

Getting the Facts Right on Pre-K and the President's Pre-K Proposal

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Both science and public policy are best advanced based on impartial analysis of *all* the available evidence. No single study stands on its own, much less provides the definitive answers to policy questions on its own. This requires that scientists and policymakers consider all the evidence rather than simply select a few studies that fit their preconceived notions. The Obama administration's new universal pre-K proposal first announced in the State of the Union address comports conclusions drawn from a full review of the evidence, just as one would hope.

Critics of the pre-K proposal in the ensuing debate have not followed the same approach. Their attacks on the President's proposal have been based on a few selected studies considered in isolation and when convenient, misinterpreted. This report from the National Institute for Early Education Research was prepared to set the record straight so that debate can proceed with accurate information. Specifically, the report reviews the research related to four key issues regarding the pre-K proposal.

These four issues are in brief:

1. Does high-quality pre-K have lasting benefits?
2. What is the evidence for the \$7 to \$1 return on investment in pre-K?
3. Do non-disadvantaged children benefit from pre-K, and is a targeted or a universal approach to pre-K more effective?
4. Are large-scale public programs, including Head Start, effective?

Question # 1. Do the effects of high-quality preschool programs persist or fade out by third grade?

Although much of the public debate has focused on a small number of well-known studies, many more studies have investigated the short- and long-term effects of preschool education. The most objective way to summarize this research is with a meta-analysis, or statistical summary, of findings from all of them. This provides a transparent quantitative summary of all the research. The most recent and comprehensive meta-analysis published in the peer-reviewed literature summarizes the results of 123 studies conducted in the United States since 1960 (Camilli, Vargas, Ryan, & Barnett, 2010). The studies included examined the effects of large-scale public programs as well as small-scale programs. The researchers found that although there was some decline in effects after children entered school, on average effects did not disappear and remained substantial throughout the school years.

The meta-analysis also provides some insights into program features associated with larger effects. Specifically, cognitive gains from preschool programs are larger when programs focus on intentional teaching, small group learning, and individualized teaching

one-on-one (Camilli et al., 2010). Preschool programs designed to emphasize these features are estimated to produce long-term cognitive effects equivalent in size to one half or more of the achievement gap between minority and white children or low-income and other children through the end of high school (Camilli et al., 2010).

Those recent meta-analysis findings are fully consistent with the findings of previous meta-analyses (Gorey, 2001; Guralnick & Bennett, 1987; Nelson, Westhues, & MacLeod, 2003; White & Casto, 1985) and with the findings of a meta-analysis of rigorous research on preschool programs conducted outside the United States (Nores & Barnett, 2010). Long-term effects found in the meta-analyses include gains on cognitive tests, improvements in social and emotional development, and improvements in school success including less grade repetition, less special education placement, and increased high school graduation (Camilli et al., 2010; Nores & Barnett, 2010). The average long-term cognitive effect in the United States is about half the size of the average initial effect, suggesting that relatively large initial effects are required to produce substantial long-term gains.

The bottom line is that pre-K does produce substantial long-term gains, particularly when programs are properly designed. A more extensive discussion of the full body of evidence regarding persistent effects can be found in a recent article in the highly respected journal *Science* (Barnett, 2011). The decline in effects over time is not adequately explained by “bad” public education or the evaporation of temporary “hot housing” that produces artificial gains in test scores. Instead, it seems that at least some of the decline in effect sizes over time is due to the compensatory efforts of public schools that help the children who are most behind catch up. These greater efforts by the schools for children who did not benefit from preschool education are reflected in the benefit-cost analyses that document the cost savings from prevention.

Question #2. What is the evidence regarding the President’s statement that “Every dollar we invest in high-quality early childhood education can save more than seven dollars later on”?

The one study most relevant to President’s statement is the Chicago Longitudinal Study which reported a \$7.14 to \$1 benefit-cost ratio (Reynolds, Temple, Robertson, & Mann, 2002). The Chicago Child Parent Centers (CPCs) were highly similar to current state pre-K programs in design and cost, and they incorporated the features of high-quality programs listed by the President’s proposal. The CPCs served more recent and broad-based (though low-income) populations on a large scale and were operated by Chicago public schools. It is notable that the estimated effects of the CPCs on achievement at kindergarten entry are very similar in size to those found for Oklahoma’s universal pre-K program. In the context of the larger literature that links initial and later effects, it is reasonable to draw inferences from the Chicago study regarding the economic benefits of Oklahoma’s universal pre-K program. However, this requires more than simply applying the CPC benefits estimates to Oklahoma without adjustments, and, as discussed below, more recent estimates of the CPCs’ benefits are highly relevant.

