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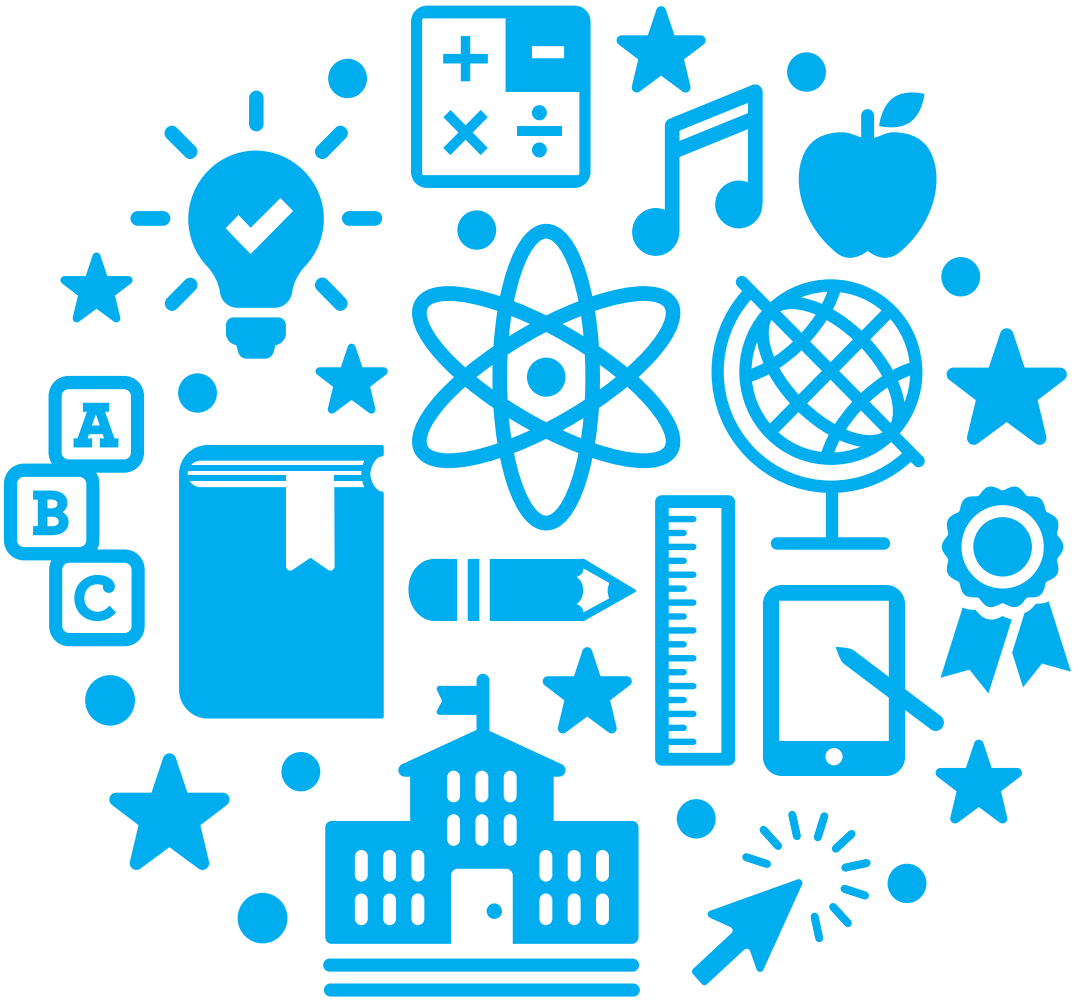

The State of the Science on Early Childhood Interventions

Pay for Success Early Childhood Education Toolkit Report #1

What Is Pay for Success?

Pay for success (PFS) offers an alternative approach to investing in the future, including early childhood education. This innovative financing mechanism shifts financial risk from a traditional funder—usually government—to a new investor, who provides up-front capital to scale an evidence-based social program to improve outcomes for a vulnerable population. If an independent evaluation shows that the program achieved agreed-upon outcomes, then the investment is repaid by the traditional funder. If not, the investor takes the loss.

For more information on pay for success, please visit **pfs.urban.org**.

About the Early Childhood Education Toolkit

This toolkit is designed to guide jurisdictions and their partners through the core elements of a PFS project in early childhood education: the existing evidence for early childhood interventions, the role of data, the measurement and pricing of outcomes, program funding and financing, implementation, and evaluation design. The toolkit includes a series of helpful features, including checklists, charts, and questions for consideration, to help direct and clarify thinking around the feasibility of pay for success to scale what works in early childhood education. Together, these briefs can help jurisdictions decide if pay for success is the right approach for them—and if so, how to get started.

