



Untangling the Evidence on Preschool Effectiveness

Insights for Policymakers

Beth Meloy, Madelyn Gardner, and Linda Darling-Hammond

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Acknowledgments

The authors thank Sean Tanner for his contributions to the research and our LPI colleagues Barbara Escobar, David Kirp, Michelle Koffa, Patrick Shields, and Marjorie Wechsler for their research contributions, insights, and support.

In addition, thanks to Bulletproof Services, Gretchen Wright, and Aaron Reeves for their editing and design contributions to this project, and Erin Chase for overseeing the production and editorial process. Without their generosity of time and spirit, this work would not have been possible.

This research was supported by the Heising-Simons Foundation. Core operating support for the Learning Policy Institute is provided by the Sandler Foundation, the Hewlett Foundation, and the Ford Foundation.

External Reviewers

This report benefited from the insights and expertise of two external reviewers: William T. Gormley, Co-Director of the Center for Research on Children in the United States at Georgetown University, and Martha Zaslow, Director of the Office for Policy and Communications at the Society for Research in Child Development and Senior Scholar at Child Trends. We thank them for the care and attention they gave the report; any shortcomings remain our own.

The appropriate citation for this report is: Meloy, B., Gardner, M., & Darling-Hammond, L. (2019). *Untangling the evidence on preschool effectiveness: Insights for policymakers*. Palo Alto, CA: Learning Policy Institute.

This report can be found online at <https://learningpolicyinstitute.org/product/untangling-evidence-preschool-effectiveness>.

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Executive Summary

Differences in how children develop are substantially linked to differences in children’s learning experiences. As early as 9 months of age, the differential experiences of children growing up in low-income households and children from more affluent homes can lead to a gap in their cognitive development. The developmental gaps continue to grow through elementary and secondary school unless other learning opportunities intervene.¹ Inspired by the effectiveness of early preschool programs that have demonstrated significant and sustained benefits for children, many states have invested in such programs to boost children’s early academic skills, narrow achievement gaps, and support children’s long-term academic success. Alongside the growth of early learning programs, the availability of research evaluating the effects of publicly funded preschool has expanded exponentially.

Yet making sense of this literature, which includes studies that employ various methodologies to examine diverse programs implemented at different points in time, is a complex endeavor. A large body of research on contemporary preschool programs finds similar benefits for children’s school readiness and later outcomes. However, evaluations of two programs—Tennessee’s Voluntary Pre-K program² and Head Start³—found mixed results, leaving policymakers and the public confused about how to interpret the findings and what to do to ensure productive investments.

This report presents the evidence on the effects of preschool, finding that well-implemented programs support substantial early learning gains and can have lasting impacts throughout school. We explain how the findings from evaluations of the Tennessee Voluntary Pre-K and Head Start programs inform our interpretations of preschool effectiveness and demonstrate how study methodology used to compare children in a program to those outside the program shapes the interpretation of research results. When children who attend a specific preschool program are compared to similar children who did not attend preschool at all—as opposed to those who attended another program—the benefits of preschool are clear. We further note research that finds that the quality of both preschool programs and primary schools can affect the measured outcomes of preschool before and during elementary education.

The Evidence

Evaluations of contemporary preschool initiatives consistently find that many large-scale programs benefit children’s early academic skills in reading and math. Furthermore, these positive effects on children’s school readiness have been observed in both targeted and universal programs, demonstrating benefits for children across the socioeconomic spectrum. Among the programs included in our review, researchers found clear benefits for participating children’s early literacy skills in 17 out of 18 where such skills were evaluated. Likewise, researchers found benefits for children’s early mathematics skills in 14 out of the 16 programs where these skills were assessed. The few findings of “no difference” generally showed positive influences, though not large enough to be considered statistically significant, usually because of small sample sizes.⁴

Among the programs examined for their effect on children’s early language abilities, such as oral language skills and receptive vocabulary, researchers found that in about half (8 out of 15 programs), the program participants benefited compared to children in the comparison group.

Other reviews have also observed this trend: positive effects on children’s literacy or mathematical skills are more readily measured than benefits to children’s language abilities, which are more profoundly affected by the out-of-school environment.⁵

Emerging evidence suggests that preschool programs can influence children’s social-emotional development as well. For example, some preschool programs have found improvements for children’s social-emotional skills and executive function at school entry by measuring outcomes such as self-control and attentiveness. Of the six studies that looked at these outcomes, four found benefits for at least one measure, including emotion recognition and teacher reports of student engagement and behavior. Difficulty in consistently measuring these skills across different grade levels and teachers may explain the lack of significant findings in some studies, as one evaluator suggested.⁶

It is clearly possible for the academic benefits of preschool to persist into elementary and middle school, but the inconsistency of outcomes across programs illustrates the importance of understanding study methodologies and of investing in quality to support sustained gains.

The evidence beyond school entry—perhaps unsurprisingly—presents a more complex story. It is clearly possible for the academic benefits of preschool to persist into elementary and middle school, but the inconsistency of outcomes across programs illustrates the importance of understanding study methodologies and of investing in quality to support sustained gains.

Studies show a consistent pattern of benefits in measures of school progress throughout school. Among the studies that examined special education placements, most (4 out of 7) found reductions in special education placements in elementary school for participating children, and two found no effect. The remaining study—of Tennessee Voluntary Pre-K—found that children who participated in preschool were significantly more likely to be placed in special education when they entered elementary school than comparison group children.⁷ In that case, involvement with the public school system at an earlier age may have led to earlier identification of underlying developmental delays.

Of the studies that measured grade retention, most (6 out of 10) found a reduction for participating children in being held back in grade. Two evaluations of Tulsa’s early childhood education programs did not find evidence of a difference between preschool participants and those in the comparison group. Both studies found fairly low rates of grade retention for all children, and in both cases, the evaluators suggested that many of the children to whom participants were compared attended other high-quality preschool programs, meaning both groups may have benefited equally from their early learning experiences.

The evidence is least consistent for gains in tested academic subjects throughout school. Some studies found enduring effects, underscoring that long-lasting benefits are possible. Others, however, found few differences between children in a particular preschool program and children to whom they were compared in later grades. Of the studies in our review that measured children’s

literacy beyond school entry, about half found significant benefits of preschool for children’s reading performance in elementary school—in several cases persisting up to 5th grade—and the other half found little difference between the children who attended the specific preschool program and other children who remained in the comparison group throughout school.

Only seven of the studies in our review examined language skills such as vocabulary development into the elementary grades. Of these, three found some evidence of a significant advantage for preschool participants relative to their peers at some point in elementary school. It is difficult to draw definitive conclusions from such a small number of studies, but this variability is in step with the results from the evaluations at school entry, which found stronger impacts on literacy and mathematics skills than on language development.

Of the 13 studies that examined children’s mathematics performance throughout school, 10 document significant benefits, including some that persist well into middle school. One other study found a positive influence, though not large enough to be considered significant. Two of the studies, however, found that preschool participants performed less well than the children to whom they were compared on at least one measure of mathematics skills in the early elementary grades.

We examine these two studies in depth—that of Head Start and of the Tennessee Voluntary Pre-K program. In both cases, we point to two factors that likely contribute to the results: (a) the study design and comparison group composition in later grades and (b) the quality of the preschool programs in question.

In the case of the Head Start study, for example, researchers compared program participants to children who had either also attended Head Start, had attended another preschool program, or had attended no preschool program. Although the initial evaluation finding did sort out these differences, when a later study compared the literacy outcomes of Head Start participants to children who did not attend any preschool program, researchers found substantial positive benefits of Head Start. Thus, knowing the early learning experiences of the comparison group matters for evaluating findings.

In the Tennessee Pre-K study, the evaluators did not account for the early learning experiences of children who did not attend the program, some of whom attended other preschools. It is therefore impossible to know from the analysis whether the effects of the program were different for children without access to alternative early learning experiences, as was the case with Head Start. In addition, the comparison group that researchers were able to follow into their grade schools proved to be more advantaged in several ways—more likely to be White, English-speaking, and older—than the preschool participants and thus may have benefited from learning opportunities in the home as well as at better resourced schools.

Furthermore, research indicates that successful programs incorporate common elements of preschool quality, such as well-qualified educators, a developmentally appropriate curriculum, and adequate learning time. A separate study suggests that the quality of Tennessee’s program may have been meaningfully different from programs that demonstrate effectiveness. An evaluation of classroom quality found substantial variation, with some classrooms scoring quite high and others extremely low. In the low-quality classrooms, teachers spent only a little more than half their time engaged in learning activities, which may reflect poor classroom management or difficulties embedding learning into everyday routines and play. In a recent assessment of statewide program

quality, Tennessee’s program met only 5 of the 10 quality benchmarks set forth by the National Institute for Early Education Research. Questions of research design and program quality may help to explain the variability in findings across evaluations.

What Makes Preschool Effective?

The studies in this review evaluate programs that vary—sometimes significantly—in their approach to preschool. Some of the preschool programs are universally available to 4-year-olds regardless of family income, whereas others serve only children living in low-income households or those with other specified risk factors. Some have a long history and reach a high proportion of eligible children, whereas others are more recently developed and serve a smaller number of children. They also diverge on dimensions of quality, including their requirements for teacher qualifications, the professional supports offered to educators, the availability of full- or part-day programs, and the types of family support services offered.

A substantial body of research on programs that succeed in preparing children for school identifies important elements of quality.⁸ These elements include

- sufficient learning time and small class sizes with low student–teacher ratios;
- well-prepared teachers who provide engaging interactions and classroom environments that support learning;
- ongoing support for teachers, including coaching and mentoring, with program assessments that measure the quality of classroom interactions and provide actionable feedback for teachers to improve instruction;
- research-based, developmentally appropriate early learning standards and curricula;
- assessments that consider children’s academic, social-emotional, and physical progress and that contribute to instructional and program planning; and
- meaningful family engagement.

Most or all of these elements are present in the programs that demonstrated the strongest and most persistent impacts on children. Limited resources may account for shortcomings among other programs. The elements of high quality are often complex and expensive to implement. Because policymakers often operate within significant resource constraints that force tradeoffs, future research should focus on identifying the most crucial elements of preschool quality for improving child outcomes.

Furthermore, when it comes to sustaining gains from an effective preschool program, ample research suggests that one must look beyond the preschool years. A year or two of even the highest quality program cannot inoculate children from the detrimental effects of living in impoverished communities or experiencing poor elementary or secondary schooling. It is critical for policymakers to understand that the quality of early learning is important for immediate outcomes, but sustained benefits likely require more comprehensive investments in children and their families. A closer examination of these questions is crucial to understanding the potential for pre-k programs to create lasting impacts.

Conclusion

The preponderance of evidence demonstrates that high-quality preschool leaves children better prepared for school, especially in terms of their academic skill development.⁹ Although studies vary, there is growing evidence of long-lasting benefits for children’s school progress and behavioral outcomes. The consistency of our conclusions and those of other scholars affirms their robustness and underscores the importance of communicating the evidence effectively to a broad audience. Rather than continuing to debate whether to invest in preschool, we recommend policymakers focus their attention on understanding what must happen in a preschool classroom and the k–12 school system to ensure their investments pay off.

Introduction

The premise that preschool programs are a sound public investment has been widely accepted for several decades, based largely on findings from a series of landmark studies of early care and education programs in the 1960s and 1970s. More recently, the availability of research evaluating the effects of publicly funded pre-k has expanded exponentially, accompanying significant expansions in the programs themselves. Yet making sense of this literature, which includes studies that use a variety of methodologies to look at diverse programs implemented at different points in time, is a complex endeavor.

Early evaluations of the Perry Preschool Project,¹⁰ the Abecedarian Project,¹¹ and the Chicago Child-Parent Centers,¹² for example, found significant benefits on outcomes such as educational attainment and income that lasted into adulthood of participation in early care and education programs. In several states across the country, state preschool programs have demonstrated sustained effects on children’s academic achievement and related outcomes, such as lower rates of special education placement and grade retention, into elementary and middle school. However, rigorous evaluations of two programs—Tennessee’s Voluntary Pre-K Program¹³ and Head Start¹⁴—found mixed results, leaving policymakers and the public confused about how to interpret the findings and what to do to ensure productive investments.

This review joins others released over the past several years in compiling the best evidence to inform discussions about the effectiveness of preschool¹⁵ and adds to the growing consensus that the preponderance of evidence demonstrates that high-quality preschool leaves children better prepared for school.¹⁶ We add to this literature by examining not only whether preschool improves children’s outcomes but also which features of the preschool program or study design may account for these effects.

The review distills lessons for policymakers by combining a detailed description of preschool program evaluations and research methodologies (see Appendix B and C) with an accessible discussion of their findings. Specifically, it unpacks the challenges that pervade the discussion around preschool, including inconsistencies in study methods, and hypothesizes about other factors that may explain the findings of the preschool literature, such as the quality of preschool programs and subsequent elementary school experiences. The ultimate goal of this review is to equip policymakers and others with the tools to assess the weight of accumulated evidence in light of these challenges and draw conclusions about the case for investing in preschool.

The Structure of This Review

This review begins with a discussion of the foundational studies that first demonstrated the substantial benefit of high-quality preschool programs to children. Specifically, we summarize the findings from longitudinal studies of three landmark programs: the Abecedarian Project, the Perry Preschool Project, and the Chicago Child-Parent Centers. Though the research base on the effects of preschool has since expanded considerably, understanding the findings and implications of these seminal studies remains crucial for interpreting more recent evidence.

We then analyze evaluations of contemporary preschool programs to draw conclusions about the benefits to children of participating in publicly funded preschool across three broad domains: (1) academic outcomes, (2) school progress outcomes, and (3) social-emotional and self-regulation

outcomes. Though these categories are imperfect because many of the measures used in preschool evaluations have both academic and social-emotional or behavioral dimensions, they are a useful heuristic for summarizing a complex literature base.

In selecting evaluations for inclusion in this review, we considered studies that examine children’s outcomes at school entry—the end of preschool or beginning of kindergarten—and studies that follow children into elementary school and beyond. The impacts of preschool at school entry have been extensively studied. Therefore, we limited our analysis of this time horizon to include only studies that use one of two especially strong research designs: a randomized control trial or a regression discontinuity design. There are fewer studies that follow preschool program participants into the early elementary grades (kindergarten to 3rd grade), and studies that extend beyond these early grades are even less common. In order to capture a robust cross-section of this literature, we expanded our criteria to include other strong quasi-experimental designs, such as natural experiments and rigorous matching studies.

When the outcomes of a preschool program have been evaluated separately in the early elementary grades and later in childhood or adolescence using a strong experimental or quasi-experimental design, we include both studies. Our inclusion criteria led us to examine 29 thoughtfully designed evaluations of 21 publicly funded preschool programs operating at scale; these include the federal Head Start program, as well as state and municipal preschool programs. Table 1 lists the studies identified using this approach. Additional information about our approach, including its limitations, is available in Appendix A. The intricacies of the research design each evaluation employed, and our rationale for focusing on this set of studies, are discussed in brief in the section titled “Why Does Methodology Matter?” and in depth in Appendix B. Finally, a detailed summary of the studies considered in our analysis is available in Appendix C.

Across our analysis, we selected studies based on their research methodologies rather than the structure or quality of the preschool programs they evaluate. As a result, the studies in this review evaluate programs that vary—sometimes significantly—in their approach to preschool. Some of the preschool programs are universally available to 4-year-olds regardless of family income, while others serve only children living in low-income households or those with other specified risk factors. Some have a long history and reach a high proportion of eligible children, while others are more recently developed and serve a smaller number of children. They also diverge on dimensions of quality, including their requirements for teacher qualifications, the professional supports offered to educators, the availability of full- or part-day programs, and the types of family support services offered. We explore the implications of this variation for drawing conclusions about the effectiveness of preschool at the end of our review.

Table 1
Programs and Studies of Outcomes Included in This Analysis

Program	Timing of Evaluation:	
	School Entry	Throughout School ^a
Arkansas Better Chance Program	Husted, Barnett, Jung, & Thomas (2007)	Jung, Barnett, Husted, & Francis (2013)
Boston Public Schools K1	Weiland & Yoshikawa (2013)	
California Transitional Kindergarten	Manship, Holod, Quick, Ogut, Brodziak de los Reyes, et al. (2017)	Manship, Holod, Quick, Ogut, Brodziak de los Reyes, et al. (2017)
Connecticut School Readiness Program	The Connecticut Academy of Science and Engineering (2016)	
Florida Pre-Kindergarten Early Intervention	Figlio & Roth (2009)	
Florida Voluntary Pre-K	Miller & Bassok (in press)	
Georgia's Pre-K Program	Peisner-Feinberg, Schaaf, LaForett, Hildebrant, & Sideris (2014)	Cascio & Schanzenbach (2013) ^b
Head Start	U.S. Department of Health and Human Services (2010)	U.S. Department of Health and Human Services (2012); U.S. Department of Health and Human Services (2010); Deming (2009)
Michigan Great Start Readiness Program	Wong, Cook, Barnett, & Jung (2008) ^{b, c}	
New Jersey Abbott Preschool Program	Frede, Jung, Barnett, Lamy, & Figueras (2007)	Barnett, Jung, Youn, & Frede (2013)
New Mexico Pre-K	Hustedt, Barnett, Jung, & Friedman (2010)	
North Carolina Pre-K	Peisner-Feinberg & Schaaf (2011)	Peisner-Feinberg, Mokrova, & Anderson (2017); Dodge, Bai, Ladd, & Muschkin (2016)
Oklahoma 4-Year-Old Program	Wong, Cook, Barnett, & Jung (2008) ^b	Cascio & Schanzenbach (2013) ^b ; Smith (2016)
San Francisco Preschool for All	Applied Survey Research (2013)	
South Carolina 4K and First Steps to Success	Wong, Cook, Barnett, & Jung (2008) ^b	
Tennessee Voluntary Pre-K	Lipsey, Farran, & Durkin (2018)	Lipsey, Farran, & Durkin (2018)
Tulsa ECE Programs: CAP Tulsa Head Start	Gormley, Phillips, & Gayer (2008) ^b	Phillips, Gormley, & Anderson (2016)
Tulsa ECE Programs: Universal Pre-K	Gormley, Phillips, & Gayer (2008) ^b	Hill, Gormley, & Adelman (2015); Gormley, Phillips, & Anderson (2017)
Virginia Preschool Initiative	Huang (2017)	Virginia University Research Consortium on Early Childhood (2015)
Washington ECEAP	Bania, Kay, Aos, & Pennucci (2014)	
West Virginia Pre-K	Wong, Cook, Barnett, & Jung (2008) ^b	
Total Studies and Programs	14 studies of 18 programs	19 studies of 14 programs

^a To capture a robust cross-section of literature on outcomes beyond school entry, we include studies of both early elementary school (grades k-3) and later grades (grade 4 through adulthood) where possible. In cells where multiple studies are listed, evaluations of both grade spans met the methodological bar for inclusion.

^b This is a multi-program study.

^c Following our review, a new and expanded version of this evaluation was released. For more information see: Barnett, W. S., Jung, K., Friedman-Krauss, A., Frede, E. C., Nores, M., Hustedt, J. T., Howes, C., & Daniel-Echols, M. (2018). State prekindergarten effects on early learning at kindergarten entry: An analysis of eight state programs. *AERA Open*, 4(2), 1-16.

Why Does Methodology Matter?

Determining a preschool program's effectiveness requires researchers to compare children who attend that preschool program to children who do not so that any differences can be attributed to the program. The only way to test the question of whether preschool influences children's development and later life outcomes is by comparing outcomes for children who did and did not attend preschool. To make the best possible comparison, researchers typically strive to ensure similarity of children being compared and account for the early learning experiences of children who do not attend the program under study. If the two groups of children differ in meaningful but unobserved ways, the study findings may be distorted, which researchers refer to as selection bias. In an effort to avoid this distortion, researchers use a variety of methodologies to ensure the children are as similar as possible. Their success in creating comparable groups—and in making the appropriate comparisons within them—has important implications for the strength and application of their conclusions.

On the surface, the most credible method for comparing children is a randomized control trial in which researchers are able to randomly choose which children can attend a program. Essentially, whether a child is able to enroll is determined by the flip of a coin. Evaluations using this approach have been particularly influential in the preschool debate because the children being compared should be quite similar if the selection is truly random and the sample size is large enough. Meanwhile their early learning experiences, it is presumed, should be quite different. However, in practice, when a child is not chosen for the program being evaluated, her parents are often likely to enroll her in another preschool program. And, for many reasons, children chosen for the comparison group may drop out of the study. Both of these circumstances can influence the evaluation's findings by changing the comparability of the children being compared—which weakens the strength of the study design and, potentially, its conclusions.

Given the potential limitations of randomized control trials, it is equally important to consider evaluations that utilize rigorous quasi-experimental designs, such as the regression discontinuity design. In many preschool studies this research design assigns children to receive preschool or not based on their birthdays, allowing children whose birthdays fall just before a set cutoff date to participate in preschool and comparing them to children who just miss the cutoff and must wait another year before entering the program. Because these children are merely days or weeks apart in age, researchers can expect the two groups to be otherwise similar.

Other rigorous quasi-experimental designs take advantage of naturally occurring comparison groups or utilize extensive information about the children in a study to construct a well-matched comparison group. The results of quasi-experimental designs such as these are often subject to greater scrutiny than results of randomized control trial evaluations. Yet well-constructed quasi-experimental evaluations represent a critical contribution to the field and may sometimes provide findings that are more well-grounded than randomized control trials that have problematic comparison groups. Because it is possible that the design choices made by program evaluators substantially influence their findings, understanding research methodologies is critical to interpreting analyses of program effectiveness.

Further, it is critical for preschool evaluations to consider the early learning experiences of comparison group children. The earliest evaluations of preschool programs compared children who attended preschool to those who had no formal early learning experiences because affordable public preschool was generally not available. Today, however, many children attend preschool or some other form of out-of-home care that is not provided through a public program.

If comparison children attend other early childhood programs, a finding of “no difference” does not mean that the preschool in question has no effect on children’s learning. Instead, it means that the children in the preschool program of interest do about as well as children who attended other preschool programs. In this case, preschool may still be found to have a positive effect because both sets of children may be performing better than they would have without preschool and better than children who did not attend preschool at all. Yet many recent studies of public preschool lack data on the experiences of children in the comparison group, making it difficult to know how the preschool program being evaluated stacks up.

