⁴ Unfortunately, the study does not clearly report whether achievement testing was conducted by the schools or the study researchers, the sample size at each year, or whether analyses are by grade level or age.
- Garber, H.L. (1988). *The Milwaukee Project: Preventing mental retardation in children at risk*. Washington, DC: American Association on Mental Retardation.

Preschool education and its lasting effects

- ⁹⁵ Infant Health and Development Program. (1990). Enhancing the outcomes of low-birth-weight, premature infants: A multisite, randomized trial. *Journal of the American Medical Association*, 263, 3035-3042.
- ⁹⁶ Average IQ in the control group is 92 compared to a norm of 100 for the population as a whole.
- ⁹⁷ McCarton, C., Brooks-Gunn, J., Wallace, I., Bauer, C., Bennett, F., Bernbaum, J. et al. (1997). Results at 8 Years of Intervention for Low Birthweight Premature Infants: The Infant Health and Development Program. *Journal of the American Medical Association*, 277, 126-32.
- ⁹⁸ McCarton, C., Brooks-Gunn, J., Wallace, I., Bauer, C., Bennett, F., Bernbaum, J. et al. (1997). Results at 8 Years of Intervention for Low Birthweight Premature Infants: The Infant Health and Development Program. *Journal of the American Medical Association*, 277, 126-32.
- ⁹⁹ McCormick, M.C., Brooks-Gunn, J., Buka, S.L., Goldman, J., Yu, J., Salganik, M., Scott, D.T., et al. (2008). 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.
- ¹⁰⁰ The IDHP study relies on mother's reports for school outcomes rather than official records, a potential source of additional error. Reported dropout rates differ by only one percentage point, and no results are reported for grade repetition.
- ¹⁰¹ Martin, A., Brooks-Gunn, J., Klebanov, P., Buka, S.L., & McCormick, M.C. (2008). Long-term effects of early childhood intervention: Findings from the Infant Health and Development Program (IHDP). *Journal of Applied Developmental Psychology*, 29, 101-107.
- ¹⁰² St. Pierre, R.G., & Layzer, J.I. (1999). Using home visits for multiple purposes: The Comprehensive Child Development Program. *Future of Children*, 9(1), 134-151.
- St. Pierre, R.G., Layzer, J.I., & Barnes, H.V. (1995). Regenerating Two-Generation Programs (99-121). In W.S. Barnett and S.S. Boocock (Eds.) *Early care and education for children in poverty: Promises, programs, and long-term results*. Albany, NY: SUNY Press.
- St. Pierre, R.G., Layzer, J.I., Goodson, B.D., & Bernstein, L.S. (1997). *National impact evaluation of the Comprehensive Child Development Program*. Cambridge, MA: Abt. Associates, Inc.
- ¹⁰³ Love, J.M., Kisker, E.E., Ross, C.M., Schochet, P.Z., Brooks-Gunn, J., Boller, K. et al. (2001). *Early Head Start research-building their futures: How Early Head Start programs are enhancing the lives of infants and toddlers in low-income families*. Princeton, NJ: Mathematica Policy Research, Inc.
- ¹⁰⁴ Love, J.M., Vogel, C., Raikes, H.H., Chazan-Cohen, R., Kisker, E.E., Constantine, J., et al. (2007, March). *Impacts of Early Head Start at the end of the program (Age 3) and two years later when children were in prekindergarten*. Presentation at the SRCD Biennial Meeting, Boston, MA. Retrieved July 20, 2008 from <http://www.mathematica-mpr.com/about%20us/srcd07abstracts.asp#impacts>
- Chazan-Cohen, R., Ayoub, C., Pan, B.A., Roggman, L., Raikes, H., McKelvey, L. et al. (2007). It takes time: Impacts of Early Head Start that lead to reductions in maternal depression two years later. *Infant Mental Health Journal*, 28(2), 151-170.
- ¹⁰⁵ Some smaller studies report effects for girls, but not boys. The interaction between treatment and gender typically is not statistically significant, however, and other studies find the opposite trend. No large scale study reports finding significant differences by gender. Some studies find somewhat larger effects for disadvantaged children, while others do not.
- ¹⁰⁶ Barnett, W. S. (2007). Benefits and costs of quality early childhood education. *The Children's Legal Rights Journal (CLRJ)*, 27(1), 7-23.
- ¹⁰⁷ Barnett, W.S., & Masse L.N. (2007). Comparative benefit-cost analysis of the Abecedarian program and its policy implications. *Economics of Education Review*, 26 (1), 113-125.