The \$7 to \$1 figure is prominently featured in the abstract of the Chicago benefit-cost analysis cited above so it is hard to see how critics of the President's pre-K proposal could have missed it. Perhaps they missed it because later follow-ups produced higher estimates of the return that are about \$11 to \$1 (Reynolds, Temple, White, Ou, & Robertson, 2011). Thus, the President did not mechanically apply the Chicago figure to his proposal to claim that every dollar invested in pre-K would produce the same benefits as the CPCs. He claimed a substantially smaller benefit. As discussed in the remainder of this section, his claim is not mechanistic and does not depend on the Chicago Longitudinal study alone.

Although the Perry Preschool Program study is not the most relevant support for the \$7 to \$1 figure, it does contribute important additional evidence. Unlike the Chicago study, which though highly rigorous is not a true experiment, the Perry study is a randomized trial. For that reason the Perry provides great confidence that its results are valid for the program and children studied (Schweinhart, Montie, Xiang, Barnett, Belfield, & Nores, 2005). As a small relatively expensive program serving quite disadvantaged children it is not as comparable to large-scale public pre-K. Nevertheless, the study demonstrates that even very high-quality pre-K can yield a high rate of return, and helps establish the links between initial program impacts on cognitive and social development and long-term outcomes like greater school success, reduced crime and delinquency, and increased earnings over a lifetime. Without a randomized trial demonstrating these outcomes, researchers might have less confidence in the Chicago study's findings of the same effects, though the Chicago results tend to be smaller in proportion to its lower cost (Reynolds et al., 2011).

How high was the Perry Preschool Program's return? A series of benefit-cost analyses have been conducted since 1985. As the length of follow-up increased from age 19 to 27 and then 40, the evidence allowed for more confident estimates of the benefits and the estimated benefit-cost ratio rose to \$16 to \$1 (Barnett, 1985; Barnett, 1996; Belfield, Nores, Barnett, & Schweinhart, 2006). Recently, James Heckman and his colleagues (2010) estimated a \$7 to \$1 return for the Perry Preschool Program based on the exactly same data as earlier estimates but relying on different assumptions. For example, they assume there is no value to preventing what they call "victimless" crimes--selling drugs to children or heroin use. When the assumptions are fully examined and the benefits not included at all (like reductions in abortion) are acknowledged, the earlier estimates are judged to provide a better guide to the actual returns to the Perry Preschool Program (Barnett, 1996; Belfield et al., 2006).

With a \$16 to \$1 return to the Perry Preschool program, the \$7 to \$1 figure seems more reasonable as an estimate of the return to the less intensive program proposed by the President for a less disadvantaged population. The \$7 to \$1 estimate can be seen to be all the more reasonable taking into account that the Perry Preschool Program and CPCs offered two years of pre-K, while the President has proposed one year. Analyses of the Chicago and Perry studies both indicate that while two years is twice the cost of one, the benefits of two years are not likely to be twice as large (Barnett, 1996; Reynolds, 1995). It follows that the President's one-year proposal would have a relatively higher return,

though obviously this does not mean that two or more years of early education do not have an adequate (though lower) pay-off (Barnett & Masse, 2007; Reynolds, 1995).

The two studies just discussed are far from the entire evidence regarding the economic benefits of the proposed plan. All of the longitudinal studies in the meta-analysis contribute supporting evidence as do studies from abroad where universal pre-K is more common (Barnett & Nores, in press). Several economists have estimated the returns to universal pre-K using the available data and a range of assumptions (Barnett, 2008b, Bartik, 2011; Bartik, Gormley, & Adelstein, 2012; Karoly & Bigelow, 2005; Lynch, 2007). Some estimates are as high as \$7 to \$1. Several conclude that pre-K for all can yield a larger net return than a program that serves only low-income children. A benefit-cost analysis for Oklahoma's universal pre-K program concludes that earnings increases alone provide a \$3 or \$4 to \$1 return (Bartik et al., 2012). As earnings are less than half the benefits in the comprehensive benefit-cost analyses cited earlier, projecting a total return of \$7 to \$1 for the Oklahoma program is not a stretch. Oklahoma's program is one of the examples of high-quality, universal pre-K cited by the President.