Studies that account for the early learning experiences of comparison children can answer two questions: (1) What are the benefits of the preschool program for all eligible children, including those with the means and motivations to access high-quality alternatives? and (2) What are the benefits of the program for those children who live in homes or communities that lack those alternatives? These are critically important questions to be able to answer in early childhood research because they are inherently linked to questions regarding where and for whom preschool should be expanded.

Note: Additional discussion of these methodologies is available in Appendix B.

The Preschool Foundation: Results From Early Studies

Initially, the policy movement for public investment in preschool was largely based on well-crafted evaluations of three early childhood programs that began in the 1960s and 1970s: the Abecedarian Project, the Child-Parent Centers, and the Perry Preschool Project. These foundational studies collectively established that preschool can have lasting impacts on the trajectories of young children's lives.

These first early childhood programs provided early learning opportunities to children living in poverty during a time when young children generally stayed at home with parents or relatives until they entered elementary school.¹⁷ The three programs differed in some ways, but all provided an intensive, high-quality early learning experience for participating children, including multiple years of programming staffed by well-trained teachers in small classes who implemented a thoughtful approach to early learning that reflected understanding of children's development. The Perry Preschool Project and Child-Parent Centers each provided a half day of preschool throughout the school year, and the Child-Parent Center model continued to support participants with supplemental services into elementary school. The Abecedarian Project was an even higher intensity program, providing full-day, full-year enrichment for children from birth to kindergarten entry and continued supports for some children through 3rd grade.

Each of these programs was studied over several decades, with longitudinal follow-up throughout school. At school entry, each program was found to bolster children's scores on test of intelligence and academic skills relative to comparison group peers.¹⁸ The programs' academic effects throughout school were more varied. In the Abecedarian Project, children who participated in the early childhood program maintained significantly higher scores on tests of intelligence and academic skills than comparison group peers through age 21.¹⁹ The Child-Parent Center study found academic benefits at multiple grade levels through 9th grade.²⁰ The study of the Perry Preschool Project found advantages on intelligence tests for participating children relative to nonparticipating peers through age 8. In the years that followed, Perry Preschool participants also scored significantly higher than their peers on standardized reading and math tests.²¹

These academic outcomes tell only part of the story. The longitudinal studies also followed participants into adulthood and found that, decades after the programs were first implemented, each of these programs had other lasting impacts on the lives of children who participated. Though the evaluations at times tested different outcomes at different ages, all had positive effects on measures of school progress—such as grade retention, high school graduation, or special education placements—as well as overall educational attainment and economic well-being.

Other benefits related to health and behavior into adulthood were also observed (see Table 2). For example, by age 30, participants in the Abecedarian Project were 4 times more likely to hold a bachelor's degree or higher and were more likely to be consistently employed than their comparison group peers.²² By age 27, participants in Perry Preschool had a higher rate of graduation, higher average monthly earnings, and a lower number of adult and lifetime arrests than individuals who had not participated.²³ These lasting benefits were found across the three programs despite the variability in their patterns of academic benefits throughout school.

Table 2
Early Evaluations of Preschool Programs Document Benefits
Throughout Adolescence and Adulthood

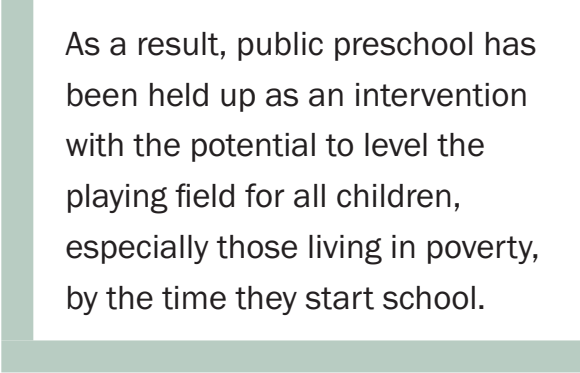
Program	Age(s)	Outcomes (relative to comparison children)
Abecedarian Project	12	<ul style="list-style-type: none"> Better performance on tests of intelligence and cognitive skills
	15	<ul style="list-style-type: none"> Better performance on reading and mathematics assessments Fewer retentions in grade Fewer special education placements
	21	<ul style="list-style-type: none"> Better performance on tests of intelligence and cognitive skills More years of total education Higher college attendance rates Lower incidence of teen pregnancy Lower reported rates of drug use
	30	<ul style="list-style-type: none"> More years of total education Four times more likely to have completed a B.A. or higher More likely to have been consistently employed Better health outcomes (lower rates of prehypertension and risk factors for heart disease)
Chicago Child-Parent Centers	14–15	<ul style="list-style-type: none"> Better performance on standardized reading and math tests Fewer retentions in grade Less likely to be placed in special education, and fewer years receiving special education services
	18–21	<ul style="list-style-type: none"> Higher rates of high school completion and lower rates of dropout More years of total education Lower incidence of juvenile arrest Fewer special education placements Fewer retentions in grade Less likely to experience child maltreatment
	23–24	<ul style="list-style-type: none"> Higher rates of high school completion More years of total education Higher rates of college attendance Lower rates of incarceration and convictions Higher rates of enrollment in health insurance Lower rates of depressive symptoms
	35	<ul style="list-style-type: none"> Higher rates of postsecondary degree completion
Perry Preschool Project	19	<ul style="list-style-type: none"> Higher average high school GPA Fewer years spent in special education during school Higher rates of high school graduation More likely to be employed More likely to be economically self-sufficient Less likely to be arrested for a minor offense
	27	<ul style="list-style-type: none"> More likely to be employed Higher rates of high school graduation Higher average educational attainment Higher average monthly earnings More likely to own their own home Lower number of adult and lifetime arrests
	40	<ul style="list-style-type: none"> More likely to be employed Higher annual median earnings Less likely to be arrested

Note: This table reports significant positive outcomes only. Outcomes tested and found to be nonsignificant are not included.
Source: See Appendix D for full source information.

These long-term findings inspired cost-benefit analyses²⁴ that calculated substantial returns on investments in the programs. For example, researchers estimated that each dollar invested in the Abecedarian Program produced \$7.30 in net benefits to society due to increased earnings among participants and their families, and reduced costs associated with health care, criminal justice, and education.²⁵ Likewise, the cost-benefit ratio for the Child-Parent Centers program has been estimated at nearly \$11 for each dollar invested, and one analysis of the Perry Preschool Project estimated that the returns to society could be as high as \$17 for every dollar invested.²⁶

Although these foundational studies all focused on unique, high-quality, and high-cost programs that served a relatively small number of disadvantaged children, they nonetheless provided the proof of concept for preschool, framing the type and scale of impacts researchers and policymakers might expect from other high-quality programs. As a result, public preschool has been held up as an intervention with the potential to level the playing field for all children, especially those living in poverty, by the time they start school. Over the last 20

years, the promise of these benefits has inspired substantial investments in preschool programs, often with support from advocates, researchers, and policymakers on both sides of the aisle. Yet recently many policymakers have rightfully become more interested in the effects of the programs that these studies inspired—the contemporary preschool programs that serve children on a much larger scale today.



As a result, public preschool has been held up as an intervention with the potential to level the playing field for all children, especially those living in poverty, by the time they start school.

The Impact of Preschool: Outcomes of Contemporary Evaluations

In this section, we review the outcomes of children who participate in contemporary publicly funded preschool programs. Evaluations of these programs demonstrate that preschool prepares children academically for school. There is also evidence that preschool programs generate lasting benefits on school progress and behavioral outcomes, despite academic effects that are less consistent in elementary school. Finally, there is some indication that preschool can improve critical social-emotional and self-regulation skills for participating children.

Evidence of Early Academic Impacts Is Strong

Differences in child development are substantially linked to differences in children's learning experiences. As early as 9 months of age, the differential experiences of children growing up in low-income households and children from more affluent homes can lead to a gap in their cognitive development. These early disparities continue to grow all the way through elementary and secondary school, creating significant academic achievement gaps in reading and mathematics unless other learning opportunities intervene.²⁷ Boosting children's early learning to help close these gaps and support children's success in school is a primary motivator for many preschool programs. Evidence suggests that preschool programs are successful in enhancing children's academic readiness for school.

In this review, we examined studies of 18 programs for their academic effects at school entry. Nearly all of these studies use a regression discontinuity design, though two studies—of Tennessee Voluntary Pre-K and Head Start—use randomized control trials. Across the studies, researchers rely on widely used early childhood assessments to gauge children's development of early academic skills in oral language, literacy, and mathematics.²⁸ For the purposes of this review, we group early academic measures into these three categories, but we recognize there is often substantial developmental overlap among them, particularly for early language and literacy skills.

Using these measures, evaluations have consistently found that preschool programs enhance children's school readiness (see Table 2). Among the programs included in our review, researchers found clear benefits for participating children's early literacy skills relative to their peers in all but one (17 out of 18 programs) on measures such as children's phonological awareness (a key predictor of later reading skills) or ability to identify written letters and the sounds they represent. A small sample size and a limited set of control variables may have contributed to the lack of significance in the case of the outlier—Oklahoma's 4-year-old program.²⁹

Likewise, nearly every program (14 out of 16) that researchers evaluated for impacts on children's early mathematics skills, such as mathematical reasoning and spatial problem solving, showed that preschool participants performed better on at least one measure than peers who did not participate. Two of the programs have not been studied for their effects on mathematical skills, and the other two had positive effects on these skills, though the findings were not statistically significant due to small sample sizes.

Among the programs evaluated for their impact on children’s early language abilities, such as oral language skills and receptive vocabulary, researchers found that in about half (8 out of 15 programs) preschool participants benefited compared to nonparticipants. This trend—that positive effects on children’s literacy or mathematical skills are more widespread than benefits to children’s language abilities, which are more profoundly affected by the out-of-school environment—has also been observed in other reviews.³⁰

Findings from studies of universal state preschool and Head Start programs in Tulsa, OK, suggest these benefits from high-quality programs can be substantial. These programs both offer early learning for preschoolers in classrooms led by teachers who hold bachelor’s degrees and early childhood certifications, and who are paid similarly to other public school teachers in the area. Both programs were found to significantly boost children’s literacy and mathematics skills relative to similar-age children who had not yet completed the program. For the state preschool program, children experienced 7 to 9 months of learning gains in literacy and 5 months in mathematics above and beyond what would normally be expected for their age; in Head Start, the effects were equivalent to 3 to 6 extra months of learning in literacy and 5 months in mathematics.³¹

Further, these positive effects on children’s school readiness have been observed in both targeted and universal programs, demonstrating benefits for children across the socioeconomic spectrum. For example, New Mexico’s preschool grants are targeted to high-poverty areas in which few children meet state proficiency standards in elementary school,³² and over 70% of the children in the New Jersey Abbott Preschool Program were eligible for free and reduced-price lunch. Research on each found positive impacts on the school readiness of children in families with low incomes with regard to language, literacy, and mathematical skills (see Table 3).³³ In contrast, Boston’s K1 prekindergarten program and Tulsa’s universal preschool program are both available to all 4-year-olds regardless of family income, and both enhanced children’s literacy and numeracy skills relative to children who did not participate.³⁴ These results illustrate that publicly funded preschool can have meaningful impacts on children’s academic school readiness across socioeconomic groups, and, overall, the weight of the evidence indicates that preschool programs operating at scale consistently benefit children’s early academic skills.

Lasting Gains in School Progress Are Common

In addition to academic outcomes, some preschool evaluations also include school progress and participation outcomes, such as grade retention and special education placement rates and later educational attainment. Some of these indicators, such as grade retention, are important predictors of later academic performance and educational attainment.³⁵ In many cases, improvements in school progress also come with financial benefits for individuals and society that contribute to the positive returns on investment observed in successful preschool programs.³⁶ Though many preschool programs are not yet mature enough to have followed children into adolescence or adulthood, a growing number of studies have considered these outcomes.

The group of studies that have investigated the effects of preschool into elementary and secondary school covers a broader age span than the previously described evaluations of academic impacts at school entry, ranging from outcomes measured at the end of kindergarten to those measured in middle school. These studies also utilize a more diverse set of methodological approaches to evaluate the impact of preschool on outcomes beyond school entry, including matching strategies, randomized control trials, and other quasi-experimental methods (see Appendix C for a description of each study).

Table 3
Preschool Programs Typically Confer Benefits for Children’s
Early Academic Skills

✓ Evidence of better outcomes than comparison group children | 0 No evidence of difference between participants and comparison group children | X Evidence of worse outcomes than comparison group children

Program (Study)	Language			Literacy			Mathematics		
Arkansas Better Chance Program (Hustedt et al. 2007)	✓			✓			✓		
Boston Public Schools K1 (Weiland & Yoshikawa 2013)	✓			✓			✓		
California Transitional Kindergarten (Manship et al. 2017)	✓			✓			✓		
Connecticut School Readiness Program (The Connecticut Academy of Science and Engineering 2016)		0		✓			✓		
Georgia's Pre-K Program (Peisner-Feinberg et al. 2014)		0		✓			✓		
Head Start (U.S. Department of Health and Human Services 2010)	✓	0		✓	0		✓	0	
Michigan Great Start Readiness Program (Wong et al. 2008)		0		✓			✓		
New Jersey Abbott Preschool Program (Frede et al. 2007)	✓			✓			✓		
New Mexico Pre-K (Hustedt et al. 2010)	✓			✓			✓		
North Carolina Pre-K (Peisner-Feinberg & Schaaf 2011)		0		✓			✓		
Oklahoma 4-Year-Old Program (Wong et al. 2008)	✓				0			0	
San Francisco Preschool for All Program (Applied Survey Research 2013)		0		✓			✓		
South Carolina 4K and First Steps to Success (Wong et al. 2008)		0		✓					
Tennessee Voluntary Pre-K (Lipsey, Farran, & Durkin 2018)	✓	0		✓			✓		
Tulsa ECE Programs: CAP Tulsa Head Start (Gormley, Phillips, & Gayer 2008)				✓			✓		
Tulsa ECE Programs: Universal Pre-K (Gormley, Phillips, & Gayer 2008)				✓			✓		
Virginia Preschool Initiative (Huang 2017)				✓					
West Virginia Pre-K (Wong et al. 2008)		0		✓				0	
✓ Evidence of better outcomes than comparison group children	8			17			14		
0 No evidence of difference between participants and comparison group children		9			2			3	
X Evidence of worse outcomes than comparison group children			0			0			0

Note: Categories are not mutually exclusive because studies often examine multiple measures within a single domain.
Source: See Appendix D for full source information.

Among the studies in this review, 11 analyzed school progress outcomes, primarily using quasi-experimental methods, including two different studies of the federal Head Start program and a follow-up study of Tennessee Voluntary Pre-K. Most of the studies find some evidence of a positive impact of preschool participation on these outcomes (see Table 4). For example, North Carolina’s prekindergarten program was found to benefit students throughout elementary school, with lower rates of special education placement and grade retention that persisted through 5th grade.³⁷ The preschool program reduced the probability of being placed into special education by 48% in 5th grade and reduced the probability of ever being retained in grade by 69% at 5th grade. These results come from a study that employs a natural experiment by taking advantage of the gradual rollout of the state’s preschool program to compare outcomes of children who lived in counties in which the program received funding when they were 4 years old to those of demographically similar children who lived in counties in which funding was limited or not yet available.

Favorable effects on school progress indicators are also evident in other studies (see Table 3). Of the seven studies in our review examining special education placements, four found that preschool participants were significantly less likely to be placed in special education in elementary school (including a Head Start study that used an index score reflecting both grade retention and special education placements).

Two of the other studies examined the effects of Tulsa’s early childhood education programs in middle school and found no difference between children who attended the program and the children to whom they were compared. Because Tulsa offers universal preschool, it is possible that many of the comparison children attended other, private programs rather than no preschool at all. Survey data from one of the studies supports this hypothesis—over half of the comparison children participated in other center-based care, and these preschool experiences may have been of similar or higher quality than the experiences of children in other locales.

The final study—of Tennessee Voluntary Pre-K, a targeted program serving children in low-income households—found that children who participated in preschool were significantly more likely to be placed in special education when they entered elementary school.³⁸ In the case of Tennessee, it is likely that involvement with the public school system at an earlier age led to earlier identification of underlying developmental delays.

Among the 10 studies that examined preschool’s impacts on grade retention in elementary or middle school, six found evidence that significantly fewer participating children were retained in grade than children to whom they were compared. (This group again included the study of Head Start that relied on the index of special education placement and grade retention.) One of these six studies—of New Jersey’s Abbott preschool—found a positive impact on both of these school progress indicators (special education placement and grade retention) for children who received one year of preschool but not children who attended the program for two years.³⁹ These findings highlight the complexity of linking preschool attendance to later child outcomes.

Two of the other studies—of the Arkansas Better Chance program and Tennessee Voluntary Pre-K—found preschool had positive effects on grade retention in elementary school but those effects were only marginally significant.⁴⁰ The other two studies—of Florida’s Voluntary Pre-K program and Head Start—found no significant difference in the rates of grade retention by 3rd grade for preschool participants and the children to whom they were compared.⁴¹

Table 4
Most Preschool Evaluations Show Positive Effects on School Progress
Throughout Childhood and Adolescence

✓ Evidence of better outcomes than comparison group children | 0 No evidence of difference between participants and comparison group children | X Evidence of worse outcomes than comparison group children

Program (Study)	Age	Grade Retention			Special Education Placements		
		✓	0	X	✓	0	X
Arkansas Better Chance Program (Jung et al. 2013)	Grades 1–4		0				
Florida Prekindergarten Early Intervention (Figlio & Roth 2009)	Grades k–2	✓			✓		
Florida Voluntary Pre-K (Miller & Bassok in press)	Grades k–3		0				
Head Start (U.S. Department of Health and Human Services 2012)	3rd grade		0				
Head Start (Deming 2009)	Ages 7–14 ^a	✓			✓		
New Jersey Abbott Preschool Program (Barnett et al. 2013)	5th grade	✓	0		✓	0	
North Carolina Pre-K (Dodge et al. 2016)	Grades 3–5	✓	0		✓		
Tennessee Voluntary Pre-K (Lipsey, Farran, & Durkin 2018)	Grades k–3		0			0	X
Tulsa ECE Programs: CAP Tulsa Head Start (Phillips, Gormley, & Anderson 2016)	8th grade	✓				0	
Tulsa ECE Programs: Universal Pre-K (Gormley, Phillips, & Anderson 2017)	7th grade	✓				0	
Virginia Preschool Initiative (Virginia University Research Consortium on Early Childhood 2016)	8th grade	✓					
✓ Evidence of better outcomes than comparison group children		6			4		
0 No evidence of difference between participants and comparison group children			6			4	
X Evidence of worse outcomes than comparison group children				0			1

^a Non-test score index of grade retention and special education placements.

Note: Categories are not mutually exclusive because studies often examine multiple measures within a single domain.

Source: See Appendix D for full source information.

These results create a fairly consistent pattern of benefits with regard to school progress throughout childhood and into adolescence. As is discussed later, consistently including these types of school progress and participation measures in preschool evaluations may be crucial to understanding the potential for preschool programs to create lasting gains for participants.

Academic Advantages Can Persist Into Elementary School

Beyond school entry, some programs find that the academic advantages of preschool participation persist, while others see few, if any, differences between participants and the children to whom they are compared on academic measures in later grades. Results from these studies are more mixed than results from studies of academic impacts at school entry (see Table 5). In some evaluations, preschool participants have demonstrated stronger academic outcomes than other students to whom they have been compared in the elementary and middle school years, while in other cases, they have not.

Washington's state preschool program, for example, has documented better academic performance into elementary school for students who attended the program relative to other, similar students.⁴² The state preschool program is only available to children whose family income is near or below the federal poverty line and typically provides a half day of preschool. All classrooms are led by qualified teachers and offer extensive wraparound services and family supports modeled after the federal Head Start program. An evaluation of the program found that it consistently raised the literacy and numeracy scores of former state preschool participants relative to the comparison group students on standardized achievement tests.⁴³ These positive results were observed in 3rd, 4th, and 5th grade, with no clear shift in the direction or scale of the effects as the children aged.⁴⁴

To study the impact of Washington's program, evaluators took advantage of data about proximity to preschool program sites to construct a comparison group of children who are similar to treatment children except that they live farther away and were therefore less likely to attend the program. Although this approach does not fully address the potential for unobservable differences between the treatment and comparison groups, additional statistical controls provide greater confidence in the findings.

Other studies, such as an evaluation of the Tennessee Voluntary Pre-K program, have found fewer academic advantages as children progress through school and a few skill areas in which participating children were surpassed by the comparison group.⁴⁵ The program provides full-day preschool taught by licensed teachers. As in Washington, the Tennessee program is designed to serve children from low-income families. Though the study of the Tennessee program found preschool participants were more ready for school than children who did not participate, it found few differences in the performance of the participants and a comparison group on academic assessments later in elementary school. Differences in children's performance on language measures throughout early elementary school were inconsistent, with participating children sometimes scoring better and sometimes scoring worse than the children to whom they were compared. By 3rd grade, children who participated in the preschool program were surpassed by children who did not on the state's mathematics achievement test. However, as we describe in "Does Tennessee's Evaluation Prove That Preschool Doesn't Work?" on page 16, there are important considerations that warrant further investigation to understand the meaning of these findings.

Table 5
Evidence of Academic Effects Throughout School Is Inconsistent

✓ Evidence of better outcomes than comparison group children 0 No evidence of difference between participants and comparison group children X Evidence of worse outcomes than comparison group children

Program (Study)	Age	Language			Literacy			Mathematics		
Arkansas Better Chance Program (Hustedt et al. 2013)	Grades 1–4	✓	0		✓	0		✓	0	
California Transitional Kindergarten (Manship et al. 2017)	Kindergarten		0		✓					
Georgia Universal Pre-K and Oklahoma 4-Year-Old Program ^a (Cascio & Schanzenbach 2013)	Grades 4 & 8				✓	0		✓	0	
Head Start (Deming 2009)	Ages 5–14 ^b	✓	0		✓	0		✓	0	
Head Start (U.S. Department of Health and Human Services 2010)	Grades k–1		0			0			0	X
Head Start (U.S. Department of Health and Human Services 2012)	3rd grade		0			0			0	
New Jersey Abbott Preschool Program (Barnett et al. 2013)	Grades 4–5				✓	0		✓	0	
North Carolina Pre-K (Peisner-Feinberg et al. 2017)	Kindergarten		0			0		✓	0	
North Carolina Pre-K (Dodge et al. 2016)	Grades 3–5				✓			✓		
Tennessee Voluntary Pre-K (Lipsey, Farran, & Durkin 2018)	Grades k–3	✓	0			0			0	X
Tulsa ECE Programs: CAP Tulsa Head Start (Phillips et al. 2016)	8th grade					0		✓		
Tulsa ECE Programs: Universal Pre-K (Hill et al. 2015)	3rd grade					0		✓	0	
Tulsa ECE Programs: Universal Pre-K (Gormley et al. 2017)	7th grade					0		✓		
Virginia Preschool Initiative (Virginia University Research Consortium on Early Childhood 2016)	8th grade					0				
Washington ECEAP (Bania et al. 2014)	Grades 3–5				✓			✓		
✓ Evidence of better outcomes than comparison group children		3			7			10		
0 No evidence of difference between participants and comparison group children			7			12			9	
X Evidence of worse outcomes than comparison group children			0			0				2

^a The results of this study do not distinguish between Georgia and Oklahoma; findings reflect both programs.