Acknowledgments

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The Urban Institute is incredibly grateful to our working group partners, who lent their time and talents to the development, research, and writing of this toolkit: Accenture, Bank of America, Enterprise Community Partners, Goldman Sachs, the Institute for Child Success, Nonprofit Finance Fund, Reinvestment Fund, Salt Lake County, Social Finance US, and Third Sector Capital Partners.

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The State of the Science on Early Childhood Interventions

For this state of the science on early childhood interventions report, we are particularly grateful to: Megan Golden, Joe Waters, and Megan Carolan (Institute for Child Success) and Gerald Croan (Third Sector Capital Partners).

This report summarizes the available evidence on the impact of selected early childhood education programs. Understanding and quantifying the outcomes likely to result from a given intervention is an essential part of planning a pay for success (PFS) project. In the first part of this report, we give an overview of the outcomes typically targeted by early childhood interventions. In part two, we summarize the evidence on early childhood education, focusing specifically on preschool and prekindergarten programs. In the third and final part, we discuss the implications for stakeholders considering a PFS model to support early childhood programs in their own communities.

Background

Over the past several decades, major scientific advances have improved our understanding of brain development as a systematic, incremental process that begins prenatally and continues into adulthood. The first years of life are a time of especially rapid and critical development, during which specific brain circuitry that acts as the foundation for later development is established (Shonkoff and Phillips 2000). Children who do not have experiences that support healthy brain development are at risk for lifelong setbacks.

Interventions such as early childhood education seek to mitigate some of the threats that poverty, toxic stress, and other family risk factors can pose for healthy development. Systematic reviews of research evidence reveal that these programs can yield measurable benefits in the short run and that some benefits persist into later childhood and adulthood (Karoly et al. 1998; Yoshikawa et al. 2013). Although much of the evidence looks at the effect of programs serving children at greatest risk for poor developmental outcomes—whether from poverty, being an English-language learner in the United States, living with a mother battling depression, or other circumstances—all children regardless of income or risk level can benefit, to varying degrees, from early childhood education programs (Nores and Barnett 2014).

How Is Pay for Success Supporting Investments in Early Childhood Education?

As states and localities look to increase investments in early childhood education—and to implement interventions that have the greatest chance of improving children's life outcomes—

PFS is emerging as a promising model for supporting those efforts (ICS 2014a, 2014b).[1] Nationwide, 10 PFS projects have been financed, 3 of which are early childhood interventions (ICS 2015).[2] The Institute for Child Success (ICS)—an intermediary providing leadership on PFS in the early childhood sector—has identified 37 additional states and localities that have either expressed interest or are already receiving technical assistance, through ICS or another provider, to support implementation of PFS projects focused on early childhood education and home visiting.[3]

How Are Early Childhood Education Programs Delivered?

Early childhood education (ECE) can take place in a range of different settings designed to support healthy growth and development. Paid home-based child care providers are an important part of the system, caring for approximately 3 million children ages 5 and younger in 2012 (NSECE Project Team 2016). However, most publicly funded interventions to enhance children's early learning opportunities take place in center-based settings. Approximately 7 million children ages 5 and younger in the United States were enrolled in center-based programs in 2012 (NSECE Project Team 2014).[4]

Center-based programs take many different forms, including for-profit and not-for-profit child care centers, state- or locally funded preschool or prekindergarten programs, and Head Start. They may be operated by public or private agencies, including governments, school districts, community- or faith-based organizations, or private businesses. Outside preschool special education and early intervention services for infants and toddlers with diagnosed developmental delays, the largest public state and local ECE investments are in preschool and prekindergarten programs serving 4- and sometimes 3-year-olds (Barnett and Hustedt 2011). Some of these preschool programs are universally available, but many specifically aim to provide at-risk children with rich opportunities that support healthy development, prepare them for school, and reduce racial and income achievement gaps.

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[1] See http://pfs.urban.org/ for additional information about the pay for success model.

[2] Also see Mayor's Office, City of Denver, "Denver Ready to Provide New Housing and Services to Homeless with City Council Vote Tonight," news release, January 25, 2016, https://www.denvergov.org/content/denvergov/en/mayors-office/newsroom/2016/denver-ready-to-provide-new-housing-and-services-to-homeless-wit.html; and "South Carolina Launches Nurse-Family Partnership Pay for Success Project," Institute for Child Success Pay for Success, February 25, 2016, http://pfs.instituteforchildsuccess.org/2016/02/25/south-carolina-launches-nurse-family-partnership-pay-for-success-project/. Ten projects have been financed as of March 1, 2016. One additional state allocated funding for a PFS project and expects to launch in summer 2016, after securing investment funding. One financed project was discontinued.