Finally, the President's pre-K proposal explicitly mentions the use of a sliding fee scale to help pay for children from higher income families. To the extent that public dollars do not pay the entire cost of pre-K for children from the most advantaged families, this tips the scale toward a higher rate of return. Even those most skeptical of high returns for more advantaged children must acknowledge that the benefit-cost ratio for public dollars rises when the cost is shared by higher income families. The evidence regarding benefits to non-disadvantaged children is considered in detail next.

Question #3. Does high-quality pre-K benefit most children or only disadvantaged children, and which is more effective, a targeted program or universal pre-K?

Generally, studies in the United States and abroad (where universal programs have a longer history) find that preschool education has larger benefits for disadvantaged children, but that high-quality programs still have substantive benefits for other children (Barnett, 2008; Burger, 2010). Rigorous studies of universal pre-K in Oklahoma and elsewhere find substantial effects that are not dramatically smaller for higher income children than for others (Gormley, Gayer, Phillips, & Dawson, 2005; Wong, Cook, Barnett & Jung, 2008). A particularly creative recent U.S. study uses twins to identify environmental effects on achievement (Tucker-Drob, 2012). This twins study finds positive impacts from attending preschool at age 4 across most of the socio-economic spectrum with effects declining gradually as socio-economic status increases.

Studies from outside the United States suggest that quality differences can explain why some programs produce positive effects for children in higher income families and others do not (Barnett & Nores, in press; Ruhm & Waldfogel, 2011; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2012). Children who are not disadvantaged are unlikely to benefit from mediocre public programs. In any case, some studies find substantial preschool education effects for children from all economic strata (Goodman & Sianesi,

2005; Melhuish, Quinn, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2012; Sylva et al., 2004).

One of the studies most relevant to the debate regarding the effects of universal pre-K is a randomized trial of preschool education in which all of the children were relatively advantaged (Larsen, Hite, & Hart, 1983). The average IQ of the roughly 200 children at study entry was at the 97th percentile. Like the Perry Preschool Program, this was a true experiment with follow-up, though the follow-up only went through the first few grades. Nevertheless, the study found that positive effects on achievement continued into the school years with very large effects for boys, in particular, found in the second and third grade (Larsen & Robinson, 1989).

Research on two types of peer effects provides further evidence that universal pre-K can produce larger gains for disadvantaged children than can means-tested programs. First, disadvantaged children benefit from attending preschool programs with more advantaged children. Research in the United States, the United Kingdom, and New Zealand has found larger gains for disadvantaged children when programs contained more children from middle-income families (Goodman & Sianesi, 2005; Hogden, 2007; Sylva et al., 2004; Schechter & Bye, 2007). Second, there are substantial spillover benefits to learning in kindergarten through grade three when children have more classmates who have attended pre-K, indicating that estimates of individual effects of program participation substantially underestimate the impacts of universal pre-K on achievement (Neidell & Waldfogel, 2010).

Question #4. Can large-scale public programs produce substantive long-term gains for children, and how effective are existing programs including Head Start?

Although it is difficult to balance the need to develop and maintain program quality with the imperative to serve very large numbers of children, it can be done. The recent meta-analysis discussed above summarized results from studies of large-scale public programs as well as smaller, highly intensive programs, as have traditional reviews (Barnett, 1995; Barnett, 2008a; Burger, 2010). It is simply not true that large-scale public programs have failed to produce meaningful short- and long-term results.

It is true that large-scale public programs have tended to produce smaller effects than the best known small-scale programs. The most obvious reason for this is that the large-scale public programs have been less intensive and less well funded. No large-scale public program has ever had the funds to replicate the highly intensive Perry Preschool Program (with one highly qualified teacher for every six children). A reasonable conclusion from the research is that underfunded programs with low standards produce few significant benefits (Barnett & Nores, in press; Ruhm & Waldfogel, 2011). In contrast, higher quality large-scale public preschool programs have produced substantive long-term gains (Barnett & Nores, in press; Melhuish et al., 2012). Examples of positive long-term impacts from large-scale public programs are not restricted to high-income countries. Rigorous studies in Latin America find that providing public preschool education on a large scale has increased test scores through third grade, decreased school failure,

increased educational attainment, and improved attention, class participation, and discipline (Berlinski, Galiani, & Gertler, 2009).