^b Test score index of literacy, language, and mathematics.

Note: Categories are not mutually exclusive because studies often examine multiple measures within a single domain.

Source: See Appendix D for full source information.

Does Tennessee’s Evaluation Prove That Preschool Doesn’t Work?

Accounts of Tennessee’s Voluntary Pre-K program began as a success story when initial results showed the program enhances children’s school readiness. However, a follow-up evaluation appears to show no differences between program participants and comparison children on language development and reading skills by 1st grade and found that children in the study’s comparison group actually surpassed program alumni on mathematics by 2nd grade.⁴⁶

These results understandably received attention, in part because of the study’s design, which allowed the evaluators to randomly choose children either to attend the program or not. However, many of the children who were not chosen to participate in the preschool program dropped out of the study at the start, and only one third of the remaining children agreed to additional developmental assessments in 3rd grade.⁴⁷ These were children whose parents returned a set of permission forms, calling the comparability of the comparison children to program alumni into question. Recent data appears to confirm this hypothesis, revealing that comparison children were in fact more advantaged than the children who attended the program.

A more recent follow-up evaluation of the Tennessee Voluntary Pre-K program accessed 3rd grade state achievement test scores and was able to include a more robust group of comparison children. This study, like its predecessor, found that children in the study’s comparison group scored higher than program alumni on mathematics tests in 3rd grade.⁴⁸ Do these findings mean the Tennessee Voluntary Pre-K program—or that preschool as an intervention—doesn’t work?

Not necessarily. There are a few other explanations that warrant careful consideration. First, as is the case with many other studies, methodological issues may contribute to the study’s findings. For example, in the follow-up evaluation, the group of children to whom participants were compared once they entered school was still more advantaged than program alumni in nearly every way reported by the program evaluators.⁴⁹ These children were older, more likely to be White, less likely to be Black or Hispanic, and more likely to be native English speakers. Although these differences were not large enough to be statistically significant, it is possible that the cumulative impact of these advantages influenced the study’s overall findings.

Further, if the group of children to whom participants were compared were in fact more advantaged, then it is also likely that those children went to better resourced elementary schools.⁵⁰ Recent research has demonstrated the impact of elementary school investments on the magnitude and persistence of the impacts of early childhood programs.⁵¹ If participant children attended more poorly resourced, lower quality elementary schools, their kindergarten teachers may have been ill-equipped to support the development of children who varied substantially in the knowledge and skills they brought into the classroom.

In addition, the evaluators did not account for the early learning experiences of children who did not attend the program, many of whom likely attended other preschools.⁵² Without direct comparisons of participants to children who did and did not attend other preschool programs, the results are difficult to interpret. It is impossible to know from the analysis whether the effects of the program were different for children without access to alternative early learning experiences, as was the case with Head Start.

Notably, earlier reports out of Tennessee foreshadowed this trend of initial gains for preschool participants followed by convergence or, in some cases, lower scores for program attendees in elementary school. Therefore, the quality of Tennessee’s program, which evidence suggests may have been meaningfully different from programs that demonstrate effectiveness, is likely the more compelling explanation for these findings.⁵³ The evaluation’s findings clearly demonstrate that program participants saw immediate benefits from program participation; however, it is possible

that the quality of early instruction children received in their preschool year did not instill the type of deep understanding of mathematical and literacy concepts that would set the foundation for continued growth.

This explanation is supported by an evaluation of the quality of a sample of Tennessee Voluntary Pre-K classrooms. The study found that critical elements of quality were missing from the program. For example, there was substantial variation in observed teacher-child interaction quality in Tennessee preschool classrooms, with some scoring quite high and others extremely low.⁵⁴ In the low-quality classrooms, teachers spent only a little more than half of their time engaged in learning activities, which may reflect poor classroom management or difficulties embedding learning into everyday routines and play. Further, researchers observed that teachers received little support for professional development to improve instruction.

At the outset, Tennessee strove to create a high-quality state preschool program, designing its program to meet 9 of the 10 preschool quality benchmarks of the National Institute for Early Education Research (NIEER).⁵⁵ That makes it similar to programs that have found evidence of sustained impacts on child outcomes, such as North Carolina Pre-K, which meets all 10 of the benchmarks. The evaluators of the Tennessee program suggest their findings raise questions about whether those benchmarks prescribe elements of preschool programs that are linked to long-term positive effects on either achievement or behavior.⁵⁶ It is a valid query. NIEER released an updated set of standards for preschool programs in 2016, of which Tennessee only meets five, whereas North Carolina meets nine.⁵⁷ If these updated standards better reflect the elements of quality that impact child outcomes, Tennessee's lower score may help, in part, to explain the evaluation's unfavorable findings.

Given these considerations, it seems that the results of the Tennessee program evaluation warrant further investigation to understand their meaning, both in Tennessee and in relation to preschool more broadly.

Similarly, the Head Start Impact Study—another randomized control trial of a means-tested preschool program—found few differences in academic outcome between program participants and the children with whom they were compared in kindergarten, 1st, and 3rd grades. At the end of kindergarten, teachers rated participants from one of the study's cohorts lower than comparison children on a measure of mathematical ability, though tests of mathematical skills showed no significant differences in the performance of the groups.⁵⁸ However, many children in the comparison group attended preschool elsewhere, including in other Head Start programs, complicating the interpretation of results. And when Head Start participants who would have been unable to attend preschool were compared to others who did not have the opportunity to attend preschool, the benefits of participation were clear. (See box below.) Indeed, other analyses of Head Start have observed academic gains into elementary school.⁵⁹

Do Head Start Gains “Fade Out”?

Head Start is a comprehensive, nationwide program for 3- and 4-year old children in families with low incomes. Over its 50-year existence, numerous evaluations have found benefits for children who participate compared to similar children who did not attend.⁶⁰ However, in 2012, the Head Start Impact Study found that early benefits of the program were undetectable by 1st grade: That is, that the Head Start participants were not performing noticeably better than children in the comparison group.⁶¹ The findings left policymakers with a lingering question: Do Head Start gains “fade out” or disappear?

To answer this question, it is important to take a step back and understand that many preschool evaluations find larger benefits at school entry and smaller benefits in subsequent years, relative to the comparison group. This trend is often misinterpreted. The gains made during preschool do not disappear, and students do not go backward in their learning. Instead, preschool participants and children in the study's comparison group often perform more similarly over time. In other words, their performance converges. There can be many different explanations for this phenomenon.

In the case of the Head Start Impact Study, many of the children who were, by design, not considered Head Start participants by evaluators still attended preschool. Specifically, 32% of children who were assigned to the comparison group attended a center-based preschool program. In fact, many comparison group children attended a different Head Start program. As a result, in part the study compared Head Start participants to other Head Start participants, masking the true effects of the program.⁶²

A recent reanalysis compared Head Start participants who would have stayed home if they had not been allowed to attend Head Start to children who did stay home when they did not have access to Head Start. The study was limited to one measure of children's vocabulary but found large positive impacts on that measure in 1st grade for Head Start participants.⁶³ The benefits of Head Start in other domains not measured by the reanalysis might also be larger and longer lasting for children without access to alternative care arrangements. Another, more recent, study also confirmed that the early learning experiences of comparison children matter for evaluating the program's effectiveness.⁶⁴ Collectively, the evidence suggests that Head Start effectively prepares young children for school and that the relative size of the persistent benefits is especially substantial when Head Start graduates are compared to children who were unable to attend preschool.

Furthermore, a recent study found that even when early test score advantages gradually leveled out between Head Start participants and those in a comparison group, significant positive effects were still present on other measures, such as grade retention, graduation, and educational attainment in adolescence and adulthood.⁶⁵ Several other evaluations of Head Start also find benefits for longer term outcomes, such as grade retention, graduation, and educational attainment in adolescence and adulthood, despite finding smaller differentials between Head Start participants and comparison students on short-term outcomes such as test scores.⁶⁶ A study that examined families in which one sibling attended Head Start and another did not due to the differing availability of the program over time found that Head Start produced health and educational benefits into young adulthood.⁶⁷

Furthermore, evidence suggests that policymakers should look beyond the Head Start years to the quality of elementary education to understand what has been called the "fade-out" phenomenon. A 2017 analysis found compelling evidence of the relationship between later school quality and the apparent impact of Head Start on child outcomes.⁶⁸ The study compared the adult outcomes of children who were differentially exposed to increases in Head Start spending and public k-12 school spending, and found that for children from low-income families the benefits of Head Start spending were larger when followed by access to better funded schools. Likewise, increases in k-12 spending were more impactful when children were exposed to greater early childhood spending. This evidence suggests that investments in elementary school may both benefit from preschool investments and be critical to sustaining gains from preschool.

Among the 15 studies of academic outcomes beyond school entry, all of them examined children's reading performance into elementary school, and half (7 out of 15) found a significant positive effect between 1st and 5th grade. In New Jersey, where some students receive two years of high-quality preschool while others have access to only one, researchers found stronger effects for children's literacy in 4th grade for students who spent more time in a preschool classroom.

In one evaluation of North Carolina Pre-K, formerly known as More at Four, researchers found significant benefits for children's performance on standardized reading tests in 3rd through 5th grade, despite another study of the program finding no difference in the literacy skills of participants and nonparticipants at the end of kindergarten.⁶⁹ Though the results may seem at odds, the two studies used different methodologies and comparison groups, measured literacy skills using different tests, and examined the program and outcomes at different points in time, all of which may influence each evaluation's findings.

Fewer of the 15 studies examine language skills such as vocabulary development. The seven evaluations that do study language development all focus on the early elementary grades. Of these, three find some evidence of a significant advantage for preschool participants relative to their peers at some point in elementary school, including one that examined a test score index that combined literacy, language, and mathematical skills. It is difficult to draw definitive conclusions from such a small number of studies, but this variability is in step with the results from the evaluations at school entry, which found stronger impacts on literacy and mathematics skills than language development.

Finally, 10 studies found a positive effect from preschool on children's mathematical performance in elementary or middle school, including evidence of benefits as late as 7th and 8th grade in Tulsa's early care and education programs.⁷⁰ One of the other studies found a marginally significant positive effect on a measure of mathematical skills, and another two studies did not examine mathematical outcomes. Only two studies—those from the Tennessee Voluntary Pre-K program and the Head Start Impact Study—found that participants were outperformed by their peers on measures of mathematical skills in the early elementary grades. The implications of these studies' findings are discussed in depth in the boxes "Do Head Start Gains 'Fade Out'?" and "Does Tennessee's Evaluation Prove That Preschool Doesn't Work?" Despite some variability, this fairly consistent, positive trend on mathematical outcomes is encouraging, especially because mathematical skills are thought less likely to be influenced by out-of-school experiences than reading and language skills.

Collectively, this group of studies indicates that it is possible for the academic benefits of preschool to persist into elementary and middle school. However, the inconsistency of these findings across the programs that have been studied to date also illustrates the importance of understanding which types of preschool and elementary school experiences are necessary to support sustained gains. This inconsistency also raises questions about the different samples, methodologies, and assessments used across studies with divergent findings. Possible explanations for this variability in academic outcomes throughout school are explored in depth in the latter half of this report.

Emerging Evidence Points to Benefits for Social and Emotional Learning

The early childhood years are formative for all aspects of children’s development, including social and emotional learning. Social and emotional learning refers to the development of a broad array of skills and capacities, ranging from the ability to control emotions and behaviors to the ability to develop relationships. Evidence suggests social-emotional skills are linked to a variety of other long-term benefits—including reduced grade retention, special education placements, and suspensions or expulsions;⁷¹ improved test scores and graduation rates; and enhanced social behavior.⁷²

Likewise, executive function—a suite of mental skills including working memory, mental flexibility, and self-control—is an important part of children’s development and has been linked to educational success in elementary and middle school.⁷³ Skills in these domains have both cognitive and social-emotional underpinnings, but we use the terms *social-emotional skills* and *executive function* to refer to these clusters of outcomes.

Given the potential for long-term benefits, there is great interest in understanding whether preschool positively influences children’s social-emotional skills and executive function. The child care literature has previously examined the relationship between early nonmaternal care and social and emotional learning, and some studies have observed more behavior problems among children in child care than those who stayed at home.⁷⁴ Research also has found that high levels of quality and continuity of care mitigate the potential for increased behavior problems.⁷⁵ This literature underscores the importance of better understanding the relationship between the nature of preschool participation and social and emotional learning in early childhood.

Evidence suggests social-emotional skills are linked to a variety of other long-term benefits—including reduced grade retention, special education placements, and suspensions or expulsions; improved test scores and graduation rates; and enhanced social behavior.

Further, studies of the Abecedarian Project, Perry Preschool Project, and Chicago Child-Parent Centers demonstrated the potential for preschool to influence social and behavioral outcomes into adolescence and adulthood, such as likelihood of becoming a teen parent or engagement with the criminal justice system. Moving the needle on these outcomes can not only have long-lasting implications for individual well-being, but also can generate significant cost savings for society, underscoring the potential of investing in high-quality preschool.

Only six of the studies in our sample measured children’s social-emotional skills or executive function at school entry, including two randomized control trials and three regression discontinuity designs. Five of these studies measured an outcome related to social-emotional skills, and three assessed children’s executive function. These studies provide emerging evidence that preschool has the potential to influence children’s development in these domains.

Of the five studies that measured social-emotional skills, three demonstrated evidence of positive effects on at least one measure, ranging from parent and teacher reports of child behavior to assessments of social awareness (see Table 6). However, each of these studies also found no

difference between preschool graduates and other comparison group students on at least one other measure of social-emotional skills.⁷⁶ Given the limited number of studies that examined this domain, it is not possible to discern a pattern with regard to the kind of social-emotional skills preschool programs are most likely to improve.

For example, California’s Transitional Kindergarten program is a school-based program taught by credentialed teachers and offered to all children whose birthdays fall within a 3-month window following the age cutoff for conventional kindergarten. An evaluation of the program using a regression discontinuity design found significant positive outcomes for a teacher-reported measure of student engagement, though no differential effect on several other measures of social-emotional development was observed.⁷⁷ In the Head Start Impact Study, parents of 3-year-olds participating in Head Start reported less hyperactive behavior and fewer problem behaviors at the end of the program year, though the same study found no impact on parent-reported social and behavioral outcomes for 4-year-olds.⁷⁸ The study of the other program—Georgia Pre-K⁷⁹—found no significant effect on social-emotional skills.

Of the three studies that measured executive function at school entry, two found evidence of a positive effect of preschool. An evaluation of Boston Public Schools K1—the city’s universal preschool initiative—utilized a regression discontinuity design and found the program had positive effects on children’s executive functioning on 4 out of the 5 measures used.⁸⁰ The program provides a full day of preschool in a school-based setting with teachers who hold a bachelor’s degree and must earn a master’s degree within 5 years. The teachers are paid on the same salary scale as other public school teachers and receive dedicated curriculum coaching from a master educator.

This finding was particularly encouraging because building executive function skills was not a specific goal of the program, which serves approximately a third of the city’s 4-year-olds, or about 2,000 children. An evaluation of San Francisco’s Preschool for All program similarly identified a significant effect for children’s executive function skills based on a direct child assessment.⁸¹ However, the study of California’s Transitional Kindergarten program found no impact on executive function.⁸²

In a handful of cases, studies have evaluated social-emotional skills and executive function into the early elementary years, from kindergarten to 3rd grade (see Table 4). Among the studies that did so, results were again mixed. The Head Start Impact Study found that participants outperformed nonparticipants on some social-emotional measures, while in other cases the findings were reversed. Specifically, there was divergence between parental and teacher reports—with parents reporting improvement in social-emotional skills in some cases and teachers reporting challenges in others.⁸³ This phenomenon could have any number of causes—including differences in children’s behavior at home and school, differences in expectations for children’s behavior, measurement error, or chance.

The other three studies found no evidence that preschool participants outperformed their peers on social-emotional measures. The study of California Transitional Kindergarten—which saw some evidence of social-emotional skill benefits at the end of preschool—found no significant differences by the end of kindergarten,⁸⁴ and an evaluation of North Carolina Pre-K found no significant effect on children’s social skills.⁸⁵ The evaluation of the Tennessee Voluntary Pre-K program found that in 1st grade, teachers of preschool participants rated them lower than peers on a scale measuring

their liking and engagement in school; and the study found no evidence of effects on a number of other social-emotional and behavioral measures between kindergarten and 3rd grade.⁸⁶ This may be due in part to the quality of the preschool program and subsequent elementary school experiences. Researchers evaluating the Tennessee program have found evidence that the quality of children's preschool experiences varies greatly.

Only two studies examined executive function into elementary school, and both focused on the end of kindergarten. An evaluation of North Carolina Pre-K identified a benefit for participants compared to nonparticipants on one measure of executive function at that point in time, but no effect on another measure.⁸⁷ The study of California Transitional Kindergarten found no significant benefit for participating children's executive function relative to their peers by the end of kindergarten.⁸⁸

These mixed results are unsurprising, as researchers are still developing strategies for measuring social-emotional learning in children, and each study measures social-emotional skills and executive function differently. Further, there is limited research on the specific dimensions of social-emotional learning that are most important for later well-being or the ways in which elementary experiences may influence the social-emotional skills and executive function of children who previously participated in preschool. That several studies of preschool programs in this review find positive effects, particularly at school entry, suggests both that preschool has the potential to promote social-emotional learning among participating children and that additional research is needed to better understand the features of preschool programs and elementary schools that support children's development in this area.⁸⁹

Finally, few state preschool programs are old enough to be studied for evidence of longer-lasting social and behavioral outcomes. Indeed, only two of the studies we examined considered social or behavioral outcomes extending into adulthood. In both cases, the results were encouraging. One study of Head Start identified a positive significant effect on a long-term outcomes index that included graduation rates, educational attainment, crime, and teen parenthood for participants when they were at least 19 years of age.⁹⁰ (For an in-depth discussion of Head Start's impacts, see "Do Head Start Gains 'Fade Out'?" on page 17.) Likewise, a study of the long-term effects of Oklahoma's 4-year-old program found a significant reduction in the likelihood of criminal activity among African American youth at ages 18 and 19.⁹¹ As with shorter-term social-emotional and self-regulation skills, more research is needed to draw conclusions about preschool's effects in this domain.

Table 6
Preschool Programs Can Benefit Children’s Social-Emotional and Executive Function Skills

✓ Evidence of better outcomes than comparison group children | 0 No evidence of difference between participants and comparison group children | X Evidence of worse outcomes than comparison group children

School Entry

Program (Study)	Social-Emotional Skills ^a			Executive Function		
Boston Public Schools K1 (Weiland & Yoshikawa 2013)	✓	0		✓	0	
California’s Transitional Kindergarten (Manship et al. 2017)	✓	0			0	
Georgia’s Pre-K Program (Peisner-Feinberg et al. 2014)		0				
Head Start (U.S. Department of Health and Human Services 2010)	✓	0				
San Francisco Preschool for All (Applied Survey Research 2013)				✓		
Tennessee Voluntary Pre-K (Lipsey, Farran, & Durkin 2018)		0				
✓ Evidence of better outcomes than comparison group children	3			2		
0 No evidence of difference between participants and comparison group children		5			2	
X Evidence of worse outcomes than comparison group children			0			0

Early Elementary School

Program (Study)	Age	Social-Emotional Skills ^a			Executive Function		
California’s Transitional Kindergarten (Manship et al. 2017)	Kindergarten		0			0	
Head Start (U.S. Department of Health and Human Services 2010)	Grades k-1	✓	0	X			
Head Start (U.S. Department of Health and Human Services 2012)	3rd grade	✓	0	X			
North Carolina Pre-K (Peisner-Feinberg et al. 2017)	Kindergarten		0		✓	0	
Tennessee Voluntary Pre-K (Lipsey, Farran, & Durkin 2018)	Grades k-3		0	X			
✓ Evidence of better outcomes than comparison group children		2			1		
0 No evidence of difference between participants and comparison group children			5			2	
X Evidence of worse outcomes than comparison group children				3			0

^a The measures used to gauge children’s social-emotional development vary across program evaluations, but commonly include parent and/or teacher reports of children’s behavior—particularly the incidence of aggressive or withdrawn behaviors—and social skills.
 Note: Categories are not mutually exclusive because studies often examine multiple measures within a single domain.
 Source: See Appendix D for full source information.

Why Do Outcomes Differ Among Programs?

Preschool can substantially improve children’s school readiness, and beyond school entry, the evidence of preschool impacts is promising. Evaluations of many preschool programs have found meaningful impacts of participation that persist into elementary school on at least some of the child outcomes they measured. Despite these trends, conclusions about the overall effects of preschool are muddled by the common finding that some of the academic advantages conferred to preschool participants relative to their peers tend to be less visible when children are followed later in school.

Some mistakenly conclude that these findings imply that children who participate in preschool actually stagnate or lose skills and knowledge over time. In reality, children who participated in preschool continue to learn as they progress through school. What the findings from these program evaluations instead indicate is that preschool participants and comparison group children often perform more similarly on the outcomes measured over time, so that eventually there is no longer a significant difference in their performance. That is, their performance converges.

There are many possible explanations for this, including the experiences of the group of children to which participants are compared, which outcomes are measured, variation in program quality, and the quality of subsequent school experiences. Each of these explanations has the potential to shape the conclusions that should be drawn about the value of investing in preschool.