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- Temple, J., & Reynolds, A. (2007). Benefits and costs of investments in preschool education: Evidence from the Child-Parent Centers and related programs. *Economics of Education Review*, 26, 126-144.
- ¹⁰⁸ For a more detailed consideration of these issues see Barnett, W. S., Brown, K., & Shore, R. (2004). The universal vs. targeted debate: Should the United States have preschool for all? *Preschool Policy Matters, Issue 6*. New Brunswick, NJ: NIEER.
- ¹⁰⁹ Barnett, W. S. (2007). Benefits and costs of quality early childhood education. *The Children's Legal Rights Journal (CLRJ)*, 27(1), 7-23.
- ¹¹⁰ Ludwig, J., & Phillips, D. (2007). The benefits and costs of Head Start. *Social Policy Report*, 21(3), 3-13
- ¹¹¹ New Jersey's highly effective model is primarily composed of former private child care programs that were upgraded, if need be, to public school standards for pay and teacher qualifications with a maximum of 15 children per teacher and assistant. Frede, E.C., Jung, K., Barnett, W.S., Lamy, C.E., & Figueras, A. (2007). *The Abbott Preschool Program Longitudinal Effects Study*. Report to the New Jersey Department of Education. New Brunswick, NJ: NIEER.
- ¹¹² Robin, K. B., Frede, E. C., & Barnett, W. S. (2006). *Is more better? The effects of full-day vs. half-day preschool on early school achievement*. New Brunswick, NJ: NIEER.
- ¹¹³ Barnett, W. S. (2003). Better teachers, better preschools: Student achievement linked to teacher qualifications. *Preschool Policy Matters, Issue 2*. New Brunswick, NJ: NIEER.
- Barnett, W. S., Schulman, K., & Shore, R. (2004). Class size: What's the best fit? *Preschool Policy Matters, Issue 9*. New Brunswick, NJ: NIEER.
- Kelly, P., & Camilli, G. (2004). *Effects of teacher qualifications in preschool education: A meta-analysis (Working paper)*. New Brunswick, NJ: NIEER.
- NICHD Early Child Care Research Network. (2002). Child care structure→ process→ outcome: Direct and indirect effects of child-care quality on young children's development. *Psychological Science*, 13, 199-206.
- Vandell, D. L., & Wolfe, B. (2000). *Child care quality: Does it matter and does it need to be improved?* Madison: Institute for Research on Poverty, University of Wisconsin.
- Yoshikawa, H., Rosman, E. A., & Hsueh, J. (2002). Resolving paradoxical criteria for the expansion and replication of early childhood care and education programs. *Early Childhood Research Quarterly*, 17: 3-27.
- ¹¹⁴ Early, D., Maxwell, K., Burchinal, M., Alva, S., Bender, R., Bryant, D., et al., (2007). Teacher education, classroom quality, and young children's academic skills: Results from seven studies of preschool programs. *Child Development*, 78(2), 558-580.
- Kelly, P., & Camilli, G. (2004). *Effects of teacher qualifications in preschool education: A meta-analysis (Working paper)*. New Brunswick, NJ: NIEER.
- Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Early, D., & Barbarin, O. (2005). Features of pre-kindergarten programs, classrooms, and teachers: Do they predict observed classroom quality and child-teacher interactions? *Applied Developmental Science*, 9(3), 144-159.
- Mashburn, A.J., Pianta, R.C., Hamre, B.K., Downer, J.T., Barbarin, O.A., Bryant, D., Burchinal, M., Early, D.M., & Howes, C. (2008) Measures of classroom quality in pre-kindergarten and children's development of academic, language and social skills. *Child Development*, 79(3), 732-749.
- ¹¹⁵ Nye, B. A., Hedges, L. V., & Konstantopoulos, S. (2000). The effects of small classes on academic achievement: The results of the Tennessee Class Size Experiment. *American Educational Research Journal*, 37, 123-151.

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- ¹¹⁶ Travers, J., Goodson, B.D., Singer, J.D., & Connell, D.B. (1980). *Research results of the National Day Care Study*. Final Report, Volume II. Cambridge, MA: Abt Associates.
- ¹¹⁷ Rothstein, J. (2008). Teacher quality in educational production: Tracking, decay, and student achievement. Unpublished manuscript, Princeton University.
- ¹¹⁸ Frede, E.C. (1998). Preschool program quality in programs for children in poverty. In: W.S. Barnett & S.S. Boocock (Eds.), *Early care and education for children in poverty* (pp. 77-98). Albany, NY: SUNY Press.
- Mashburn, A.J., Pianta, R.C., Hamre, B.K., Downer, J.T., Barbarin, O.A., Bryant, D., Burchinal, M., Early, D.M., & Howes, C. (2008) Measures of classroom quality in pre-kindergarten and children's development of academic, language and social skills. *Child Development*, 79(3), 732-749.
- ¹¹⁹ Preschool Curriculum Evaluation Research Consortium (2008). *Effects of preschool curriculum on school readiness*. Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education.
- ¹²⁰ Although cross study comparison of the research reviewed here is instructive, two particularly relevant randomized trials that compare curricula directly add significantly to our knowledge in this respect (cited below).
- Barnett, W.S., Jung, K., Yarosz, D.J., Thomas, J., Hornbeck, A., Stechuk, R., & Burns, S. (2008). Educational effectiveness of the Tools of the Mind curriculum: a randomized trial. *Early Childhood Research Quarterly*, 23, 299-313.
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science*, 318, 1387-1388.
- Schweinhart, L.J. & Weikart, D.P. (1997). The High/Scope preschool curriculum comparison study through age 23. *Early Childhood Research Quarterly*, 12(2), 117-143.
- ¹²¹ In addition to their intrinsic importance, poor nutrition and health have been implicated in childhood-onset of persistent patterns of anti-social behavior. Head Start and state pre-k programs (to varying degrees) address children's health and nutrition needs.
- Raine, A., Mellinger, K., Liu, J., Venables, P., & Mednick, S. A. (2003). Effects of environmental enrichment at ages 3-5 years on schizotypal personality and antisocial behavior at ages 17 and 23 years. *American Journal of Psychiatry*, 160(9), 1627-1635.
- van Goozen, S.H.M., Farichild, G., & Harold, G.T. (2008). The role of neurobiological deficits in childhood antisocial behavior. *Current Directions in Psychological Science*, 17(3), 224-228.