Returning to a focus on the United States, the programs scrutinized by the Chicago Longitudinal Study were operated by the Chicago public schools (Reynolds et al., 2011). The CPC study is a clear test of whether large-scale public programs can replicate the quality and results of smaller scale studies. And, while the effects are smaller than those found for more intensive small scale programs, they are large enough and persistent enough to significantly change the life course of the participating children. As noted earlier the estimated benefits were 10 times the cost. Additional examples are provided by studies of higher quality preschool programs funded by states including one recent randomized trial (Barnett, 2008a; Lipsey, Farran, Hofer, Bilbrey & Dong, 2011). It is particularly difficult to estimate the long-term effects of universal programs, but research on universal pre-K in Oklahoma and Georgia has found persistent gains in achievement (Fitzpatrick, 2008; Hill, Gormley, & Adelstein, 2012).

Both the Oklahoma and Georgia studies (especially the latter) underestimate the longer-term effects of universal pre-K. The Oklahoma study does not adjust for the lower percentage of no-pre-K children tested in follow-up (low achievers are less likely to be tested). The Georgia study measures the marginal effect of universal pre-K policy in Georgia compared to that state's previous targeted policy and pre-K policies in other states. And in so doing it incorrectly assumes that other state's policies (regardless of whether they are called universal) could not offer greater improvements access to quality pre-K. It also estimates effects at a time when Georgia's universal pre-K was not yet very different from the prior program, and it served only about 50 percent of children. In sum, the Georgia study is a worse case estimate of the effect of an incomplete and quite modest policy change—not the effect of attending the pre-K program.

The Georgia study compounds its problems by concluding that the universal pre-K program does not pass a cost-benefit test based on a comparison of the total costs of the program to the marginal effects of the policy change on earnings. Not only does this fail to include any of the other benefits found in more comprehensive benefit-cost studies of pre-K, but the appropriate cost for the comparison is the marginal cost of universal pre-K above the cost of the previous targeted program. The added cost of the policy change is much smaller than the total cost of the program, and use of total cost grossly biased the estimated benefit-cost ratio downward.

Of course, Oklahoma and Georgia are not the only states to provide evidence regarding the effects of state-funded pre-K. New Jersey's Abbott preschool program, named for a court case in which the State Supreme Court mandated the implementation of high-quality preschool for all 3- and 4-year-olds in the 31 poorest school districts in the state, also has been rigorously studied. The program transformed the quality of preschools and had positive effects on child development (Frede & Barnett, 2011). Test scores were higher at kindergarten entry, and gains persisted to second grade, the last grade for which results have been reported (stay tuned). The New Jersey program's effects were comparable in size to those found in the Chicago Longitudinal Study (Frede, Barnett,

Jung, Lamy & Figueras, 2010; Frede, Jung, Barnett & Figueras, 2009). Other state-funded pre-K programs with rigorous studies that find positive longer-term effects include those of New York, North Carolina, and Michigan, which has positive findings all the way through high school graduation (Irvine, Horan, Flint, Kukuk, & Hick, 1982; Peisner-Feinberg & Schaaf, 2010; Schweinhart, Xiang, Daniel-Echols, Browning, & Wakabayashi, 2012).

Highly relevant evidence has come from studies of state pre-K programs using a regression discontinuity design that takes advantage of the birth date cut-off for school entry to estimate program effects. Children who attend the program in one year are compared to slightly younger children who must wait to attend until the next year. This approach is particularly useful for estimating the effects of a universal pre-k program. It also deals with one of the most difficult problems in any study of pre-K effectiveness – that comparing children who attend pre-K with others who are eligible but do not attend may unintentionally confound program effects with unmeasured differences in children’s family background. Studies using the regression discontinuity approach have found that *some* state pre-K programs produced gains in language, literacy and mathematics comparable to those found in the Chicago Longitudinal Study (Barnett, 2011; Gormley et al., 2008; Wong et al., 2005). Those programs appear to produce larger gains than Head Start, though how much larger is difficult to judge due to limitations of the Head Start research discussed below (Barnett, 2008a; Barnett, 2011; U.S. Department of Health and Human Services, Administration for Children and Families, 2010).

The regression discontinuity results have been questioned by opponents of universal pre-K. They challenge the methodology by claiming that children on different sides of the birth date cut-off have abruptly different experiences and development because, for example, parents spend more time in rich interactions with the child who starts school a year earlier than another child even if they differ in age by only a few days. It is an interesting story, but one for which not a single shred of empirical evidence has been offered. Not one study of parent behavior or child development has been cited in support of this claim. On the other hand, when state pre-K programs have been studied simultaneously with both regression discontinuity and other methods (including in one instance a randomized trial) the results of the two methods have been consistent (Frede et al., 2010; Lipsey et al., 2011).