Early Learning Experiences of Comparison Children

When analyzing the preschool evaluation literature to determine the value of investing in early childhood, it is important for researchers and policymakers to consider the experiences of the comparison group. The lack of preschool alternatives in the settings and era in which Perry Preschool and the Abecedarian Project were evaluated allowed for a clean test of high-quality preschool against the alternative of no center-based care.

But modern program evaluations must contend with a much less clearly defined set of alternatives. By 2012, 66% of American children ages 3–5 participated in formal early care and education.⁹² Thus, while many children may not have had access to high-quality programs without publicly funded preschool, most children attended some form of center-based care. Even in a randomized control trial, assigning a child to the study’s comparison group—composed of those who do not attend a specific preschool program that is under study—does not mean they will not attend an early education program at all. They may ultimately attend the same preschool program in another year or location. Or, they may attend another early care and education program that confers similar benefits.

As Appendix C demonstrates, when evaluators do collect information about the early care experiences of children in the comparison group, they usually find that at least some of the children are exposed to another early learning experience, including a different center-based preschool. The comparison, then, is often not between preschool and no preschool, but rather between a specific preschool and some other, often unknown, mix of subsidized and unsubsidized early care and education, which might be equally effective but not available to serve all children who need it.

Understanding the experiences of children who are not in the treated group is crucial for interpreting the meaning of evaluation findings. If researchers find that children who have attended a publicly funded preschool program experience learning gains similar to those of comparison group children attending other preschools, the “no effect” finding may actually mean that both sets of programs have positive effects of approximately the same size, rather than that the program has no effect on learning.

And, it sometimes happens that comparison groups shift over time because some families leave the group as they are followed over the years. If this results in a group that is more socioeconomically advantaged than the group of children in the treatment group, the later differences in performance may be a function of their advantage rather than of preschool effects. When evaluators make comparisons between recipients of preschool and non-recipients in a socioeconomically similar comparison group, the impacts of the programs are consistently large and persistent.⁹³

Measures Related to Long-Term Success

Most discussions of preschool effectiveness and the so-called “fade-out” phenomenon focus on cognitive and academic outcomes. Yet many of the long-term outcomes that preschool programs hope to impact may actually be derived from social-emotional or behavioral skills, such as motivation, perseverance, and tenacity.⁹⁴ For children entering elementary school, the capacity to manage peer relationships, follow instructions, pay attention, and persist in the face of challenges predicts more positive attitudes about school, fewer problem behaviors, and higher rates of high school graduation.⁹⁵

Advantages in these skills may help to explain why lasting impacts are prevalent in studies that follow participants into adulthood. Several programs that have been rigorously evaluated into young adulthood have found lasting gains in social-emotional development, school progress, and behavioral outcomes, including the Perry Preschool Project,⁹⁶ the Abecedarian Project,⁹⁷ the Child-Parent Centers,⁹⁸ Oklahoma’s 4-year-old program,⁹⁹ and Head Start.¹⁰⁰ In the case of Perry Preschool¹⁰¹ and Head Start,¹⁰² this pattern appears even while differences on tests of intelligence or achievement in elementary school appear to diminish in comparison with other children.

If evaluators are only concerned with whether students maintain a test score advantage in elementary school, they may miss preschool’s effects on better predictors of children’s long-term success. As such, evaluators should continue efforts to develop measures designed to capture likely precursors of school progress and longer term success, which may include children’s self-competency, learning orientation, and scholastic motivation.¹⁰³

Preschool Program Quality

There is broad agreement that implementing a high-quality program is crucial for promoting desired child outcomes, and it may be that not all programs are of high enough quality to generate lasting impacts. The substantial body of research on programs that succeed in preparing children for school, as well as professional standards for early education, identify important elements of preschool quality.¹⁰⁴

These elements include

- sufficient learning time and small class sizes with low student-teacher ratios;
- well-prepared teachers who provide engaging interactions and classroom environments that support learning;
- ongoing support for teachers, including coaching and mentoring, with program assessments that measure the quality of classroom interactions and provide actionable feedback for teachers to improve instruction;
- research-based, developmentally appropriate early learning standards and curricula;
- assessments that consider children’s academic, social-emotional, and physical progress and contribute to instructional and program planning; and
- meaningful family engagement.

Most or all of these elements are present in the programs that demonstrate the strongest and most persistent impacts on children.¹⁰⁵ Yet these quality benchmarks are not consistently applied across all states and localities that offer public preschool.¹⁰⁶ Even where quality assurance policies are in place, the nature and quality of children’s experiences in the classroom—typically assessed by specially trained assessors using structured classroom observations—tend to be highly variable.

It is also difficult, if not impossible, to isolate the contributions of each quality element, such as teacher preparation requirements or class sizes, to the overall effects of a program. Furthermore, evaluations of preschool programs tend to inconsistently document the features of the programs under study, making it difficult to systematically analyze the characteristics of effective programs and evaluate the impact of programs that include some, but not all, quality elements. Nonetheless, the two most cited counterpoints to preschool effectiveness (Head Start and Tennessee) offer evidence of the role of quality in sustaining preschool gains.

For example, research demonstrates that Head Start programs have tended to vary significantly in terms of many elements of quality, including effective family engagement strategies, use of assessment data to inform instruction in the classroom, availability of coaching to support effective teaching practices, length of the program day, and observed classroom quality.¹⁰⁷ A recent reanalysis of the Head Start Impact Study found that quality inputs vary significantly across Head Start programs and that these inputs, including the number of instructional hours (dosage) children receive, appear to explain a substantial proportion of the variation in Head Start effectiveness across programs.¹⁰⁸ In fact, a group of expert researchers and practitioners, chartered to provide recommendations for improving Head Start in response to the findings of the Head Start Impact Study, concluded that Head Start needed to make substantial quality improvements—recommendations the federal government has moved to address.¹⁰⁹ Preschool quality is also a suspected contributor to the Tennessee story. (For a detailed analysis, see “Does Tennessee’s Evaluation Prove That Preschool Doesn’t Work?” on page 16.)

By contrast, programs that have demonstrated evidence of more consistent impacts throughout elementary school, such as the New Jersey Abbott Preschool Program and North Carolina Pre-K, may maintain higher, more consistent levels of quality. For example, New Jersey’s Abbott Preschool Program adheres to structural standards associated with successful programs, including class sizes capped at 15 children with a qualified teacher and aide, which has resulted in a teacher-child ratio

that exceeds professional standards set by the National Association for the Education of Young Children.¹¹⁰ Furthermore, both New Jersey and North Carolina have invested significantly in their early education workforce by offering scholarships, providing paid professional learning time, and connecting higher qualifications to higher wages.¹¹¹

Studies have found that it is important for teachers to have knowledge about child development and instruction for young children, including knowledge that is specific to the age group they teach.¹¹² A strong teacher preparation pipeline, such as the one that North Carolina has built through its Training, Education, and Compensation Helps, or T.E.A.C.H., program,¹¹⁵ can help ensure a sufficient supply of qualified teachers and provide adequate compensation for early educators.

These comparisons suggest there are quality questions that might explain differing findings across studies.¹¹⁴

Later School Quality

Finally, early childhood researchers have often invoked the analogy of vaccination to suggest that it may be unreasonable to expect a single dose of preschool to permanently inoculate children from the ongoing detrimental effects of living in poverty and attending low-quality schools.¹¹⁵ Given the evidence that schools serving children from low-income families are often underresourced,¹¹⁶ another compelling explanation for studies sometimes finding a lack of sustained gains from preschool is the low quality of schools that many participants may subsequently attend. Research suggests that children from low-income families who attend high-quality preschool programs such as Head Start are more likely to attend low-quality and low-performing schools, compared to their counterparts.¹¹⁷ For example, evidence from a study that used nationally representative data found that Head Start participants attended schools with lower achievement in mathematics and reading, more children of color, and more children eligible for free and reduced-price lunch than other children.¹¹⁸

It may be unreasonable to expect a single dose of preschool to permanently inoculate children from the ongoing detrimental effects of living in poverty and attending low-quality schools.

There are many reasons that later school quality could contribute to converging outcomes between preschool graduates and their peers. One explanation that is particularly relevant to the preschool discussion is that in lower quality and lower performing schools, teachers may be ill equipped to support the development of children who vary substantially in the knowledge and skills they bring into the classroom. It is possible that underprepared and under-supported teachers focus more of their attention on the lowest performers in early elementary school. If true, this focus could lead preschool attendees in these settings to be less challenged academically than they might otherwise be, which could reduce differences between them and their peers on measures of academic skills. Alternatively, strong peer effects often operate in classrooms.¹¹⁹ If teachers are equipped with the skills and competencies necessary to individualize instruction, the scores of all students could be buoyed by the presence of preschool participants in the classroom.

There are few studies that directly assess the relative impact of preschool and subsequent public school quality. However, one study found that exposure to a classroom-based intervention targeted toward improving children's emotional and behavioral adjustment in Head Start classrooms had significant effects on academic and behavioral outcomes, and that the convergence of child outcomes was slower for children who attended high-performing elementary schools.¹²⁰ Another, more recent, study analyzed data from the Early Childhood Longitudinal Study–Kindergarten Cohort and found that academic benefits of preschool experiences were sustained when children subsequently attended high-quality elementary schools (such as those with low child-teacher ratios, low turnover, and a positive school climate). Children who attended lower quality schools saw few long-term benefits.¹²¹

The most compelling evidence of the relationship between later school quality and the impact of preschool on child outcomes comes from a 2017 analysis.¹²² The study compared the adult outcomes of children who were differentially exposed to changes in Head Start spending and public k–12 school spending, based on the place and year of their birth. Results indicate that for children from low-income families, greater Head Start spending and public k–12 spending each individually increased educational attainment and reduced the likelihood of poverty and incarceration in adulthood. However, the benefits of Head Start spending were larger when followed by access to better funded schools, and the increases in k–12 spending were more impactful when children were exposed to greater early childhood spending. This evidence suggests that investments in preschool enhance success in elementary school, while investments in elementary school are critical to sustaining preschool gains.

Lessons From Preschool Research

This review set out to distill lessons for preschool policy from the broad and ever-expanding research base to address the debate surrounding the effectiveness of preschool. From this review, it's clear that there is not a single, best approach to preschool evaluation. Whatever the methodology, the way a study is structured and how it unfolds has implications for its findings—such as which outcomes are measured, whether the research accounts for the experiences of comparison group children, and how much attrition from the sample occurs.

Taking these factors into consideration, we find that the weight of the evidence indicates that high-quality preschool is an effective strategy for improving children's school readiness. This conclusion aligns with the growing consensus that effective preschool leaves children better prepared for school and can have long-lasting impacts on children who participate. At this point, it seems that the most useful policy questions are less about whether preschool is effective and more about asking how to ensure that a preschool program is effective.

Preschool Has Significant Benefits

The weight of the evidence reviewed in this report clearly indicates that high-quality preschool has positive impacts on children's school readiness. Other recent analyses of the literature have also reached this conclusion.¹²³ Preschool also has benefits for key school progress indicators. Most studies that follow children into late elementary and middle school find evidence that preschool participation has positive impacts on grade retention and special education placements, which generate cost savings for school systems.¹²⁴ Finally, although evidence is more limited with regard to social-emotional and behavioral outcomes, recent studies are promising.

We have discussed the fact that test score differentials between participants in some preschool programs and comparison group peers (who have also often attended preschool) are inconsistently observed beyond kindergarten. This can occur for a variety of reasons, ranging from challenges in maintaining comparable comparison groups to differentials in preschool or elementary school quality. Nonetheless, evidence from places such as Tulsa, Oklahoma; New Jersey; and Washington suggest that publicly funded preschool has the potential to produce substantial, sustained academic gains.

Few studies of state preschool programs have followed children beyond adolescence. However, studies of the Abecedarian Project, Perry Preschool Project, and Chicago Child-Parent Centers followed children into adulthood and found additional benefits for graduation rates and educational attainment, which generated cost savings for society as a whole. These long-term benefits appeared whether or not test score differentials were consistently found, suggesting that the range of cognitive, social, and emotional skills and abilities children develop in preschool and carry through grade school may serve them well in a variety of ways throughout life.

Does Preschool Pay for Itself?

When it comes to public investments, policymakers looking to wisely spend public dollars are often interested in understanding how the costs of a program compare with its anticipated benefits. Preschool programs are often held up as savvy investments, in large part due to economic analyses signaling large returns on investment. Estimates of returns on investment in preschool range from the modest (\$2 for every \$1 invested)¹²⁵ to the substantial (\$17 for every \$1 invested).¹²⁶

What explains this variability? The timing of cost-benefit analyses and the outcomes that evaluators measure directly affect the size of an estimated return. The largest returns have been observed among high-intensity programs such as the Perry Preschool Project, the Abecedarian Project, and the Chicago Child-Parent Centers that followed students for decades and have documented long-term benefits such as higher graduation rates, lower rates of incarceration, lower rates of teen pregnancy, and higher earnings well into adulthood.

More modest returns from contemporary programs, on the other hand, are usually based on short-term benefits such as reductions in special education placements and grade retention in elementary and middle school.¹²⁷ These can be expected to predict longer term benefits as children grow into adulthood and are more likely to graduate and gain productive employment.

Importantly, however, no cost-benefit analysis of a preschool program has ever found zero return, and any return that exceeds \$1 for every \$1 spent means the program pays for itself and more.

Research Should Inform the Design of Effective Programs

Although evaluators have yet to isolate all the ways in which preschool and later school quality may affect the presence and magnitude of impacts over time, it is clear that, in order to generate and maintain meaningful gains, young children need rich and engaging experiences in preschool and subsequent grades that capitalize on their readiness to learn. More research is needed to understand how to craft the types of high-impact experiences that consistently generate and maintain such gains.

Meanwhile, there are lessons to be learned from the current research on preschool quality that suggest directions for policymakers to consider now. Specifically, a substantial body of research on programs that succeed in preparing children for school identify important elements of preschool quality,¹²⁸ including sufficient learning time and low student-teacher ratios; well-prepared and well-supported teachers; research-based, developmentally appropriate early learning standards and curricula; assessments that contribute to instructional and program planning; and meaningful family engagement.

In order to generate and maintain meaningful gains, young children need rich and engaging experiences in preschool and subsequent grades that capitalize on their readiness to learn.

Most or all of these elements are present in the programs that demonstrate the strongest and most persistent impacts on children.¹²⁹ Although the idea that a program should seek to implement such features with fidelity may seem obvious, this is much easier said than done. One likely reason is

limited resources. The elements of high quality—such as compensation and support for a highly qualified and well-compensated workforce, a program day that provides adequate productive learning time and activities and supports parental work, and family engagement that improves parent-child relationships—are complex to implement and are often expensive. Studies of how well-functioning state preschool programs are designed and implemented can help policymakers and practitioners make thoughtful decisions.¹³⁰

Finally, when it comes to sustaining gains from an effective preschool program, research suggests the importance of looking beyond the preschool years. A year or two of even the highest quality preschool cannot inoculate children from the detrimental effects of impoverished communities and poor elementary or secondary schooling. It is critical for policymakers to understand that, while the quality of early learning instruction is important for immediate outcomes, sustained benefits likely require comprehensive investments in children and their families. Because policymakers often operate within significant resource constraints that force tradeoffs, future research should work to uncover the various elements of preschool and primary school quality to identify those that are the most crucial for improving child outcomes.

Despite these open questions, the evidence indicates that high-quality preschool remains a worthy public investment. Rather than continuing to debate whether to invest in preschool, policymakers should focus their attention on understanding what must happen in a preschool classroom as well as in the k–12 school system to ensure their investments pay off.

Appendix A: Literature Selection

To convey what research indicates about the effects of preschool on children’s short and longer term outcomes, we analyzed 30 studies of 21 preschool programs. To select these studies from the substantial preschool literature, we focused specifically on evaluations of contemporary, publicly funded preschool programs operating at scale, including Head Start, as well as state and municipal preschool programs. Each evaluation was published in the year 2000 or later and includes measures of children’s academic or social-emotional and behavioral outcomes. We further limited our analysis to studies that employ an experimental or a quasi-experimental comparison group. Because the impacts of preschool at school entry—at the end of preschool or beginning of kindergarten—have been extensively studied, our analysis of this time horizon includes only studies that use one of two strong designs: a randomized control trial or regression discontinuity design. The nuances of these designs are described in additional detail in Appendix B, but both are regarded as rigorous when used effectively. The discussion of outcomes at school entry includes studies of 18 programs.

Studying the outcomes of preschool programs beyond children’s school entry is more complex, and there are far fewer studies of these longer term outcomes available. To ensure we captured a robust cross-section of the literature on longer term outcomes, we examined not only studies using randomized control trials and regression discontinuity designs, but also other strong quasi-experimental designs with comparison groups. The relative strengths and limitations of these designs are discussed in Appendix B.

To further expand the literature base on outcomes beyond school entry, we looked for recent studies of outcomes in both the early elementary grades (kindergarten through 3rd grade) and later years (4th grade into adulthood). Where outcomes have been evaluated in the early elementary grades and later in childhood or adolescence using a strong experimental or quasi-experimental design, we include both studies in the review. We have endeavored to be consistently clear about children’s ages and grade levels at the time outcomes were measured for each study.

To identify this literature base, the research team began by creating a list of recent, known preschool evaluations. We supplemented this list of studies with a systematic internet search. Because we focus on evaluations of preschool programs, we began with a list of states and cities with publicly funded preschool programs operating at scale and used Google to locate evaluations that met our criteria for inclusion—published after the year 2000, examining children’s short or longer term outcomes, and using an experimental or quasi-experimental approach. Key terms used in these searches include state and program names, “state pre-k,” “impact,” “effect,” “children,” and “findings.” We then used the National Institute for Early Education Research’s *State of Preschool Yearbook, 2016* and Research Connections’ *State Preschool Program Evaluations and Research: Research-to-Policy Resources* to identify evaluations that may not have emerged during this search. Although we endeavored to undertake an exhaustive search of recent literature, it is possible that we overlooked relevant studies. Where multiple studies of a single program examining a similar age group and using similar methodologies were available, we selected the most recent for inclusion in the review.

We then reviewed each study, noting its methodology, measures of child outcomes, and findings to inform our description of the extant literature on preschool. These details are compiled by program and study in Appendix C.

We recognize that this methodology is not without limitations. Our purposes are primarily descriptive and focus on a qualitative analysis of the existing research in order to convey the research base in accessible ways. Formal meta-analyses—several of which exist on this topic and are cited in this report—provide quantitative summaries of the existence and extent of preschool’s effects. We are also unable to do more than hypothesize about the potential mechanisms that drive the results that we describe. Though we strive to provide research-based explanations of what has been observed in the literature, additional research is needed to confirm which of these hypotheses may explain the results of any given evaluation.

Appendix B: Unpacking the Methodological Nuances of Preschool Evaluation

Calculating the impact of publicly funded preschool requires making comparisons between children who attended a given preschool program (the treated group) and those who did not (the comparison group). A fundamental challenge in this enterprise is selecting these two groups of children in such a manner that they do not meaningfully differ on any characteristics that affect their academic success, save for their preschool experience. This is not an easy task. Which preschool children attend, be it public or private, or whether they attend any program at all, is influenced by multiple factors, from family-level characteristics such as their socioeconomic circumstances and parents' preferences for education, to the quality and proximity of preschool centers.

These factors are also likely to influence a child's academic career irrespective of their preschool experience. For example, parents who choose to send their daughter to a state preschool might also choose to make other investments in her academic growth, such as frequently reading to her, which would enhance her kindergarten readiness whether or not she went to preschool. Without accounting for such differences, a comparison of her literacy skills to those of her classmates who did not attend preschool will conflate the effect of preschool attendance with the effect of her parents' behavior. Researchers are rarely able to measure all of these relevant factors and thus cannot separate out the effects of preschool without careful research design.

This literature review chose several research designs that can, when well implemented, provide credible, apples-to-apples comparisons between children who attend a given preschool program and those who do not. When reviewing the impacts of preschool on students in their kindergarten year, we selected studies that used one of two rigorous research designs: randomized control trials, in which children are assigned to attend preschool or not by a random number generator, and regression discontinuity designs, in which children either attend preschool or not based only on which side of the age cutoff their birthdays fall. When well executed, these are both considered highly rigorous research designs. Because, for reasons explored in depth below, there is a comparative dearth of randomized control trials and regression discontinuity designs examining the effects of preschool past kindergarten, when reviewing performance in elementary school and beyond we expand our methodological catchment to include quasi-experimental designs—research strategies that attempt to construct a valid comparison group in the absence of formal randomization or an arbitrary age cutoff. If undertaken carefully, these designs can, theoretically, uncover the correct impact of prekindergarten.

When used to study children in a real-world context, however, even the strongest methods have limitations, and careful attention must be paid to exactly what is being calculated in each study. Evaluations of Head Start are perfect examples of this principle, where the conclusions one makes about the program's efficacy hinge crucially on the relative strengths and weaknesses of the methods used therein. This appendix highlights salient features of each research design that can affect how one interprets results from the studies contained in the main body of this review. It also defines a common metric used to compare results across studies using different methodologies and measures—the effect size.

Randomized Control Trials

The most credible method of selecting treatment and comparison groups is a randomized control trial (RCT), in which children are assigned to attend a particular prekindergarten program via a random number generator. Because a random number generator cannot possibly be biased in favor of certain children receiving the treatment or not, RCTs are considered the “gold standard” method of eliminating bias from analyses of preschool programs. While that opinion is warranted in the abstract, the way in which RCTs operate in reality often diminishes their comparative advantage over other methods. Three aspects to which careful attention should be paid are: (1) which children remain in the study, (2) who among the treated and comparison groups is actually given the treatment, and (3) what the program under study is being compared to.

Differential attrition: Which children are actually studied?

After a group of children has been selected for participation in a study and the treatment has been randomly assigned, some children inevitably leave the study. Sometimes, substantially more children leave the comparison group than the treatment group, or vice versa. The study of Tennessee’s prekindergarten program was hampered by this seemingly trivial issue that, in reality, threatens the validity of random assignment. The study was designed as a randomized control trial, with children randomly assigned to either attend or not attend the preschool. However, after being told their treatment status, more children in the comparison group dropped out of the study than did children in the treatment group. This differential attrition threatens the validity of the impact estimates because it introduces selection bias into the treatment and comparison groups as analyzed rather than as assigned. If the comparison group children who dropped out of the study performed worse than the comparison group as a whole on standardized achievement tests in subsequent grades, the impacts of the Tennessee program will appear lower than they really are. This is a common problem in RCTs and any other research design in which data is collected specifically for a particular study, as opposed to studies that rely on large administrative datasets. For example, the regression discontinuity study of the impact of Oklahoma’s 4-year-old program on adolescent criminal behavior used comprehensive birth and criminal justice records from the state, reducing the potential for differential attrition.

Noncompliance: Which children are actually treated?

Formally, RCTs of preschool programs randomly assign the offer of a slot in the schools, not the slots themselves. For both ethical and practical reasons, researchers cannot compel study participants to perfectly comply with their randomly assigned treatment offer. The Head Start Impact Study illustrates this issue. Twenty-three percent of the children who were offered a seat in Head Start did not accept it, while 14% of the children who were not offered a seat attended a nearby Head Start anyway. This noncompliance creates two conceptually distinct treatments: (1) the offer of attendance and (2) the actual attendance. As the offer of prekindergarten attendance is truly random, noncompliance does not impact the validity of the effects of the offer. These estimates are often called policy effects because they reflect the impact of creating a policy expanding the availability of a noncompulsory preschool program. Still, the effects of actually attending a prekindergarten program are important too, as they reflect the impacts on children who will comply with the offer and are a gauge of the program’s efficacy. To calculate the effect of attending a preschool, researchers must deal with imperfect compliance because the choice over whether to accept the treatment offer or, conversely, seek treatment elsewhere introduces

some selection bias into the study. The statistical procedure used to overcome this bias can be compromised by a high degree of noncompliance due to the weakened ability to detect an effect of the program—what researchers call the statistical power of the study.

These issues play out in the Head Start Impact Study, in which the impact of receiving an offer of a slot in Head Start is lower than the impact of actually attending Head Start, reflecting the study's moderate degree of noncompliance. This is particularly problematic in the sample of 3-year-olds, in which the comparison group could reapply for Head Start attendance in the second year of the study, by which time half of the original comparison group was attending some Head Start center. When following the study children into elementary school, the impact of Head Start on these children's numeracy and literacy skills is indistinguishable from zero by 1st grade. However, that conclusion is mostly driven by the fact that noncompliance has weakened the ability of the researchers to draw conclusions about the impact of Head Start on 1st grade skills—it might be as large as .3 standard deviations (quite large by education standards) or even slightly negative. If all children remained in their randomly assigned treatment group, then the observed effect of .1 standard deviations would very likely be statistically distinguishable from zero and the research community would be confident in claiming that Head Start has an impact into 1st grade. In reality, the determination of parents to place their children in a Head Start center has obfuscated the study's ability to make strong claims about the impact of the program. This is an inherent limitation of RCTs in a context in which ethical and pragmatic concerns prevent researchers from enforcing strict compliance with the treatment assignment.

Counterfactual: What are the experiences of the comparison group?

In a randomized control trial, as in other designs, we often do not know what the experience of the comparison group is. Do they stay at home with a relative or do they attend an equally efficacious preschool? Not knowing is problematic because the observed impact of the preschool under study on children's kindergarten readiness (or any other outcome) can differ depending on what the treated children would have done in the absence of the program—the counterfactual. In the late 1960s, when the RCT of the Perry Preschool Project was undertaken, few of the children in the study would have had access to center-based preschool. The impact from this study can therefore be assumed to be the impact of attending Perry Preschool versus staying at home with a relative. However, when the Head Start Impact Study was fielded decades later, many of the children in the study would have attended a state preschool program if not for attending Head Start. Indeed, this is what we see in the data—32% of the comparison group actually attended some form of center-based preschool. The overall impact of Head Start in this scenario is a mix of two different effects—the impact of attending Head Start instead of another public preschool program, and the impact of attending Head Start instead of staying at home with a relative. When researchers have attempted to separate out these two effects, they have found a larger impact on those children who would likely have stayed home than on those children who would likely have attended a center-based preschool. This underscores the importance of considering the counterfactual in evaluations of preschool programs—whether evaluations utilize an RCT or some other methodology.

Regression Discontinuity

In a regression discontinuity design, children who qualify for preschool based on their birthdays are compared to children who just miss the age cutoff for participation and must wait another year before entering the program. Because a subset of these children is merely days apart in age from those who have qualified, researchers assume that these children are similar at the start of the study. This design can yield strong evidence of the impact of a single year of public preschool.

A critical assumption is that parents are unable to choose whether their children are born on one side of the cutoff or another. Scheduled cesarean sections may threaten the validity of this design, but empirical evidence suggests that parents do not select C-sections to accommodate school entry age cutoffs, despite media accounts of such behavior. Another potential threat to the validity of regression discontinuity designs is that the age cutoff also assigns children to different age-grade cohorts, specifically regarding entry to kindergarten. Parents of the treated group (those in the preschool program) know that their children will be entering kindergarten the following year, whereas the parents of the comparison group (those who just miss the age cutoff) know that their children will have an extra year to prepare for kindergarten. Consequently, the parents of the treated group might make additional investments in their children's academic development in order to prepare for their kids' impending entrance into kindergarten. This scenario would threaten the validity of the regression discontinuity designs because the impact of preschool would be mixed with the impact of differential preparation for kindergarten. It should be noted that evidence of such behavior is difficult to come by because it is mixed with the true impacts of preschool attendance.

Long-term effects

One of the most serious and widely acknowledged limitations of the regression discontinuity design as it is usually implemented in preschool research is the inability to calculate effects past the kindergarten year. There are two reasons for this. First, the children who just miss the cutoff are typically enrolled in the preschool program the following year, eliminating any untreated comparison group. Even if this were not the case and the children who just miss the age cutoff never received treatment, the age-cohort difference forestalls the possibility of making an apples-to-apples comparison because the treated children enter kindergarten at age 5 and the comparison group enters kindergarten at age 6. Given that both time and grade progression impact child development, a valid assessment of a preschool program must compare the treated children to the comparison children at the same age and grade. This is unfortunately impossible in the preschool regression discontinuity designs. For example, if a test is administered in 2nd grade, then the comparison group will be a year older when they receive the test and the difference in age could account for a difference in test performance. Conversely, if a test is administered when the children are 8 years old, then the treated children will have completed an extra year of schooling, which may account for any test score differences. Any subsequent comparisons of these two groups will conflate the effects of the program with age and grade level at the time they are tested.

Quasi-Experimental Designs

Beyond RCTs and regression discontinuity designs, many researchers make use of a broader category of methods often labeled quasi-experimental designs. While there is no agreed-upon definition of a quasi-experimental design, many of the preschool studies that can reasonably fall

into this category share one of two main design features—they either attempt to leverage variation in access to the treatment in order to facilitate apples-to-apples comparisons (*natural experiments*) or they attempt to statistically adjust for any observed differences in the treatment and comparison groups (*matching designs*). The strongest of these studies can mimic random assignment and provide valid estimates of the impact of a preschool program.

Natural experiments

So called because they take advantage of policy differences (an “experiment”) that occur outside of researchers’ comparison (“naturally”), natural experiments can mimic an RCT if children’s differential access to a preschool program is unrelated to other determinants of their development. One common strategy is to evaluate a program that has been expanded over time, particularly if the expansion has happened at different times in different regions. For example, in North Carolina, the state’s program was initiated in 2001 as a pilot serving disadvantaged children. By 2010, the program had expanded to reach roughly a quarter of the state’s 4-year-olds. This allows for a natural experimental design in which children who had access to the program are compared to those who did not because the program was not yet available when they were of age to attend. Similarly, an evaluation of Florida’s Prekindergarten Early Intervention Program compared pairs of siblings in which one attended the program and one did not, merely because the program wasn’t available at their locally zoned elementary school at the time the older sibling was of age to attend. By comparing siblings to one another, the authors eliminated any distortion in the results that arose due to observable and unobservable family and child characteristics. Furthermore, by comparing siblings whose difference in attendance was due only to the timing of program availability, the authors eliminate any bias that could arise when parents choose to send one child but not the other due to unobserved differences in siblings (such as behavior problems). This natural experiment yields strong causal evidence of the impact of the program.

One of the most critical assumptions in these studies is that parents have little choice in whether the preschools are available in their region or at the time their children are of age to attend. This means merely that parents must not have choice over the availability of state preschool for their children. If they did, then the treated and comparison groups would no longer be similar—the comparison group would be made up of children whose parents chose not to make the state preschool available in their region, and this choice might be correlated with family factors that also impact academic development.

Matching

When none of the prior study designs are feasible, researchers sometimes use a matching design. In such a design, children who attend preschool are matched to a group of children who do not but are similar with respect to demographic characteristics that may influence academic development. The validity of this design rests on having the correct demographic variables, and so it is important to realize that matching is not a monolithic approach—like any research design, it can be done poorly or well. If all the relevant child characteristics are included in the matching design, then this method does indeed mimic a randomized control trial and provides accurate impacts of preschool.

Unfortunately, it is exceedingly difficult to adjust for all the plausibly relevant differences between children who attend preschool and those who do not. For instance, parents may be more likely to send their children to a state preschool if they are in need of cognitive support. If true, the

children who attended would likely have scored lower on cognitive achievement tests—without the program—than those children who did not attend. If this difference in cognitive development is even partially unrelated to the demographic variables typically collected in preschool studies, a matching design will underestimate the impact of the program. However, an alternate scenario could be described in which parents who send their children to a state preschool also invest more heavily in their children’s cognitive development in additional, unobservable ways. This would likely lead a matching design to overstate the impact of the program by partially ascribing test score gains to the preschool program when they are in fact due to differences in parenting. For this reason, the data on students used in matching designs is of critical importance—the matching must account for all differences in the treatment and comparison groups that affect academic development.

Additional methods not considered in this review

Many social science methods exist that may be employed to help understand how preschool affects children, from experiments in a child development laboratory to classroom observations and parental surveys. While each of these has particular advantages for gaining certain insights, we endeavored to focus on the research designs best suited to generating quantitative, causal estimates of the impact of prekindergarten.

Interpreting Effect Sizes

Researchers often describe the impact of an intervention in terms of effect size—a standardized measure of the impact’s magnitude that can be compared across interventions and outcome measures. While many types of effect size can be computed, perhaps the most common measure is the impact of a program in terms of standard deviations of the outcome variable.¹³¹ While this metric is useful and widely understood by the research community, there is no consensus on which magnitudes are meaningful. One oft-cited guide suggests that .2 standard deviations should be considered “small,” .5 “medium,” and .8 “large.”¹³² By this scale, many impacts of early childhood programs would be considered small, but that label risks undervaluing the effects of preschool. The social importance of any effect size is dependent on context. For example, the association between smoking cigarettes and dying from any form of cancer is approximately .6—merely a medium effect size according to the aforementioned scale.¹³³ In rigorous education research, effect sizes are typically in the range of .1 to .25.¹³⁴ Even large policy changes, such as implementing school busing programs and shifting school accountability systems, have “small” effect sizes.¹³⁵ While effects of .1 standard deviations may appear small, they nevertheless represent typical effects in rigorous education research, making them meaningful despite their size.

Appendix C: Study Descriptions and Findings

The following table outlines the literature reviewed for the discussion of preschool impacts in this report, including key facts about each preschool program, the evaluation methodologies, and findings related to children’s outcomes. Where studies include evaluations of multiple programs, we have reported the study findings discretely by program whenever possible in this appendix; as a result, one study is included more than once in this appendix. Note: Throughout the table below, the abbreviation “ES” refers to effect size.

Program and Overview	Study	Evaluation Methodology	Findings
<p>Arkansas Better Chance (ABC) program</p> <p>The Arkansas Better Chance (ABC) early childhood education program was first offered in 1991, with a significant expansion in funding in 2004. In FY2005, ABC served 9,316 3- to 5-year-olds across Arkansas with voluntary preschool. Another 5,242 children received voluntary home visits through the program. By 2010–11, 44% of the state's 4-year-olds were served by the program. ABC serves children in families with low incomes or other risk factors. Most programs are delivered in public schools, but other settings, such as child care and Head Start centers, are allowed. Lead teachers in public schools are required to hold a bachelor's degree with preschool through 4th grade certification (p-4); in other settings, for every three classrooms one teacher must hold a bachelor's degree. Nearly all teachers (94%) held at least a bachelor's degree in the 2007 study group.</p>	<p>School Entry</p> <p>Hustedt, J. T., Barnett, W. S., Jung, K., & Thomas, J. (2007). <i>The effects of the Arkansas Better Chance Program on young children's school readiness</i>. New Brunswick, NJ: National Institute for Early Education Research.</p>	<p>Regression discontinuity design examining cognitive outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> Data from 2005 n = 911 children Sample characteristics: 6% Latinx, 36% African American, 57% White, 1% Asian, 0.3% American Indian Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the previous early learning experiences of comparison group children is not available. Measures of child outcomes: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) Preschool Comprehensive Test of Phonological and Print Processing—print awareness (English and Spanish) Woodcock-Johnson Tests of Achievement—Applied Problems subtest (English and Spanish) <p>Other methodological details: Classrooms and children were randomly selected for participation in the study. A parallel longitudinal matching design was implemented concurrently to allow researchers to examine longer term effects of the program.</p>	<p>With 1 year of preschool, significant positive outcomes for all the early learning measures reported:</p> <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.36) Print awareness (ES = 0.76) Applied Problems (ES = 0.24)
<p>Elementary School</p> <p>Jung, K., Barnett, W. S., Hustedt, E., & Francis, J. (2013). <i>Longitudinal effects of the Arkansas Better Chance program: Findings from first grade through fourth grade</i>. New Brunswick, NJ: Rutgers University, National Institute for Early Education Research.</p>	<p>Ordinary least squares regression analysis examining academic achievement 1st through 4th grade</p> <ul style="list-style-type: none"> Data from 2008 to 2010 for two cohorts of children, who attended public kindergarten in 2005–06 school year (cohort 1) and 2006–07 school year (cohort 2) n = 1,555 children in 2010 (sample sizes varied slightly each year of the study) Sample characteristics (2010): <ul style="list-style-type: none"> 64% White or Asian, 31% Black, 5% Hispanic 40% eligible for free lunch, 9% eligible for reduced-price lunch, 42% paid lunch, 9% lunch status not available Comparison group: Comparison group children attended public kindergarten in 2006–07, but not ABC preschool. Of the 810 children in the comparison group, 442 did not attend any prekindergarten, and 368 attended a non-ABC prekindergarten option. Measures of child outcomes: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary Woodcock-Johnson Tests of Achievement—Composite of Reading Fluency, Letter-Word Identification, Word Attack, and Passage Comprehension subtests (English and Spanish) Woodcock-Johnson Tests of Achievement—Composite of Applied Problems, Calculation, and Math Fluency subtests (English and Spanish) Grade retention <p>Other methodological details: A regression discontinuity design study of kindergarten outcomes was used to estimate the extent of selection bias; effects identified using the regression discontinuity design were 1.3 to 1.8 times greater than using the matching design. Only one cohort of children was tested through 4th grade; the second cohort was tested through 3rd grade only.</p>	<p>When comparing ABC participants to children with no other prekindergarten, significant positive outcomes for:</p> <ul style="list-style-type: none"> Receptive vocabulary at the end of 1st (ES = 0.14) and 2nd (ES = 0.14) grades Composite math at the end of 1st (ES = 0.12) and 2nd (ES = 0.16) grades Composite literacy at the end of 1st (ES = 0.15), 2nd (ES = 0.11), and 3rd (ES = 0.13) grades <p>The cumulative retention rate for ABC participants was 3.4 percentage points lower than children without any reported prekindergarten.</p> <ul style="list-style-type: none"> No significant outcomes for: <ul style="list-style-type: none"> Receptive vocabulary or composite math at the end of 3rd or 4th grades Composite literacy at the end of 4th grade 	<p>The cumulative retention rate for ABC participants was 3.4 percentage points lower than children without any reported prekindergarten.</p> <ul style="list-style-type: none"> No significant outcomes for: <ul style="list-style-type: none"> Receptive vocabulary or composite math at the end of 3rd or 4th grades Composite literacy at the end of 4th grade

Program and Overview	Study	Evaluation Methodology	Findings
<p>Boston Public Schools K1</p> <p>Boston Public Schools served more than a third of all 4-year-olds in the city—over 2,000 children—through its universal Kindergarten 1 (K1) preschool program in 2008–09. The program provides a full day of preschool throughout the school year. It is school-based and includes exposure to research-based language, literacy, and mathematics curricula. All teachers must hold a bachelor's degree and earn a master's degree within 5 years of hire. They are paid on the same salary scale as other public school teachers and receive dedicated curriculum coaching from a master educator.</p>	<p>School Entry</p> <p>Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. <i>Child Development, 84</i>(6), 2112–2130.</p>	<p>Regression discontinuity design examining cognitive and social-emotional learning outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> Data from fall 2009, the second year of implementation of dedicated language, literacy, and mathematics curricula $n = 2,018$ children <i>Sample characteristics:</i> <ul style="list-style-type: none"> 41% Hispanic, 26% Black, 18% White, 11% Asian 50% spoke only English, 28% Spanish, 22% another language 69% eligible for free and reduced-price lunch <i>Comparison group:</i> Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Overall, two thirds of the comparison group experienced nonparental care in the year prior to entry into the BPS K1 program. More than half (57%) of these children experienced center-based care at Head Start (16%), public centers (12%), or private centers (29%). <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary Woodcock-Johnson Tests of Achievement—Letter-Word Identification and Applied Problems subtests Research-Based Elementary Mathematics Assessment (subset of items) Pencil Tap, Backward Digit Span, Forward Digit Span, Dimensional Card Change Sort—executive function Emotion Recognition Questionnaire Task Orientation Questionnaire (subset of items) 	<p>With 1 year of preschool, significant positive outcomes for measures of:</p> <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.44) Print awareness (ES = 0.62) Applied Problems (ES = 0.59) and Elementary mathematics assessment (ES = 0.50) Executive function: Pencil tap (ES = 0.21), Backward digit span (ES = 0.24), Forward digit span (ES = 0.24), Dimensional card change sort (ES = 0.28) Emotional development from the Emotion Recognition Questionnaire (ES = 0.19) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> One measure of executive function skills and two measures from the Task Orientation Questionnaire

Program and Overview	Study	Evaluation Methodology	Findings
<p>California Transitional Kindergarten</p> <p>California's Transitional Kindergarten (TK) program was launched in 2010 to offer a new, voluntary grade level for children who fall just below the age cutoff for traditional kindergarten. The program, which is the first year of a 2-year kindergarten program, is available to 4-year-old children with birthdays between September and December, regardless of family income or other risk factors. The school-based program spans an academic year and uses the state kindergarten standards as a curriculum guide. Teachers in the program are required to hold a bachelor's degree and license and are compensated based on the k-12 salary schedule.</p>	<p>School Entry</p> <p>Manship, K., Holod, A., Quick, H., Ogut, B., Brodziak de los Reyes, L., Anthony, J., Jacobson Chernoff, J., Hauser, A., Martin, A., Keuter, S., Vontsolos, E., Rein, E., & Anderson, E. (2017). <i>The impact of transitional kindergarten on California students: Final report from the study of California's Transitional Kindergarten program</i>. San Mateo, CA: American Institutes for Research.</p>	<p>Regression discontinuity design examining cognitive and social-emotional outcomes at beginning and end of the kindergarten year</p> <ul style="list-style-type: none"> Data from fall 2014 and 2015 (two cohorts) n = 6,241 children Sample characteristics: Data are provided from cohort 1. Characteristics for cohort 2 are largely similar and are available in the full report. <ul style="list-style-type: none"> Transitional Kindergarten <ul style="list-style-type: none"> 55.2% Hispanic, 4.5% Black, 26.2% White, 11.8% Asian, 2.4% other 59.4% eligible for free and reduced-price lunch 44.1% English learner 13.2% had parents with education less than a high school degree, 20.2% a high school degree, 16.7% some college, 17.4% associate degree, 18.5% bachelor's degree, 14.1% graduate education Comparison group <ul style="list-style-type: none"> 56.5% Hispanic, 3.9% Black, 27.8% White, 9.9% Asian, 2% other 58.3% eligible for free and reduced-price lunch 39.4% English learner 13.7% had parents with education less than a high school degree, 21.1% high school degree, 17.5% some college, 18.2% associate degree, 15.9% bachelor's degree, 13.7% graduate education Comparison group: Comparison group children did not attend TK due to a strict age-eligibility cutoff and had birthdays no more than 60 days after TK's December 2 cutoff date. Among comparison group children, more than 80% attended a center-based preschool program in the year before kindergarten and more than half attended such a program 15 or more hours per week. Measures of child outcomes: <ul style="list-style-type: none"> Woodcock-Johnson Tests of Achievement—Letter-Word Identification, Quantitative Concepts, and Applied Problems subtests (English and Spanish) Clinical Evaluation of Language Fundamentals, Preschool—Expressive Vocabulary and Phonological Awareness subtests (English and Spanish) Head-Toes-Knees-Shoulders task—executive function (English and Spanish) Social Skills Improvement System Rating Scales—Cooperation, Engagement, Self-Control, Internalizing Behavior, and Externalizing Behavior subscales California English Language Development Test data (for English learners only) Attendance data 	<p>At kindergarten entry, significant positive outcomes for measures of:</p> <ul style="list-style-type: none"> Letter-Word Identification (ES = 0.48) Phonological awareness (ES = 0.27) Expressive vocabulary (ES = 0.15) Quantitative concepts (ES = 0.29) Applied Problems (ES = 0.20) Teacher reports of students' engagement (ES = 0.18) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Executive function Teacher reports of cooperation, self-control, internalizing behavior, and externalizing behavior <p>At end of kindergarten, significant positive outcomes for measures of:</p> <ul style="list-style-type: none"> Letter-Word Identification (ES = 0.18) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Phonological awareness Expressive vocabulary (marginally significant in positive direction) Quantitative concepts (marginally significant in positive direction) Applied Problems Executive function Teacher reports of social skills and problem behaviors