Finally, critics of the President’s proposal hold up Head Start as an example of the inability of government to scale up high-quality pre-K. They fail to acknowledge that Head Start has never been funded to replicate the small scale intensive programs or that Head Start is required to provide a myriad of services those small-scale programs did not offer. Their primary source for the assertion that Head Start has little or no lasting effects on children is the National Head Start Impact Study (Puma, Bell, Cook, Heid, Broene, Jenkins, Mashburn, & Downer, 2012; U.S. Department of Health and Human Services, Administration for Children and Families, 2010). Yet, what the National Impact Study actually shows is that random assignment to Head Start or a no-treatment control group is not associated with significant lasting gains in learning and development. This is not an unbiased estimate of Head Start’s effects *per se* as is explained below.

The National Impact Study very likely underestimates the effects of participation in Head Start for several reasons. First, children did not always comply with random assignment—some assigned to Head Start did not attend, some assigned to the control group got into Head Start. Adjusting for these crossovers could increase estimated effects by 50 percent. Second, control group children frequently attended other programs some of which also had positive impacts, including some state pre-K programs. Third, immediate gains from Head Start were found, and the erosion of these later on is likely due (at least in part) to compensatory efforts by the public schools rather than “fade-out” (Barnett, 2011). In short, Head Start’s impacts are stronger than pre-K critics admit even based on the recent National Impact Study. In addition, there is other evidence that Head Start’s benefits are hardly trivial, and this evidence should not be ignored but considered alongside the results of the national randomized trial (Ludwig & Phillips, 2010).

Weighing all of the evidence, some researchers conclude that Head Start’s effects could be substantially larger if the program was better focused and made other improvements (Barnett, 2011; Ramey and Ramey, 2010). (Head Start may have produced larger effects in the past when health care and other services are less available to children in poverty from other sources.) It appears that the same conclusion led the Obama Administration to implement the most ambitious Head Start reform since the program’s earliest years. For the first time, Head Start centers will face re-competition if teaching is not up to par.

The President’s pre-K proposal also is an early childhood systems reform strategy that will contribute to Head Start’s improvement. Universal pre-K programs like those in Oklahoma and West Virginia, and New Jersey’s Abbott program have raised standards for Head Start and private preschool programs by incorporating them into state-funded universal pre-K. States provide additional resources so that Head Start centers can meet higher state pre-K standards. For example, New Jersey adds funds so that Head Start teachers (typically paid little better than dog walkers) can be paid equally with public school teachers (Barnett, 2013; Schmit, 2012). Oklahoma places a public school teacher in each Head Start classroom. These efforts also appear to get results (Gormley, Phillips, & Gayer, 2008; Frede & Barnett, 2011).

In summary, when all of the evidence is considered it is found that large-scale public programs have succeeded in producing meaningful long-term gains for children and not just disadvantaged children. The size of those gains depends on the quality of the program. Some public programs have been more effective than others. Adopting models that are more like those that had the greatest success in the past would increase the success of public programs in the future. The President’s proposal with its focus on high-quality pre-K for all children is designed to promote just that result. (For more on what high-quality in preschool means see Pianta, Barnett, Burchinal, & Thornburg, 2009.) In addition, universal pre-K would extend the benefits of these programs to many more children, including the half (49 percent) of American preschoolers living in families below 200 percent of the poverty line and others with limited access to quality pre-K under current policies (Addy, Engelhardt, & Skinner, 2013; National Center for Educational Statistics, 2011).