Program and Overview	Study	Evaluation Methodology	Findings
<p>Connecticut School Readiness Program</p> <p>Connecticut's School Readiness Program provides funding for preschool for 3- and 4-year-olds in low-wealth districts and cities. In 2013–14, the program served 5,381 4-year-olds and 2,347 3-year-olds, or about 10% of preschool-age children in the state. The program can be part-, full-, or extended-day and provide a school-year or calendar-year preschool experience. Lead teachers are required to have specialized training in early childhood education.</p>	<p>School Entry</p> <p>The Connecticut Academy of Science and Engineering. (2016). <i>Early childhood regression discontinuity study</i>. Rocky Hill, CT: Author.</p>	<p>Regression discontinuity design examining cognitive and social-emotional outcomes at kindergarten entry</p> <ul style="list-style-type: none"> • Data from 2015–16 school year • $n = 529$ children (206 kindergarten; 323 preschool) • <i>Sample characteristics</i> <ul style="list-style-type: none"> ◦ <i>Treatment group:</i> <ul style="list-style-type: none"> • 45% Hispanic/Latinx, 31.8% African American/Black, 26% White, 3.7% Asian, 9% other • 60.4% eligible for free lunch, 5% eligible for reduced-price lunch ◦ <i>Comparison group:</i> <ul style="list-style-type: none"> • 42.8% Hispanic/Latinx, 29.3% African American/Black, 36.5% White, 3.4% Asian, 6.3% other • 52% eligible for free lunch, 5.3% eligible for reduced-price lunch • <i>Comparison group:</i> Comparison children were entering preschool in 2015–16 and had not yet attended the program due to a strict age-eligibility cutoff. Information on the previous early learning experiences of comparison group children was collected and controlled for in study analyses but was not reported in the findings. • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ Woodcock-Johnson Tests of Achievement—Early Literacy composite: Letter-Word Identification, Word Attack, and Picture Vocabulary, and Early Mathematics composite: Calculations, Math Fluency, Applied Problems, and Oral Comprehension subtest ◦ Peabody Picture Vocabulary Test—receptive vocabulary ◦ Researchers also administered the Behavior Assessment Scales for Children—an instrument evaluating social development—to a subset of the study's participants. The use of this tool was exploratory, and findings are not included in the paper. • <i>Other methodological details:</i> The study examines the effect of the school-day (6 hours) and full-day (10 hours) program options and does not include part-time participants. 	<p>With 1 year of school readiness program, significant positive outcomes for:</p> <ul style="list-style-type: none"> • Early literacy (ES = 0.69) • Early mathematics (ES = 0.48) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> • Receptive vocabulary • Oral comprehension

Program and Overview	Study	Evaluation Methodology	Findings
<p>Florida Pre-Kindergarten Early Intervention Program</p> <p>During the 1990s, Florida's Pre-Kindergarten Early Intervention Program (PKEI) served 25,000 to 35,000 children per year with state-funded preschool. The program prioritized 3- and 4-year-old children eligible for free and reduced-price lunch for services, as well as children with other risk factors, such as children in foster care, those who experienced abuse or neglect, or children of migrant workers. Other children were eligible to participate and pay an income-based fee. PKEI offered full-day programs 5 days per week during the school year, though providers could decide to extend the length of the program day and year. In public schools, lead teachers were required to hold an early childhood education certification; providers in community-based settings were required to hold at least a Child Development Associate (CDA).</p>	<p>Elementary School</p> <p>Figlio, D., & Roth, J. (2009). "The Behavioral Consequences of Pre-Kindergarten Participation for Disadvantaged Youth" in Gruber, J. (Ed.). <i>The Problems of Disadvantaged Youth: An Economic Perspective</i>. Chicago and London: University of Chicago Press.</p>	<p>Instrumental variables design examining behavioral outcomes in elementary school</p> <ul style="list-style-type: none"> • Data from 1994 to 2003 • <i>n</i> = 59,418 children • <i>Sample characteristics</i>: The sample is restricted to free-lunch-eligible students. • <i>Comparison group</i>: Due to the nature of the instrumental variable design, the authors describe numerous covariates of interest, including Black/non-Black race, marital status of parents, and maternal education by both family composition and availability of preschool options in the school zone. • <i>Measures of child outcomes</i>: Administrative data on whether children have been referred for disciplinary action by their teachers. • <i>Other methodological details</i>: Authors use differential access within a family to a preschool program at a family's zoned elementary school as an instrument to predict attendance at publicly funded preschool. 	<p>After 1 year of preschool participation, significant positive effect on:</p> <ul style="list-style-type: none"> • Problem behavior: Reduced likelihood of being disciplined in kindergarten and the year following, but not in year 3. • Special education classification: Reduced likelihood of being classified as emotionally disabled or severely emotionally disturbed in the 3 years following participation. <p>These effects were strongly correlated with measures of neighborhood disadvantage.</p>
<p>Florida Voluntary Pre-K</p> <p>Florida introduced a free, universal preschool program—Voluntary Pre-K—in 2005. The program now serves more than three quarters of all 4-year-olds in the state. Most children are served in center-based programs in schools, churches, and private centers, though home-based settings are also allowed to serve children through the program. The hours of care provided through the program are variable, and families may choose to enroll their child for the school year or the summer. Lead teachers are required to hold a CDA and complete a course on literacy instruction from the state department of education.</p>	<p>Elementary School</p> <p>Miller, L. C., & Bassok, D. (In press). The effects of universal preschool on grade retention. <i>Education Finance and Policy</i>, 0, 1–49.</p>	<p>Instrumental variables design examining grade retention between kindergarten and 3rd grade</p> <ul style="list-style-type: none"> • Data from 2002 to 2012 • <i>n</i> = 1.5 million students in eight cohorts • <i>Sample characteristics</i>: Not provided, though analyses accounted for free and reduced-price lunch status, gender, race/ethnicity, immigration status, and home language • <i>Comparison group</i>: Children enrolled in Florida public schools who turned 4 before the program was offered. Information on the early learning experiences of comparison group children is not provided. • <i>Measures of child outcomes</i>: Administrative data on grade progression from kindergarten to 3rd grade. • <i>Other methodological details</i>: The authors examine outcomes for eight cohorts of children—four that did not have access to the program at age 4 and four that did. 	<p>After 1 year of preschool participation, the authors observed no significant effect on the likelihood of ever being retained by the end of 3rd grade. However, the authors did observe a shift in the timing of retention, with preschool participants less likely to be held back in kindergarten.</p>

Program and Overview	Study	Evaluation Methodology	Findings
<p>Georgia's Pre-K Program</p> <p>Georgia's state preschool program began in 1995 and was one of the first universal preschool programs in the nation. At the time of the study's publication, the program served over 81,000 4-year-old children annually, regardless of family income. The program is full-day (6.5 hours) and runs during the academic year. It is offered in schools, child care centers, and Head Start programs; every classroom implements an approved curriculum. Lead teachers must have a bachelor's degree in an early-childhood-related field (unless previously exempted), and assistant teachers are required to hold a CDA. Salaries for teachers are set by the state.</p>	<p>School Entry</p> <p>Peisner-Feinberg, E. S., Schaaf, J. M., LaForett, D. R., Hildebrandt, L. M., & Sideris, J. (2014). <i>Effects of Georgia's Pre-K Program on children's school readiness skills: Findings from the 2012–2013 evaluation study</i>. Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.</p>	<p>Regression discontinuity design examining academic and social-emotional outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> • Data from fall 2012 • $n = 1,181$ children (611 in the treatment group, 570 in the comparison group) • Sample characteristics: <ul style="list-style-type: none"> ◦ Treatment group: <ul style="list-style-type: none"> • 14.5% Hispanic • 36.5% Black/African American, 55% White/European-American, 1.3% Asian, 1.2% Native American/Alaskan Native, 4.4% multiracial, 1.6% Native Hawaiian/Pacific Islander • 58.6% participate in TANF or a similar family support program • 10.8% limited English proficiency <ul style="list-style-type: none"> ◦ Comparison group: <ul style="list-style-type: none"> • 13.4% Hispanic • 40.4% Black/African American, 51.5% White/European-American, 2.6% Asian, 2.1% Native American/Alaskan Native, 2.8% multiracial, 0.5% Native Hawaiian/Pacific Islander • 58.4% participate in TANF or a similar family support program • 8.8% limited English proficiency • Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the previous early learning experiences of comparison group children is not available. • Measures of child outcomes: <ul style="list-style-type: none"> ◦ Naming Letters Task—letter knowledge ◦ Woodcock-Johnson III Tests of Achievement—Letter-Word Identification, Picture Vocabulary, Sound Awareness, Word Attack, and Applied Problems subtests ◦ Counting task ◦ Social awareness task ◦ Social Skills Improvement System Ratings Scale—Social Skills and Problem Behaviors subscales • Other methodological details: Children in sample were chosen from a randomly selected sample of Georgia preschool classrooms. Analyses were conducted using hierarchical linear models, with children nested in classrooms, and included controls for child, family, and provider characteristics. 	<p>Significant positive outcomes for:</p> <ul style="list-style-type: none"> • Letter knowledge (ES = 0.89) • Letter-Word Identification (ES = 1.05) • Phonological awareness (ES = 0.59) • Phonemic awareness (ES = 1.20) • Applied Problems (ES = 0.51) • Counting (ES = 0.86) • Social awareness (ES = 0.43) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> • Word attack • Teacher-reported Social Skills and Problem Behaviors subscales from the Social Skills Improvement System Ratings Scale

Program and Overview	Study	Evaluation Methodology	Findings
<p>Georgia Universal Preschool/ Oklahoma's 4-year-old program</p> <p>Georgia and Oklahoma are two of only a handful of states offering universal preschool.</p> <p>Georgia's universal program began in 1995 and by 2011–12 enrolled 59% of all 4-year-olds in the state. The program is often run through private child care centers. Teachers are required to hold a bachelor's degree with certification in early childhood education.</p> <p>Oklahoma's universal program began in 1998. By 2011–12, the state enrolled 74% of all 4-year-olds in publicly funded preschool. The program is delivered largely through public schools. Teachers are required to hold a bachelor's degree with early childhood certification.</p>	<p>Elementary and Middle School</p> <p>Cascio, E. U., & Schanzenbach, D. W. (2013). <i>The impacts of expanding access to high-quality preschool education</i> (No. w19735). Cambridge, MA: National Bureau of Economic Research.</p>	<p>Difference-in-difference approach examining academic outcomes through 8th grade</p> <ul style="list-style-type: none"> • Data from 1970 to 2010 • <i>n</i> = 3,569 children • <i>Sample characteristics</i>: Described for maternal education only (1,785 children's mothers had a high school degree or less; 1,784 some college or more) • <i>Comparison group</i>: Study examines changes in achievement over time relative to the availability of universal preschool by comparing performance in Georgia and Oklahoma—both of which offer universal preschool—to performance in the remaining states. • <i>Measures of child outcomes</i>: National Assessment of Educational Progress reading and math scores in 4th and 8th grades. • <i>Other methodological details</i>: In addition to academic outcomes, study considers several family outcomes, including time mothers and children spend reading together and likelihood mothers work. 	<p>In 4th grade, offer of universal preschool was associated with significant increases in reading and math scores among students who qualify for free and reduced-price lunch. In 8th grade, universal preschool was associated with significant increases in math scores only for this group. Reading scores were not significantly different.</p> <p>Among students from higher income families, offer of universal preschool was not associated with any increase in reading or math scores.</p>

Program and Overview	Study	Evaluation Methodology	Findings
<p>Head Start</p> <p>Head Start is a comprehensive child development program targeting 3- and 4-year-old children in families with low incomes, or those who experience other developmental risk factors. Initially founded in 1965 as part of President Johnson's War on Poverty legislation, Head Start expanded from a summer pilot program to a 9- to 12-month comprehensive program known for offering extensive wraparound services and family supports. In FY2003, the program served over 909,000 children nationally. The program offers multiple options: center-based, family child care homes, home visiting, or some combination of these features. Exact time in program varies but may be full-day or part-day. At the time of the study, 4-year-olds attended, on average, 24 hours per week and 3-year-olds an average of 27 hours. Thirty percent of children are taught by teachers with a bachelor's degree; 30% by teachers with an associate degree; 40% by teachers with neither. The Head Start Performance Standards require a curriculum be used in all classrooms.</p>	<p>School Entry and Elementary School</p> <p>U.S. Department of Health and Human Services, Administration for Children and Families. (2010). <i>Head Start Impact Study: Final report</i>. Washington, DC: Author.</p>	<p>Randomized control trial examining academic and social-emotional outcomes from the end of the Head Start year through 1st grade</p> <ul style="list-style-type: none"> Data from fall 2002 to spring 2006 n = 4,667 children Sample characteristics: The total sample, spread over 23 different states, consisted of 84 randomly selected Head Start grantees/delegate agencies; 383 randomly selected Head Start centers; and a total of 4,667 newly entering children, including 2,559 in the 3-year-old cohort and 2,108 in the 4-year-old cohort. Treatment group (3-year-old/4-year-old cohorts): <ul style="list-style-type: none"> 24.5%/26.7% White, 32.8%/17.5% Black, 37.4%/51.6% Hispanic 91.4%/91.8% income eligible 23.1%/37.8% Spanish speaking Comparison group (3-year-old/4-year-old cohorts): <ul style="list-style-type: none"> 26.6%/23.3% White, 31.8%/17% Black, 35.7%/53.8% Hispanic 91.9%/87.9% income eligible 22.0%/39.5% Spanish speaking Comparison group: Children who were eligible to participate in Head Start but were randomly assigned to a control group. Measures of child outcomes: <ul style="list-style-type: none"> Cognitive outcomes Peabody Picture Vocabulary Test—receptive vocabulary Color Naming—color identification Counting Bears McCarthy Scales of Children's Abilities Draw-a-Design Subtest Woodcock-Johnson Tests of Achievement—Pre-Academic Skills composite, Academic Skills composite, and Academic Applications composites and all subtests Preschool Comprehensive Test of Phonological and Print Processing—phonological awareness Emergent literacy (parent report) 	<p>4-year-old cohort:</p> <p>At end of Head Start year</p> <ul style="list-style-type: none"> Significant positive impacts on: <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.09) Letter-word Identification (ES = 0.22) Spelling (ES = 0.015) Pre-academic skills composite (ES = 0.19) Color identification (ES = 0.16) Letter naming (ES = 0.25) Emergent literacy (ES = 0.31) Access to dental care (ES = 0.31) No significant impacts on the social-emotional domain. <p>At end of kindergarten</p> <ul style="list-style-type: none"> Significant positive impacts on: <ul style="list-style-type: none"> Overall health status (ES = 0.11) Health insurance (ES = 0.13) No significant impacts in the cognitive or social-emotional domain. <p>At end of 1st grade</p> <ul style="list-style-type: none"> Suggestive evidence of a positive impact on: <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.09) Withdrawn behavior (ES = -0.13) Health insurance (ES = 0.11) Significant negative impacts on: <ul style="list-style-type: none"> ASPI problems with peers (ES = 0.19) ASPI problems with teachers (ES = 0.13) No significant impacts were found for math skills, pre-writing, children's promotion, or teacher report of children's school accomplishments or abilities in any year. Note that stronger impacts through 1st grade for some outcomes were found for dual language learners (health), children with depressed parents (cognitive), children in lowest academic quartile at baseline (social), and Black children (social). <p>3-year-old cohort:</p> <p>At end of Head Start year</p> <ul style="list-style-type: none"> Significant positive impacts on: <ul style="list-style-type: none"> McCarthy Draw-a-Design (ES = 0.14) Receptive vocabulary (ES = 0.18) Letter-Word Identification (ES = 0.26) Pre-academic skills composite (ES = 0.22) Letter naming (ES = 0.24)

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Program and Overview	Study	Evaluation Methodology	Findings
<p>Head Start (Continued)</p>	<p>School Entry and Elementary School (Continued)</p>	<p>(Continued from previous page)</p> <ul style="list-style-type: none"> ◦ Social-emotional outcomes • Social skills and positive approaches to learning • Adjustment Scales for Preschool Intervention (ASPI) • Total Child Behavior Problems Scale and Subscales • Pianta Scale: Closeness, Conflict, and Positive Relationship • Social Competencies Checklist ◦ Child health outcomes <ul style="list-style-type: none"> • Overall health status • Access to dental care • Health insurance • Chronic illness • Child injury 	<p>(Continued from previous page)</p> <ul style="list-style-type: none"> ◦ Phonological awareness (ES = 0.10) ◦ Applied Problems (ES = 0.15) ◦ Emergent literacy (ES = 0.35) ◦ Hyperactive behavior (ES = -0.21) ◦ Overall behavior problems (ES = -0.14) ◦ Access to dental care (ES = 0.33) ◦ Overall health status (ES = 0.11) <p>At end of age 4 year</p> <ul style="list-style-type: none"> • Significant positive impacts on: <ul style="list-style-type: none"> ◦ Phonological awareness (ES = 0.15) ◦ Emergent literacy (ES = 0.16) ◦ Social skills and positive approaches to learning (ES = 0.11) ◦ Access to dental care (ES = 0.20) ◦ Child injury (ES = 0.10) <p>At end of kindergarten</p> <ul style="list-style-type: none"> • Significant positive impacts on: <ul style="list-style-type: none"> ◦ Social skills and positive approaches to learning (ES = 0.14) ◦ Hyperactive behavior (ES = -0.12) ◦ Health insurance (ES = 0.14) • No significant impacts in the cognitive domain at the end of kindergarten. <p>At end of 1st grade</p> <ul style="list-style-type: none"> • Suggestive evidence of a positive impact on: <ul style="list-style-type: none"> ◦ Oral comprehension (ES = 0.08) ◦ Pianta—closeness (ES = 0.10) ◦ Pianta—positive relationships (ES = 0.10) • Note that stronger impacts through 1st grade for some outcomes were found for children with special needs (social and cognitive), children with depressed parents (social and cognitive), children from the highest risk families (cognitive), and non-urban children (cognitive).

Program and Overview	Study	Evaluation Methodology	Findings
<p>Head Start (Continued)</p>	<p>Elementary School U.S. Department of Health and Human Services, Administration for Children and Families. (2012). <i>Third grade follow-up to the Head Start Impact Study: Final report.</i> Washington, DC: Author.</p>	<p>Randomized control trial examining academic and social-emotional outcomes at the end of 3rd grade</p> <ul style="list-style-type: none"> • Data from 2008 • <i>Sample size and characteristics:</i> See entry for “U.S. Department of Health and Human Services, Administration for Children and Families. (2010). <i>Head Start Impact Study: Final report.</i> Washington, DC: Author.” • <i>Comparison group:</i> See entry for “U.S. Department of Health and Human Services, Administration for Children and Families. (2010). <i>Head Start Impact Study: Final report.</i> Washington, DC: Author.” • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ Cognitive outcomes <ul style="list-style-type: none"> • Peabody Picture Vocabulary Test—receptive vocabulary • Woodcock-Johnson Tests of Achievement—Letter-Word Identification, Applied Problems, and Calculations subtests (English and Spanish) • ECLS-K reading assessment • Grade promotion • Academic ratings ◦ Social-emotional outcomes <ul style="list-style-type: none"> • Adapted child behavior checklist (parent-reported) • Strengths and difficulties questionnaire (teacher-reported) • Social skills and positive approaches to learning • Social competencies • Child self-assessment on academic and social skills • Teacher-child relationship scale (teacher-reported) ◦ Child health outcomes <ul style="list-style-type: none"> • Receipt of health services • Health status • <i>Other methodological details:</i> Study is a follow-up to Administration for Children and Families (2010) and uses the same sample and methodology. 	<p>At end of 3rd grade</p> <ul style="list-style-type: none"> • Significant positive impacts on: <ul style="list-style-type: none"> ◦ Parent ratings of aggressive behavior (ES = -.013) ◦ Social skills and positive approaches to learning (ES = .12) • Significant negative impacts on: <ul style="list-style-type: none"> ◦ Teacher reports of emotional symptoms (ES = -.24) ◦ Child reports of peer relations (ES = -.13) • Suggestive evidence of a positive impact on: <ul style="list-style-type: none"> ◦ ECLS-K reading assessment (ES = .11) • Suggestive evidence of an unfavorable impact on: <ul style="list-style-type: none"> ◦ Grade promotion (ES = -.11) • No other significant effects were identified in the cognitive, social-emotional, or health domains.

Program and Overview	Study	Evaluation Methodology	Findings
<p>Head Start (Continued)</p>	<p>Elementary School Through Adulthood Deming, D. (2009). Early childhood intervention and life-cycle skill development: Evidence from Head Start. <i>American Economic Journal: Applied Economics</i>, 1(3), 111–134.</p>	<p>Family fixed effects model examining cognitive school-age outcomes and noncognitive outcomes through adulthood</p> <ul style="list-style-type: none"> Data from the National Longitudinal Mother-Child Supplement (from the CNLSY) of the National Longitudinal Survey of Youth 1979, which tracks all children born to NLSY respondents. n = 3,698 children in families with at least two children age 4 or older by 1990 Sample characteristics: Author reports sample characteristics by race (White/Hispanic, Black) and preschool status (Head Start/preschool/none). <ul style="list-style-type: none"> Permanent family income levels varied among these groups, from \$52,130 among White children attending preschool to \$24,005 among Black children attending Head Start. Maternal education levels varied among these groups, from 51% of mothers with less than a high school degree among White children enrolled in Head Start to 50% of mothers with some college or more among Black children attending preschool. Comparison group: Author addresses selection bias by comparing children who attended Head Start to their siblings who did not. The author demonstrates few differences across siblings who attended Head Start and those who did not. Measures of child outcomes: <ul style="list-style-type: none"> Index of cognitive test scores that includes the child's standardized Peabody Picture Vocabulary Test and Peabody Individual Achievement Test math and reading scores at each age School-age outcomes index: grade retention and learning disability diagnosis Long-term outcomes index: high school graduation, some college, idleness, crime, and teen parenthood Other methodological details: Author reports outcomes overall and by race, gender, and maternal intelligence test. In some specifications, author used differences in program availability to overcome potential bias related to siblings' differential enrollment in Head Start. 	<p>Significant positive outcomes for Head Start participation:</p> <ul style="list-style-type: none"> Cognitive test score index <ul style="list-style-type: none"> Ages 5–6 (ES = 0.15) Ages 7–10 (ES = 0.13) Non-test score index <ul style="list-style-type: none"> Ages 11–14 (ES = 0.27) Long-term index <ul style="list-style-type: none"> Ages 19+ (ES = 0.23) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Cognitive test score index <ul style="list-style-type: none"> Ages 11–14
<p>Michigan Great Start Readiness Program Michigan's Great Start Readiness Program (GSRP) began in 1985. By 2004–05, the program had grown to serve 24,729 4-year-olds, or about 19% of all 4-year-old children in the state. GSRP is a voluntary program and serves children who meet income eligibility requirements or experience other risk factors identified by the state. At the time of the study, GSRP provided half-day preschool at public schools, Head Start programs, and private child care facilities. The program did not have a comprehensive curriculum requirement, though lead teachers working in public school settings were required to hold a bachelor's degree.</p>	<p>School Entry Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. <i>Journal of Policy Analysis and Management</i>, 27(1), 122–154.</p>	<p>Regression discontinuity design examining cognitive outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> Data from 2004–05 school year n = 871 children (Michigan) Sample characteristics: <ul style="list-style-type: none"> 10% Hispanic, 22% Black, 53% White/Asian, 4% other, 10% race missing 49% eligible for free or reduced-price lunch, 28% ineligible, 23% eligibility unknown Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the early learning experiences of comparison group children is not available, but many were eligible for Head Start or other subsidized early learning programs. Measures of child outcomes: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) Preschool Comprehensive Test of Phonological and Print Processing—print awareness (English and Spanish) Woodcock-Johnson Tests of Achievement—Applied Problems subtest (English and Spanish) Other methodological details: Classrooms and students were randomly selected for participation in the study. 	<p>Significant positive outcomes for:</p> <ul style="list-style-type: none"> Print awareness (ES = 1.09) Applied Problems (ES = 0.53) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Receptive vocabulary

Program and Overview	Study	Evaluation Methodology	Findings
<p>New Jersey Abbott Preschool Program</p> <p>New Jersey's Abbott Preschool Program served over 40,000 3- and 4-year-old children in 2005–06, an estimated 78% of all children eligible for the program. The Abbott program was created in 1999 following a state Supreme Court ruling and universally serves preschool-age children in the state's lowest income school districts. It offers 1 or 2 years of full-day, calendar-year preschool across a variety of settings, including public schools, private centers, and Head Start. All classrooms use a developmentally appropriate curriculum and require both a lead and assistant teacher. Lead teachers for the program hold EOE certification and receive ongoing coaching and supports.</p>	<p>School Entry</p> <p>Frede, E., Jung, K., Barnett, W. S., Lamy, C. E., & Figueras, A. (2007). <i>The Abbott Preschool Program longitudinal effects study: Interim report</i>. New Brunswick, NJ: National Institute for Early Education Research.</p>	<p>Regression discontinuity design examining cognitive outcomes at beginning of kindergarten</p> <ul style="list-style-type: none"> Data from 2005–06 school year n = 1,544 children Sample characteristics: Not reported. Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the previous early learning experiences of comparison group children is not available. Measures of child outcomes: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) Preschool Comprehensive Test of Phonological and Print Processing—print awareness (English and Spanish) Woodcock-Johnson Tests of Achievement—Applied Problems subtest (English and Spanish) Other methodological details: Sample taken from 15 largest Abbott districts, likely with lower quality than smaller districts in the state. Results from regression discontinuity design were compared with results using a matching design to assess the extent of bias in the matching design. 	<p>With 1 year of preschool, significant positive outcomes for all early learning measures reported:</p> <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.28)* Print awareness (ES = 0.56)* Applied Problems (ES = 0.36)* <p>*Effect sizes are reported in entry for "Barnett, W. S., Jung, K., Youn, M., Frede, E. (2013). <i>Abbott Preschool Program longitudinal effects study: Fifth grade follow-up</i>. New Brunswick, NJ: National Institute for Early Education Research."</p> <p>With 2 years of preschool, children outperformed those who attended for only 1 year at age 4 or not all:</p> <ul style="list-style-type: none"> Scores nearly doubled on receptive vocabulary—closing the gap by more than half on the national average vocabulary score Scores were 70% higher on Applied Problems
<p>Elementary School</p> <p>Barnett, W. S., Jung, K., Youn, M., Frede, E. (2013). <i>Abbott Preschool Program longitudinal effects study: Fifth grade follow-up</i>. New Brunswick, NJ: National Institute for Early Education Research.</p>	<p>Longitudinal matching design examining academic outcomes in 4th and 5th grade</p> <ul style="list-style-type: none"> Data from 2005–11 school years n = 754 children Sample characteristics: <ul style="list-style-type: none"> 39% Black, 53% Hispanic, 3% White/other 19% of parents had at least a high school degree 7.1% eligible for free and reduced-price lunch 50% English as home language 32% of parents married 42% of parents employed Comparison group: Comparison children were similarly eligible for preschool but did not attend. They were matched on demographic characteristics: district, age, gender, race/ethnicity, parental employment, parental education, and parental marital status. Measures of child outcomes: <ul style="list-style-type: none"> New Jersey state standardized achievement test Grade retention and special education placement data Other methodological details: Sample taken from 15 largest Abbott districts (likely with lower quality). Results reflect difference of means test between Abbott children and their matched control group. 	<p>With 1 year of preschool, significant positive outcomes for:</p> <ul style="list-style-type: none"> 5th grade literacy (ES = 0.18) Special education placement by 5th grade (ES = -0.36) Grade retention by 5th grade (ES = -0.47) <p>With 2 years of preschool, significant positive outcomes for:</p> <ul style="list-style-type: none"> 4th grade math (ES = 0.37) 4th grade literacy (ES = 0.26) 5th grade math (ES = 0.29) 5th grade science (ES = 0.37) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> 4th grade literacy and 5th grade math, with 1 year of preschool Special education placement and grade retention by 5th grade, with 2 years of preschool 4th grade math with 1 year of preschool (marginally significant in positive direction) 5th grade science with 1 year of preschool (marginally significant in positive direction) 5th grade literacy with 2 years of preschool (marginally significant in positive direction) 	<p>With 1 year of preschool, significant positive outcomes for all early learning measures reported:</p> <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.28)* Print awareness (ES = 0.56)* Applied Problems (ES = 0.36)* <p>*Effect sizes are reported in entry for "Barnett, W. S., Jung, K., Youn, M., Frede, E. (2013). <i>Abbott Preschool Program longitudinal effects study: Fifth grade follow-up</i>. New Brunswick, NJ: National Institute for Early Education Research."</p> <p>With 2 years of preschool, children outperformed those who attended for only 1 year at age 4 or not all:</p> <ul style="list-style-type: none"> Scores nearly doubled on receptive vocabulary—closing the gap by more than half on the national average vocabulary score Scores were 70% higher on Applied Problems

Program and Overview	Study	Evaluation Methodology	Findings
<p>New Mexico Pre-K</p> <p>New Mexico's voluntary preschool program began in 2005 and grew rapidly in the years that followed. The initiative is a grant-based program serving 4-year-olds that prioritizes sites with a low percentage of elementary schoolers meeting proficiency requirements and in which more than two thirds of children live in Title I school catchments. In 2008–09, there were 4,745 slots budgeted for the program and 17% of New Mexico's 4-year-olds participated in the program. The preschool program is delivered in a variety of settings: schools, private child care centers, Head Start, universities, and family child care homes. Lead teachers may be hired with a high school diploma but are required to earn a bachelor's degree and early childhood license within 5 years of hire. Assistant teachers must have a high school degree and earn an associate degree in early childhood education within 5 years.</p>	<p>School Entry</p> <p>Husted, J. T., Barnett, W. S., Jung, K., & Friedman, A. H. (2010). <i>The New Mexico pre-k evaluation: Impacts from the fourth year (2008–2009) of New Mexico's state-funded pre-k program</i>. New Brunswick, NJ: Rutgers University, National Institute for Early Education Research.</p>	<p>Regression discontinuity design examining cognitive outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> • Data from 2008–09 school year • $n = 1,359$ children • <i>Sample characteristics:</i> <ul style="list-style-type: none"> ◦ 63.8% Hispanic, 2.2% Black, 20.9% White, 0.9% Asian, 10.7% Native American, 1.5% other ◦ Among treatment group children, 13.6% spoke Spanish only and 85.6% spoke English or English and another language. Among comparison group children, the proportions were 14.3% and 84.8%, respectively. • <i>Comparison group:</i> Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the early learning experiences of comparison group children is not available. • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) ◦ Woodcock-Johnson Tests of Achievement—Applied Problems subtest (English and Spanish) ◦ Early Literacy Skills Assessment (English and Spanish) • <i>Other methodological details:</i> Children were randomly selected for participation in the study from enrollment lists. 	<p>Significant positive outcomes for:</p> <ul style="list-style-type: none"> • Receptive vocabulary (ES = 0.24) • Early literacy (ES = 1.30) • Applied Problems (ES = 0.37)
<p>North Carolina Pre-K</p> <p>North Carolina Pre-K, previously known as More at Four, began in 2002. The voluntary school-readiness program serves 4-year-old children with identified risk factors, such as low family income, limited English proficiency, or an identified special need. The program is delivered in public schools, child care centers, and Head Starts and offers full-day, academic-year services. Lead teachers must have or be working toward licensure; assistant teachers must have or be working toward an associate degree in ECE or CDA. Classrooms use an approved curriculum, with many selecting Creative Curriculum. North Carolina also provides state funding to counties to fund early childhood services for children birth to age 5 through its Smart Start initiative.</p>	<p>School Entry</p> <p>Peisner-Feinberg, E. S., & Schaaf, J. M. (2011). <i>Summary of key findings: Effects of the North Carolina More at Four Prekindergarten Program on children's school readiness skills</i>. Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.</p>	<p>Regression discontinuity design examining cognitive outcomes at kindergarten entry</p> <ul style="list-style-type: none"> • Data from 2009–10 school year • $n = 1,010$ children • <i>Sample characteristics:</i> Not described in paper. • <i>Comparison group:</i> Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the previous early learning experiences of comparison group children is not available. • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ Peabody Picture Vocabulary Test—receptive vocabulary ◦ Test of Preschool Early Literacy—Phonological Awareness and Print Knowledge subtests ◦ Woodcock-Johnson Tests of Achievement—Letter-Word Identification and Applied Problems subtests ◦ National Center for Early Development and Learning Counting Numbers Task 	<p>Significant positive outcomes for:</p> <ul style="list-style-type: none"> • Phonemic awareness (ES = 0.56) • Print knowledge (ES = 1.16) • Letter-Word Identification (ES = 1.14) • Applied Problems (ES = 0.34) • Counting (ES = 0.81) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> • Receptive vocabulary

Program and Overview	Study	Evaluation Methodology	Findings
<p>North Carolina Pre-K (Continued)</p>	<p>Elementary School Pelsner-Feinberg, E. S., Mokrova, I. L., & Anderson, T. L. (2017). <i>Effects of participation in the North Carolina Pre-Kindergarten Program at the end of kindergarten: 2015–2016 statewide evaluation</i>. Chapel Hill, NC: University of North Carolina, FPG Child Development Institute.</p>	<p>Propensity score matching examining cognitive and social-emotional outcomes</p> <ul style="list-style-type: none"> • Data from 2015–16 school year • n = 512 children • <i>Sample characteristics:</i> <ul style="list-style-type: none"> ◦ 28.7% Hispanic/Latinx, 71.3% Non-Hispanic/Latinx ◦ 49.6% Non-White, 50.4% White ◦ 21.7% have primary caregivers with less than a high school degree, 56.8% high school degree, 15.6% associate degree, 4.9% bachelor's degree, 1% graduate education ◦ 62.7% reside in families with incomes \$26,069 or less, 18.2% with incomes \$26,070–\$34,090 • <i>Comparison group:</i> Comparison group was identified from a sample of kindergarten classrooms across the state. Comparison children met NC Pre-K income eligibility criteria, had not attended an NC Pre-K site, had not previously been retained in grade, did not have an IEP, and had sufficient data to complete matching. Information on the previous early learning experiences of comparison group children was collected but not reported in the study. • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ Woodcock-Johnson Tests of Achievement—Picture Vocabulary, Phonological Awareness, Letter-Word Identification, Passage Comprehension, Word Attack, Applied Problems, and Calculations subtests; Basic Reading Skills, Brief Reading, and Brief Math composites (English and Spanish) ◦ Forward Digit Span, Backward Digit Span—executive function (English and Spanish) ◦ Social Skills Improvement System—Social Skills and Problem Behaviors subscales (teacher report) 	<p>Significant positive outcomes for:</p> <ul style="list-style-type: none"> • Calculations (ES = 0.21) • Brief math (ES = 0.22) • Forward digit span (ES = 0.17) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> • Phonological awareness (marginally significant in positive direction) • Applied Problems (marginally significant in positive direction) • Picture vocabulary • Letter-Word Identification • Passage comprehension • Word attack • Basic reading • Brief reading • Social skills • Problem behaviors • Backward digit span

Program and Overview	Study	Evaluation Methodology	Findings
<p>North Carolina Pre-K (Continued)</p>	<p>Elementary School Dodge, K. A., Bai, Y., Ladd, H. F., & Muschkin, C. G. (2016). Impact of North Carolina's early childhood programs and policies on educational outcomes in elementary school. <i>Child Development</i>, 88(3), 1–19.</p>	<p>Natural experiment examining academic achievement and other academic outcomes in grades 3–5 in relation to the availability of funding for More at Four and Smart Start by county</p> <ul style="list-style-type: none"> • Data from 13 consecutive years, 1988–2000 • $n = 1,004,571$ observations • <i>Sample characteristics:</i> 61% Non-Latinx/White, 30% African American, 4% Latinx, 5% other • <i>Comparison group:</i> Comparison group children resided in counties that received smaller allocations of NC Pre-K and Smart Start funding • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ Reading and math scores from state standardized achievement tests ◦ Special education placements ◦ Grade retention (student identified in same grade in consecutive years) • <i>Other methodological details:</i> Study seeks to avoid the challenge of selection bias by using county-level state funding allocations as the independent variable of interest. Analyses are based on student-level regression models with county and year fixed effects, as well as controls for child, maternal, and county characteristics derived from birth and education records. 	<p>More at Four allocations associated with significant positive outcomes for:</p> <ul style="list-style-type: none"> • Math scores in grades 3, 4, and 5 • Reading scores in grades 3, 4, and 5 • Probability of special education placements in grades 3, 4, and 5 (average funding reduced the probability of special education placement by 29% in grade 3, 43% in grade 4, and 48% in grade 5) • Probability of ever repeating a grade by grades 4 or 5 <p>No significant association with:</p> <ul style="list-style-type: none"> • Probability of grade retention in grades 3, 4, or 5 • Probability of ever repeating a grade by grade 3 <p>When controlling for prior-year scores, there was no significant association between More at Four spending and math or reading scores in grade 5.</p> <p>Smart Start allocations associated with significant positive outcomes for:</p> <ul style="list-style-type: none"> • Math scores in grades 3, 4, and 5 • Reading scores in grades 3, 4, and 5 • Probability of special education placements in grades 3, 4, and 5 (the average allocation was associated with a 10% reduction in the probability of special education placement) • Probability of grade retention in grade 3, at 10% level • Probability of ever repeating a grade by grade 3 (at 10% level), 4, and 5 <p>No significant association with:</p> <ul style="list-style-type: none"> • Probability of grade retention in grades 4 and 5 <p>When controlling for prior-year scores, there was no significant association between Smart Start spending and math scores in grades 4 and 5.</p>

Program and Overview	Study	Evaluation Methodology	Findings
<p>Oklahoma's 4-year-old program</p> <p>Oklahoma began a pilot state preschool program for 4-year-olds in 1980. The program later expanded to serve all children eligible for Head Start before becoming universal in 1998. Enrollments grew steadily, and by 2004–05, the program enrolled 30,180 children, over two thirds of all 4-year-olds in the state, in voluntary preschool. The length of the preschool program day and year varied locally at the time of the study, but the program had a comprehensive curriculum standard, and lead teachers were required to have a bachelor's degree with specialized training in early childhood education.</p>	<p>School Entry</p> <p>Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. <i>Journal of Policy Analysis and Management</i>, 27(1), 122–154.</p>	<p>Regression discontinuity design examining cognitive outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> Data from 2004–05 school year n = 838 children (Oklahoma) Sample characteristics: <ul style="list-style-type: none"> 7% Hispanic, 7% Black, 13% Native American, 65% White/Asian, 1% other, 8% race missing 50% eligible for free and reduced-price lunch, 32% ineligible, 18% eligibility unknown Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the early learning experiences of comparison group children is not available, but many were eligible for Head Start or other subsidized early learning programs. Measures of child outcomes: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) Preschool Comprehensive Test of Phonological and Print Processing—print awareness (English and Spanish) Woodcock-Johnson Tests of Achievement—Applied Problems subtest (English and Spanish) Other methodological details: Classrooms and students were randomly selected for participation in the study. 	<p>Significant positive outcomes for:</p> <ul style="list-style-type: none"> Receptive vocabulary (ES = 0.28) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Print awareness Applied Problems
<p>Adulthood</p> <p>Smith, A. <i>The long-run effects of universal pre-k on criminal activity</i>. (2016). Presentation at the annual meeting of the Society of Labor Economists, Seattle, WA. http://www.sole-jole.org/16422.pdf.</p>	<p>Regression discontinuity and difference-in regression discontinuity design examining likelihood of participation in criminal activity at age 18–19</p> <ul style="list-style-type: none"> Birth data from 1992 to 1995 and crime data from 2010 to 2014 for age cohort eligible for first year of universal preschool in Oklahoma n = 46,217 births Sample characteristics: 78.2% White, 10.6% Black Comparison group: Comparison group children were not eligible for universal preschool due to a strict age-eligibility cutoff in the first year of the implementation of a universal program. In 1997–98, only 4% of all Oklahoma 4-year-olds were in public preschool, approximately a quarter attended private centers, 20% attended Head Start, and over half of all 4-year-olds did not attend preschool. Measures of child outcomes: Likelihood of criminal charges at age 18–19 (by date of birth). 	<p>Significant negative outcome (which in this instance connotes a benefit) for:</p> <ul style="list-style-type: none"> Likelihood of a criminal charge at age 18–19 for Black children who just miss the kindergarten cutoff (For felonies, ES = -0.045; for misdemeanors, ES = -0.068) <p>No significant outcome regarding likelihood of a criminal charge at age 18–19 for White children.</p>	

Program and Overview	Study	Evaluation Methodology	Findings
<p>San Francisco Preschool for All</p> <p>Preschool for All is a municipal initiative providing access to preschool for children in San Francisco. The program began in 2005 and is funded under a citywide proposition.</p>	<p>School Entry</p> <p>Applied Survey Research (2013). <i>Evaluating preschool for all effectiveness</i>. San Jose, CA: Author.</p>	<ul style="list-style-type: none"> Regression discontinuity design examining cognitive and social-emotional outcomes at kindergarten entry Data from 2011–12 school year <i>n</i> = 606 <i>Sample characteristics</i>: Only gender reported (49.5% female) <i>Comparison group</i>: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the previous early learning experiences of the comparison group was not reported. <i>Measures of child outcomes</i>: <ul style="list-style-type: none"> Woodcock-Johnson Tests of Achievement—Letter-Word Identification and Applied Problems subtests Receptive One-Word Picture Vocabulary Test—receptive vocabulary (English and Spanish) Head-Toes-Knees-Shoulders task—executive function (English, Spanish, and Chinese) Preschool and Kindergarten Behavior Scales—Social Skills and Problem Behavior subscales (parent reports, English, Spanish, and Chinese) <i>Other methodological details</i>: Regression discontinuity design is one strategy of several used to examine the outcomes of the Preschool for All program. 	<p>Positive significant outcome for:</p> <ul style="list-style-type: none"> Letter-Word Identification (ES = 0.40) Applied Problems (ES = 0.40) Executive function (ES = 0.51) <p>No significant outcome for:</p> <ul style="list-style-type: none"> Receptive vocabulary
<p>South Carolina 4K and First Steps to Success</p> <p>South Carolina's state preschool efforts began in 1984. The voluntary state initiative comprises two distinct programs—the Half-Day Child Development Program (4K) and First Steps to School Readiness, an initiative providing supplemental funding for preschool. In 2004–05, state preschool served 17,821 children, or 32% of all 4-year-olds in the state. Eligibility for the program is determined locally but is based on identified risk factors such as low family income. At the time of the study, the half-day (2.5 hours) program was available 5 days per week during the academic year and was delivered primarily through public schools, though other settings, including child care centers and Head Start programs, were allowed. Lead teachers in the program were required to hold a bachelor's degree in early childhood education. The program did not have a comprehensive curriculum requirement.</p>	<p>School Entry</p> <p>Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. <i>Journal of Policy Analysis and Management</i>, 27(1), 122–154.</p>	<p>Regression discontinuity design examining cognitive outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> Data from 2004–05 school year <i>n</i> = 777 children (South Carolina) <i>Sample characteristics</i>: <ul style="list-style-type: none"> 44% Black, 40% White/Asian, 4% other, 13% race missing 54% eligible for free and reduced-price lunch, 35% ineligible, 11% eligibility unknown <i>Comparison group</i>: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the early learning experiences of comparison group children is not available, but many were eligible for Head Start or other subsidized early learning programs. <i>Measures of child outcomes</i>: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) Preschool Comprehensive Test of Phonological and Print Processing—print awareness (English and Spanish) <i>Other methodological details</i>: Classrooms and students were randomly selected for participation in the study. 	<p>Significant positive outcomes (intent to treat) for:</p> <ul style="list-style-type: none"> Print awareness (ES = 0.78) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Receptive vocabulary