References

- Addy, S., Engelhardt, W., & Skinner, C. (2013). *Basic facts about low-income children: Children under 6 years*. Washington, DC: National Center for Children in Poverty, Columbia University.
- Barnett, W. S. (1985). Benefit-cost analysis of the Perry Preschool Program and its policy implications. *Educational Evaluation and Policy Analysis*, 7(4), 333-342.
- Barnett, W. S. (1996). *Lives in the balance: Benefit-cost analysis of the Perry Preschool Program through age 27* (Monographs of the High/Scope Educational Research Foundation). Ypsilanti, MI: High/Scope Press.
- Barnett, W. S. (2008a). *Preschool education and its lasting effects: Research and policy implications*. Boulder and Tempe: Education and Public Interest Center & Education Policy Research Unit.
- Barnett, W. S. (2008b). Why governments should invest in early education. CESifo-DICE report, *Journal for Institutional Comparisons, Early Childhood Education and Care*, 6(2), 9-14.
- Barnett, W.S. (2011). Effectiveness of early educational intervention. *Science*, 333, 975-978.
- Barnett, W.S. (2013). Data obtained from online salary data services as well as the Head Start Program Information Report. See:
http://www.payscale.com/research/US/Job=Dog_Walker/Hourly_Rate
http://www.payscale.com/research/US/Job=Dog_Sitter/Hourly_Rate
<http://teacherssalary.net/1/1/salary/Head-Start-Teacher-Salary>
- Barnett, W. S. & Nores, M. (in press). The investment and productivity argument for ECCE, in UNESCO (2013). *An International Volume, Early Childhood Care and Education: Building the Wealth of Nations*. UNESCO Publishing.
- Barnett, W. S., & Masse, L. N. (2007). Early childhood program design and economic returns: Comparative benefit-cost analysis of the Abecedarian program and policy implications, *Economics of Education Review*, 26, 113-125.
- Bartik, T.J. (2011). *Investing in kids: Early childhood programs and local economic development*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.
- Bartik, T. J., Gormley, W., & Adelstein, S. (2012). Earnings benefits of Tulsa's pre-K program for different income groups. *Economics of Education Review*. 31(6), December 2012, 1143–1161.

- Belfield, C., Nores, M., Barnett, W. S., & Schweinhart, L. (2006). The High/Scope Perry Preschool Program: Cost-benefit analysis using data from the age 40. *Journal of Human Resources*, 16(1), 162-190.
- Berlinski, S., Galiani, S., & Gertler, P. (2009). The effect of pre-primary education on primary school performance. *Journal of Public Economics*, 93(1), 219-234.
- Burger, K. (2010). How does early childhood care and education affect cognitive development? An international review of the effects of early interventions for children from different social backgrounds. *Early Childhood Research Quarterly*, 25(2), 140-165.
- Camilli, G., Vargas, S., Ryan, S., & Barnett, W.S. (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record*, 112(3), 579-620.
- Fitzpatrick, M. D. (2008). Starting school at four: The effect of universal pre-kindergarten on children's academic achievement. *The BE Journal of Economic Analysis & Policy*, 8(1), Article 46.
- Frede, E. C., & Barnett, W. S. (2011). New Jersey's Abbott pre-k program: A model for the nation. In E. Zigler, W. Gilliam, & W. S. Barnett (Eds.), *The pre-k debates: current controversies and issues* (pp. 191-196). Baltimore, MD: Brookes Publishing.
- Frede, E. C., Barnett, W. S., Jung, K., & Esposito-Lamy, C. (2010). Abbott Preschool Program Longitudinal Effects Study (APPLES): Year one findings. In A. J. Reynolds, A. J. Rolnick, M. M. Englund, & J. A. Temple (Eds.) *Childhood programs and practices in the first decade of life: A human capital integration* (pp. 214-231). New York, NY: Cambridge University Press.
- Frede, E., Jung, K., Barnett, W.S., & Figueras, A. (2009). *The APPLES blossom: Abbott Preschool Program longitudinal effects study (APPLES), preliminary results through 2nd grade*. New Brunswick, NJ: National Institute for Early Education Research.
- 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.
- 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.
- 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(5884), 1723.
- Guralnick, M.J., & Bennett, F.C. (Eds.) (1987). *The effectiveness of early intervention for at-risk and handicapped children*. New York, NY: Academy Press.
- Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics*, 94(1), 114-128.
- Hill, C., Gormley, W., & Adelstein, S. (2012). Do the short-term effects of a strong preschool program persist? *Center for Research on Children in the U.S. Working Paper*. Washington, DC: Georgetown University.
- 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.
- 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.
- Karoly, L.A., & Bigelow, J.H. (2005). *The economics of investing in universal preschool education in California*. Santa Monica, CA: RAND Corporation.
- 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.
- Larsen, J.M., & Robinson, C.C. (1989). Later effects of preschool on low-risk children. *Early Childhood Research Quarterly*, 4, 133-144.
- Lipsey, M.W., Farran, D.C., Hofer, K.G., Bilbrey, C., & Dong, N. (2011, March). *The effects of the Tennessee voluntary pre-kindergarten program: Initial result*. Paper presented at the annual conference of the Society for Research on Educational Effectiveness. Washington, DC.
- Lynch, R.G. (2007). *Enriching children, enriching the nation: Public investment in high-quality prekindergarten*. Washington, DC: Economic Policy Institute.
- Ludwig, J. & Phillips, D. (2010). Leave no (young) child behind: Prioritizing access in early childhood education. In R. Haskins & W.S. Barnett (Eds.). *Investing in young children: New directions in federal preschool and early childhood policy* (49-58). Washington, DC: Center on Children and Families, Brookings Institution.