Program and Overview	Study	Evaluation Methodology	Findings
<p>Tennessee Voluntary Pre-K</p> <p>The Tennessee Voluntary Pre-K (VPK) program initially began in 1996 as a pilot program but expanded significantly a decade later, when the state expanded eligibility for the program. By 2008–09, the program enrolled over 18,000 children annually. The grant-based program is administered through local school systems but allows districts to collaborate with other providers, such as Head Start and child care, to implement the program. VPK gives priority to children eligible for free and reduced-price lunch. The program offers full-day preschool services consistent with the k–12 academic calendar. Each VPK classroom implements a curriculum from an approved list. Lead teachers in the program are required to hold a teaching license and are paid on the same salary scale as k–12 teachers. Each classroom has an aide, preferably with an associate degree in early childhood education.</p>	<p>School Entry and Elementary School</p> <p>Lipsey, M. W., Farran, D. C., & Durkin, K. (2018). Effects of the Tennessee Prekindergarten Program on children's achievement and behavior through third grade. <i>Early Childhood Research Quarterly</i>, 45, 155–176.</p>	<p>Randomized control trial examining academic outcomes in 3rd grade and analysis of a non-random subsample drawn from the randomized control trial examining academic and social-emotional outcomes from preschool through 3rd grade.</p> <ul style="list-style-type: none"> Data from two cohorts beginning preschool in the 2009–10 school year and 2010–11 school year n = 2,990 children in randomized control trial and 1,076 in intensive subsample Sample characteristics: <ul style="list-style-type: none"> Randomized control trial: <ul style="list-style-type: none"> 22.5% Hispanic, 27.1% Black, 48.9% White 24% Non-native speakers of English Intensive subsample: <ul style="list-style-type: none"> 18.7% Hispanic, 22.9% Black, 56.2% White 20% Non-native speakers of English Comparison group: For the randomized control trial, control group children applied to oversubscribed preschool programs and were randomly assigned to remain on a waiting list. For the intensive subsample, comparison group children were age-eligible for kindergarten the following year and had a parent's consent to individual assessments after being randomly selected from among applicants at preschool sites that received more interest than they could accommodate. Among the comparison group, 63% of children received home-based care, 13% enrolled in Head Start, 16% attended center-based child care, 5% some combination of center-based programs, and 3% did not report care arrangements. Measures of child outcomes (intensive subsample): <ul style="list-style-type: none"> Woodcock-Johnson Tests of Achievement—Pre-Academic Composite, Letter-Word Identification, Spelling, Oral Comprehension, Picture Vocabulary, Applied Problems, and Quantitative Concepts subtests Cooper-Farran Behavioral Rating Scales—Work-Related Skills and Social Behavior subscales Academic Classroom and Behavior Record—readiness for grade-level work, feelings about school, peer relations, and behavior problems From kindergarten to 3rd grade, also included Woodcock-Johnson Tests of Achievement—Battery, Passage Comprehension, and Calculation subtests Other methodological details: The findings described are based on both the performance of children in the randomized control trial and an intensive subsample of children whose parents consented to additional assessments prior to 3rd grade. To minimize the threat of selection bias in the latter group, researchers treated that portion of the study as a quasi-experiment and their analyses included multilevel models and controls for student demographics, child performance on academic achievement pretests and performance, and family background via propensity scores. The authors also conducted a regression discontinuity design in a select number of schools; the outcomes of that study are not reported in this paper. 	<p>All findings reported here are intent-to-treat impact estimates for observed values. The study also provides treatment-on-treated and weighted values for some measures.</p> <p>Randomized control trial</p> <p>Kindergarten:</p> <ul style="list-style-type: none"> Significant positive outcome for special education placements (any IEP except gifted or physical disability; ES = 0.11). Marginally significant negative outcome for grade retention (which indicates a benefit). No significant outcome for attendance. <p>1st grade:</p> <ul style="list-style-type: none"> Significant positive outcome for special education placements (ES = 0.1). No significant outcome for: <ul style="list-style-type: none"> Grade retention in grades k–1 Attendance <p>2nd grade:</p> <ul style="list-style-type: none"> No significant outcome for: <ul style="list-style-type: none"> Grade retention in grades k–2 Attendance Special education placements (marginally significant) <p>3rd grade:</p> <ul style="list-style-type: none"> Significant negative outcome for: <ul style="list-style-type: none"> State mathematics assessments (ES = -.14) State science assessment (ES = -.09) Marginally significant positive outcome for: <ul style="list-style-type: none"> Special education placements Disciplinary actions (in this case, positive outcome denotes an undesirable outcome); using weighted imputation, significant positive effect for major offenses and offenses overall No significant outcome for: <ul style="list-style-type: none"> State reading assessment Grade retention in grades k–3 Attendance

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Program and Overview	Study	Evaluation Methodology	Findings
<p>Tennessee Voluntary Pre-K (Continued)</p>	<p>School Entry and Elementary School (Continued)</p>		<p>(Continued from previous page)</p> <p>Intensive subsample</p> <p>Preschool (intensive subsample):</p> <ul style="list-style-type: none"> • Significant positive outcome for: <ul style="list-style-type: none"> ◦ Pre-academic composite (ES = 0.23) ◦ Letter-Word Identification (ES = 0.28) ◦ Spelling (ES = 0.23) ◦ Picture vocabulary (ES = 0.19) ◦ Applied Problems (ES = 0.16) ◦ Quantitative concepts (ES = 0.2) • Marginally significant positive outcome for preparedness for grade (measured in fall of kindergarten). • No significant outcomes for: <ul style="list-style-type: none"> ◦ Oral comprehension ◦ Interpersonal skills ◦ Work-related skills ◦ Peer relations ◦ Behavior problems ◦ Feelings about school <p>Kindergarten (intensive subsample):</p> <ul style="list-style-type: none"> • Significant positive outcome for: <ul style="list-style-type: none"> ◦ Picture vocabulary (ES = 0.13) • No significant effects on other academic measures. <p>1st grade (intensive subsample):</p> <ul style="list-style-type: none"> • Significant negative outcome for feelings about school (ES = -0.15). • Marginally significant negative outcome for spelling. • No significant outcomes for other academic, social-emotional, or behavioral measures. <p>2nd grade (intensive subsample):</p> <ul style="list-style-type: none"> • Significant negative outcome for quantitative concepts (ES = -0.12). • No significant outcomes on other academic, social-emotional, or behavioral measures. <p>End of 3rd grade (intensive subsample):</p> <ul style="list-style-type: none"> • No significant outcomes on any academic, social-emotional, or behavioral measures.

Program and Overview	Study	Evaluation Methodology	Findings
<p>Tulsa Early Childhood Education Programs: 4-Year-Old Program</p> <p>The state preschool program is universal for 4-year-olds regardless of family income or other risk factors. At the time of the study, the program reached a higher portion of 4-year-olds than any other state preschool program in the country (68% of all 4-year-olds). The program is administered by school districts, but Head Start programs and private child care providers may also implement the program in collaboration with public schools. Lead teachers in the program must hold a bachelor's degree and be certified in early childhood education; teachers are paid well relative to preschool teachers in other places.</p> <p>The length of the program day and curriculum is locally determined, though most children participate in full-day programs.</p>	<p>School Entry</p> <p>Gormley, W. T., Phillips, D., & Gayer, T. (2008). Preschool programs can boost school readiness. <i>Science</i>, 320, 1723–1724.</p>	<p>Regression discontinuity design examining cognitive outcomes at kindergarten entry for participants in two early childhood programs in Tulsa: state preschool and federally funded Head Start</p> <ul style="list-style-type: none"> Data from 2006 $n = 2,756$ children for state preschool and 810 for Head Start Sample characteristics: Not reported. Comparison group: Comparison group children were entering state preschool or Head Start but had not yet completed the program due to a strict age-eligibility cutoff observed by both Tulsa Public Schools and the Community Action Project of Tulsa County. Information on the early learning experiences of comparison group children is unavailable. Measures of child outcomes: Woodcock-Johnson Tests of Achievement—Letter-Word Identification, Spelling, and Applied Problems subtests 	<p>Significant positive outcome for:</p> <ul style="list-style-type: none"> Letter-Word Identification (ES = 0.51) Spelling (ES = 0.33) Applied Problems (ES = 0.37)
<p>Elementary School</p> <p>Hilli, C. J., Gormley, W. T., & Adelman, S. (2015). Do the short-term effects of a high-quality preschool program persist? <i>Early Childhood Research Quarterly</i>, 32, 60–79.</p>	<p>Propensity score weighting controlling for the likelihood of attending preschool and examining academic outcomes at the end of 3rd grade</p> <ul style="list-style-type: none"> Data from cohorts that attended kindergarten in 2001–02 (early cohort) and 2006–07 (later cohort) $n = 1,999$ children (early cohort), 2,024 children (later cohort); includes children who had at least one test score reported in 3rd grade Sample characteristics: Not reported. Comparison group: Comparison group children attended public kindergarten in Tulsa, but not the universal preschool or CAP Head Start programs. Parent surveys for the later cohort indicated that comparison group children experiences the year before kindergarten included care at home (44%), other preschool (26%), child care (13%), Head Start (9%), or family child care home (8%). Propensity score weighting was used to achieve balance between the comparison and treatment groups. Measures of child outcomes: State standardized test scores for reading and math Other methodological details: Some covariates derived from a 2005 parent survey. 	<p>Significant positive outcome observed for math scores in the later cohort (ES = 0.18). No significant outcome observed for:</p> <ul style="list-style-type: none"> Reading or math scores in the early cohort Reading scores in the later cohort 	<p>Significant positive outcome observed for:</p> <ul style="list-style-type: none"> Math scores (ES = .10) Enrollment in honors courses (6 percentage points higher for treated group) Reduced grade retention (7 percentage points lower for treated group) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Reading scores GPA Special education status Identification as gifted Absenteeism Suspensions
<p>Middle School</p> <p>Gormley, W. T., Phillips, D., & Anderson, S. (2017). The effects of Tulsa's pre-k program on middle school student performance. <i>Journal of Policy Analysis and Management</i>, 37(1), 63–87.</p>	<p>Propensity score weighting examining academic outcomes at the end of 7th grade</p> <ul style="list-style-type: none"> Data from 2006–07 school year (preschool) and 2013 to 2015 (middle school) $n = 2,656$ students Sample characteristics (weighted comparison sample): <ul style="list-style-type: none"> 20% Hispanic, 34% Black, 34% White, 1% Asian, 9% Native American 1.1% eligible for free lunch, 23% eligible for reduced-price lunch, 46% full-price lunch 21% of mothers held no high school diploma, 28% had a high school diploma, 39% had some college, 12% had a college degree Comparison group: Comparison group children attended public kindergarten in Tulsa but not the universal preschool or CAP Head Start programs. Propensity score weighting was used to achieve balance between the comparison and treatment groups. Measures of child outcomes: <ul style="list-style-type: none"> State standardized scores in reading and math GPA Grade retention (defined as not being in 8th grade in 2014–15) Special education status (possessing active individualized education plan) Enrollment in honors courses Identification as gifted Absences: total absences and chronic absenteeism (10% of school year) Suspensions: in- and out-of-school Other methodological details: Covariates derived from administrative data and a 2005 parent survey. To reduce attrition, sample includes Tulsa Public Schools and three surrounding districts for most measures, and entire state for standardized test scores and grade retention. Findings were robust to sensitivity checks. 	<p>Significant positive outcome for:</p> <ul style="list-style-type: none"> Math scores (ES = .10) Enrollment in honors courses (6 percentage points higher for treated group) Reduced grade retention (7 percentage points lower for treated group) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Reading scores GPA Special education status Identification as gifted Absenteeism Suspensions 	<p>Significant positive outcome for:</p> <ul style="list-style-type: none"> Math scores (ES = .10) Enrollment in honors courses (6 percentage points higher for treated group) Reduced grade retention (7 percentage points lower for treated group) <p>No significant outcomes for:</p> <ul style="list-style-type: none"> Reading scores GPA Special education status Identification as gifted Absenteeism Suspensions

Program and Overview	Study	Evaluation Methodology	Findings
<p>Tulsa early childhood programs: CAP Tulsa Head Start</p> <p>The Community Action Project of Tulsa County (CAP) is Tulsa County's largest Head Start grantee. Its programs are eligible for state preschool funding, and its teachers and classrooms meet the same standards as those in the preschool program. Lead teachers in the program must hold a bachelor's degree and be certified in early childhood education; teachers are paid well relative to preschool teachers in other places. CAP Head Start programs are all full-day and serve 3- and 4-year-olds.</p>	<p>School Entry</p> <p>Gormley, W. T., Phillips, D., & Gayer, T. (2008). Preschool programs can boost school readiness. <i>Science</i>, 320, 1723-1724.</p>	<p>Regression discontinuity design examining cognitive outcomes at kindergarten entry for participants in two early childhood programs in Tulsa: state preschool and federally funded Head Start</p> <ul style="list-style-type: none"> • Data from 2006 • $n = 2,756$ children for state preschool and 810 for Head Start • <i>Sample characteristics:</i> Not reported. • <i>Comparison group:</i> Comparison group children were entering state preschool or Head Start but had not yet attended the programs due to a strict age-eligibility cutoff observed by both Tulsa Public Schools and the Community Action Project of Tulsa County. Information on the early learning experiences of comparison group children is unavailable. • <i>Measures of child outcomes:</i> Woodcock-Johnson Tests of Achievement—Letter-Word Identification, Spelling, and Applied Problems subtests • <i>Other methodological details:</i> Analyses included controls for demographic characteristics such as race/ethnicity, eligibility for free and reduced-price lunch, and maternal education. 	<p>Significant positive outcome for:</p> <ul style="list-style-type: none"> • Letter-Word Identification (ES = 0.99) • Spelling (ES = 0.74) • Applied Problems (ES = 0.36)
<p>Middle School</p> <p>Phillips, D., Gormley, W., & Anderson, S. (2016). The effects of Tulsa's CAP Head Start program on middle-school academic outcomes and progress. <i>Developmental Psychology</i>, 52(8), 1247-1261.</p>	<p>Propensity score weighting examining academic achievement and progress at the end of 8th grade</p> <ul style="list-style-type: none"> • Data from 2006-07 school year (kindergarten) and 2014-15 school year (8th grade) • $n = 1,774$ children • <i>Sample characteristics</i> (Weighted comparison group characteristics at kindergarten entry): <ul style="list-style-type: none"> ◦ 45% Hispanic, 37% Black, 12% White, 1% Asian, 6% Native American ◦ 88% free lunch, 5% reduced-price lunch, 7% full-price lunch ◦ 29% of mothers held no high school diploma, 36% had a high school diploma, 28% had some college, and 8% had a college degree • <i>Comparison group:</i> Comparison group children were enrolled in public kindergarten in 2006-07 but did not participate in public preschool or CAP Head Start. More than half of all comparison children with parent survey data (53%) received care in a child care center and 22% at a child care home (excluding parental care). • <i>Measures of child outcomes:</i> <ul style="list-style-type: none"> ◦ State standardized achievement scores in reading and math ◦ GPA ◦ Enrollment in honors-level courses ◦ Designation as gifted ◦ Special education status ◦ Ever retained in grade ◦ Number of days absent ◦ Chronic absenteeism (>10% of days) ◦ Receipt of in-school suspension ◦ Receipt of out-of-school suspension • <i>Other methodological details:</i> Some covariates derived from a 2006 parent survey. Models included fixed effects for school at kindergarten. 	<p>Significant positive outcome for math achievement (ES = 0.13), including for:</p> <ul style="list-style-type: none"> • White students (ES = 0.13) • Hispanic students (ES = 0.24) • Students qualifying for free lunch (ES = 0.14) <p>The likelihood of being retained by 8th grade was 6 percentage points lower for Head Start participants than comparison students. The likelihood of being chronically absent in 8th grade was 3 percentage points lower for Head Start participants. These patterns were mirrored for students qualifying for free lunch, Hispanic students, and girls.</p> <p>No significant outcome for:</p> <ul style="list-style-type: none"> • Reading achievement • GPA • Enrollment in honors courses • Designation as gifted • Special education status • Days absent • School suspensions 	<p>The likelihood of being retained by 8th grade was 6 percentage points lower for Head Start participants than comparison students. The likelihood of being chronically absent in 8th grade was 3 percentage points lower for Head Start participants. These patterns were mirrored for students qualifying for free lunch, Hispanic students, and girls.</p> <p>No significant outcome for:</p> <ul style="list-style-type: none"> • Reading achievement • GPA • Enrollment in honors courses • Designation as gifted • Special education status • Days absent • School suspensions

Program and Overview	Study	Evaluation Methodology	Findings
<p>Virginia Preschool Initiative</p> <p>The Virginia Preschool Initiative (VPI) was founded in 1995 to offer preschool for 4-year-olds with identified risk factors not served by Head Start or other existing programs. In 2013–14, VPI served over 17,000 children, or about 17% of all 4-year-olds. The program serves children whose families live in poverty or experience homelessness, or whose parents did not complete high school; localities may also decide to serve children based on other criteria, such as English proficiency or participation in foster care. Curricula are locally determined but must align with the state's early learning standards. Lead teachers must have a specialized preschool certification.</p>	<p>School Entry</p> <p>Huang, F. L. (2017). Does attending a state-funded preschool program improve letter name knowledge? <i>Early Childhood Research Quarterly</i>, 38, 116–126.</p>	<p>Regression discontinuity design examining early language skills at kindergarten entry</p> <ul style="list-style-type: none"> Data from fall 2011 n = 20,586 children Sample characteristics: <ul style="list-style-type: none"> 15% Hispanic, 44% Black, 36% White, 2% Asian, 3% two or more race/ethnicities 5% had an identified disability Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on previous early learning experiences of comparison group children is not available. Measures of child outcomes: Phonological Awareness Literacy Screening—Preschool and Kindergarten assessments, lowercase alphabet recognition task Other methodological details: Sample excludes children served through programs receiving services from funding sources other than VPI (e.g., Head Start, early childhood special education, Title I). 	<p>Significant positive outcome for:</p> <ul style="list-style-type: none"> Phonological awareness (ES = 0.89–1.01)
<p>Middle School</p> <p>Virginia University Research Consortium on Early Childhood. (2015). <i>Predicting on-time promotion to and literacy achievement in eighth grade in relation to public prekindergarten in Virginia</i>. Richmond, VA: Virginia Early Childhood Foundation.</p>	<p>Propensity score matching examining academic outcomes in 8th grade</p> <ul style="list-style-type: none"> Data from 2005 to 2014 in the Virginia Longitudinal Data System (VLDS) n = 77,451 Sample characteristics: Not reported Comparison group: Comparison group children attended public kindergarten in Virginia in 2005–06 but did not attend public prekindergarten—a category that includes VPI and Head Start. Other information on the early learning experiences of comparison group children is not available. Measures of child outcomes: State standardized achievement scores in reading and writing Other methodological details: Treatment group includes participants in all public preschool, including VPI and Head Start, due to data limitations. 	<p>Preschool participants were 3.9% more likely to be promoted on time to 8th grade relative to the comparison group, a statistically significant margin.</p> <p>No significant outcome observed for literacy scores.</p>	

Program and Overview	Study	Evaluation Methodology	Findings
<p>Washington Early Childhood Education and Assistance Program (ECEAP)</p> <p>Washington's Early Childhood Education and Assistance Program (ECEAP) was created by the state legislature in 1985 to provide early learning opportunities and extensive wraparound supports for children. In 2013–14, the program served 8,741 children, or approximately 18% of children eligible. Eligible children are 3 or 4 years old and in families with low incomes or have other risk factors outlined by the program. The program underwent significant changes from 2008 to 2014, expanding the number of hours of care available, establishing new caseload maximums for family support specialists, and offering a new continuous quality improvement system for early learning providers.</p>	<p>Elementary School</p> <p>Bania, N., Kay, N., Aos, S., & Pennucci, A. (2014). <i>Outcome evaluation of Washington State's Early Childhood Education and Assistance Program</i>. Olympia, WA: Washington State Institute for Public Policy.</p>	<p>Instrumental variables design examining academic achievement in 3rd, 4th, and 5th grade</p> <ul style="list-style-type: none"> Data from 2008 to 2013, for children participating in ECEAP from 2003 to 2008 n = 29,726 children for 5th grade outcomes. Sample characteristics: <ul style="list-style-type: none"> Treatment group: <ul style="list-style-type: none"> 34% Hispanic, 15% Black, 6% Native American, 5% Asian or Pacific Islander, 36% other 19% primary language Spanish, 1% Russian, 2% other Comparison group: <ul style="list-style-type: none"> 32% Hispanic, 13% Black, 8% Native American, 5% Asian or Pacific Islander, 33% other 14% primary language Spanish, 3% Russian, 3% other Comparison group: Comparison group children were born between September 1999 and August 2004 and were in families receiving food assistance. Information on the previous early learning experiences of comparison group children is not available. Measures of child outcomes: Washington state standardized achievement test Other methodological details: Used the distance children resided from preschool centers as an instrument to account for unobserved differences between the treatment and comparison groups. 	<p>Statistically significant positive results for student performance on measures of:</p> <ul style="list-style-type: none"> 3rd grade math (ES = 0.14) and reading (ES = 0.17) 4th grade math (ES = 0.16) and reading (ES = 0.26) 5th grade math (ES = 0.16) and reading (ES = 0.23) <p>The study estimates the lifetime monetary benefits of these gains to be approximately \$13,030 per participant, though a complete cost-benefit analysis was not feasible without an examination of longer term benefits.</p>
<p>West Virginia Pre-K</p> <p>West Virginia Pre-K began in 1983 and expanded to provide universal access to preschool for 4-year-olds by 2010. When the program was studied, it served over 6,500 children—or about a third of 4-year-olds in preschool. Eligibility and class schedules were determined locally, though all programs were required to use a comprehensive curriculum. Teachers in the program were required to have a bachelor's degree or associate degree with specialized training in early education.</p>	<p>School Entry</p> <p>Wong, V. C., Cook, T. D., Barnett, W. S., & Jung, K. (2008). An effectiveness-based evaluation of five state pre-kindergarten programs. <i>Journal of Policy Analysis and Management</i>, 27(1), 122–154.</p>	<p>Regression discontinuity design examining cognitive outcomes at the beginning of kindergarten</p> <ul style="list-style-type: none"> Data from 2004–05 school year, when program was in process of scaling to universal access. West Virginia is one of five states studied. n = 720 children (West Virginia) Sample characteristics: <ul style="list-style-type: none"> 89% White, 5% other, 6% race missing 33% eligible for free and reduced-price lunch; information on eligibility for free and reduced-price lunch was missing for 53% Comparison group: Comparison children were entering preschool and had not yet attended the program due to a strict age-eligibility cutoff. Information on the early learning experiences of comparison group children is not available, but many were eligible for Head Start or other subsidized early learning programs. Measures of child outcomes: <ul style="list-style-type: none"> Peabody Picture Vocabulary Test—receptive vocabulary (English and Spanish) Preschool Comprehensive Test of Phonological and Print Processing—print awareness (English and Spanish) Woodcock-Johnson Tests of Achievement—Applied Problems subtest (English and Spanish) Other methodological details: Classrooms and students were randomly selected for participation in the study. In West Virginia, 41% of students selected did not participate in the study and were replaced in the sample, not necessarily at random. 	<p>Significant positive outcome for:</p> <ul style="list-style-type: none"> Print awareness (ES = 0.92) <p>No significant outcome for:</p> <ul style="list-style-type: none"> Receptive vocabulary Applied Problems

Appendix D: Sources for Tables 2 Through 6

Table 2

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Table 3

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Georgia's Pre-K Program

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Head Start

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Early Elementary School:

California Transitional Kindergarten Program

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