- Melhuish, E., Quinn, L., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2012). Preschool affects longer term literacy and numeracy: results from a general population longitudinal study in Northern Ireland. *School Effectiveness and School Improvement*, (ahead-of-print), 1-17.
- National Center for Education Statistics (2011). Percentage distribution of quality rating of child care arrangements of children at about 4 years of age, by type of arrangement and selected child and family characteristics: 2005-06. Table 57. *Digest of Education Statistics*. Available online at http://nces.ed.gov/programs/digest/d11/tables/dt11_057.asp
- Neidell, M., & Waldfogel, J. (2010). Cognitive and noncognitive peer effects in early education. *The Review of Economics and Statistics*, 92(3), 562-576.
- 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.
- Nores, M., & Barnett, W. S. (2010). Benefits of early childhood interventions across the world: (Under) Investing in the very young. *Economics of Education Review*, 29(2), 271-282.
- Peisner-Feinberg, E.S., & Schaaf, J.M. (2010). *Long-term effects of the North Carolina More at Four Pre-kindergarten Program: Children's reading and math skills at third grade*. Chapel Hill: The University of North Carolina, FPG Child Development Institute.
- Pianta, R. C., Barnett, W. S., Burchinal, M., & Thornburg, K. (2009). The effects of preschool education: What we know, how public policy is or is not aligned with the evidence base, and what we need to know. *Psychological Science in the Public Interest*, 10(2), 49-88.
- Puma, M., Bell, S., Cook, R., Heid, C., Broene, P., Jenkins, F., Mashburn, A., & Downer, J. (2012). *Third grade follow-up to the Head Start Impact Study: Final report*. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.
- Ramey, C.T. & Ramey, S.L. (2010). Head Start: Strategies to improve outcomes for children living in poverty. In R. Haskins & W.S. Barnett (Eds.). *Investing in young children: New directions in federal preschool and early childhood policy* (59-67). Washington, DC: Center on Children and Families, Brookings Institution.
- Reynolds, A. J. (1995). One year of preschool intervention or two: Does it matter? *Early Childhood Research Quarterly*, 10(1), 1-31.

- Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2002). Age 21 cost-benefit analysis of the Title I Chicago Child-Parent Centers. *Educational Evaluation and Policy Analysis*, 24(4), 267–303.
- Reynolds, A. J., Temple, J. A., White, B. A. B., Ou, S., & Robertson, D. L. (2011). Age 26 cost-benefit analysis of the Child-Parent Center Early Education Program. *Child Development*, 82(1), 379–404.
- Ruhm, C. & Walfoegel, J. (2011). Long-term effects of early childhood care and education. *IZA Discussion Paper No. 6149*. Bonn, Germany: Institute for the Study of Labor (IZA).
- Schechter, C., & Bye, B. (2007). Preliminary evidence for the impact of mixed-income preschools on low-income children's language growth. *Early Childhood Research Quarterly*, 22, 137–146.
- Schmit, S. (2012). *Head Start participants, programs, families and staff in 2011*. Washington, DC: CLASP.
- 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 Educational Research Foundation.
- Schweinhart, L.J., Xiang, Z., Daniel-Echols, M., Browning, K., & Wakabayashi, T. (2012). *Michigan Great Start Readiness Program evaluation 2012: High school graduation and grade retention findings*. Ypsilanti, MI: HighScope.
- Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2012). *Effective pre-school primary and secondary education 3-14 project (EPPSE 3-14). Final report from the key stage 3 phase: Influences on students' development from age 11-14*. London: Department for Education.
- 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.
- Tucker-Drob, E. (2012). Preschools reduce early academic-achievement gaps: A longitudinal twin approach. *Psychological Science*, 23(3), 310-319.
- U.S. Department of Health and Human Services, Administration for Children and Families. (2010). *Head Start impact study: Final report*. Washington, DC: Author.
- 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.

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.