[3] See http://www.instituteforchildsuccess.org/pfs.php for a map of the 37 jurisdictions.

[4] Estimates only count 5-year-olds who have not yet started kindergarten.

Key Domains of Early Development

In 1995, the National Education Goals Panel defined five domains of school readiness, covering the early childhood outcomes that represent healthy development for children from birth to age 5. These domains emerged from decades of research in developmental psychology and psychiatry, education, and pediatrics. They have since been widely adopted in the field, refined, and repurposed in dozens of states' early learning guidelines, as well as the Head Start Early Learning Outcomes Framework (Office of Head Start 2015).

These domains serve as a useful framework as stakeholders consider how PFS projects might support healthy early childhood development and what outcomes they might seek to achieve. The domains are summarized in table 1 below. Table A.1 in the appendix provides additional information on how progress in each domain has been measured at the conclusion of a program or in medium- and long-term evaluations. Although the domains are presented separately, they are highly interdependent. The National Education Goals Panel concluded it is "imperative that the dimensions [of the domains] be considered as a totality, with no single dimension acting as a proxy for the complex interconnectedness of early development and learning" (Kagan, Moore, and Bredekamp 1995, 5). To the extent that PFS projects can have a positive impact on longer-term outcomes, stakeholders might consider interventions that jointly address all domains of development.

BOX 1

MAIN TAKEAWAYS: DOMAINS OF DEVELOPMENT

The early childhood education field has adopted a model of child outcomes centered on five developmental domains that capture the holistic nature of child development.

Because the domains are interdependent, experts warn programs against focusing on a particular domain or subdomain, such as early math or receptive language test scores.

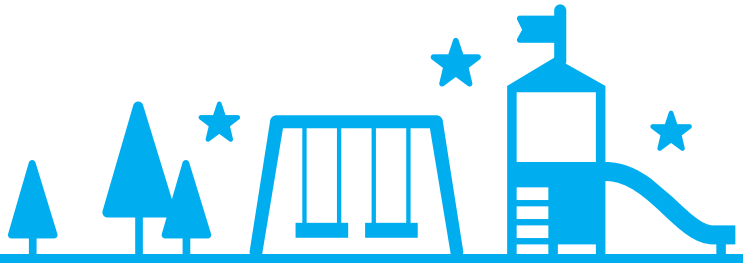

TABLE 1

Key Early Childhood Developmental Domains

DOMAIN	SUBDOMAINS	SUMMARY OF IMPORTANCE
Approaches toward learning	• Executive function • Self-regulation • Task persistence • Attention • Creativity	Early approaches toward learning have been linked to literacy and math ability in kindergarten. These skills are also linked to adult outcomes, including economic productivity, fewer illegal activities, lower rates of incarceration, and delayed childbearing.
Cognition and general knowledge	• Exploration and discovery • Memory • Reasoning and problem solving • Math • Counting • Operations and algebraic thinking • Measurement • Geometry and spatial sense • Scientific inquiry	Early math scores are the strongest predictors of both math and reading achievement in elementary and middle school. Student test scores and academic achievement have been associated with access to college, and economic returns to higher education accrue through higher employment rates and earnings.
Language development	• Language • Receptive language • Communication and speaking • Vocabulary • Literacy • Phonological awareness • Print and alphabet knowledge • Comprehension • Writing	Early language and reading scores consistently predict math and reading achievement in elementary and middle school. Student test scores and academic achievement have been associated with access to college, and returns to higher education accrue through higher employment rates and earnings.
Physical well-being and motor development	• Gross motor • Fine motor • Perception • Health and safety • Nutrition	Early physical health and development lay the foundation for cumulative advantages and disadvantages over a range of child and adult outcomes, such as obesity and lifespan. Early well-being can yield substantial savings via decreased health care costs over the life course.
Social and emotional development	• Internalizing and externalizing • Prosocial behavior • Theory of mind • Empathy	Early social-emotional skills have mixed associations with later academic achievement. Later in life, though, these skills relate to greater economic productivity, fewer illegal activities, lower rates of incarceration, and delayed childbearing.

Sources: Domains and subdomains: Kagan, Moore, and Bredekamp (1995) and Office of Head Start (2015). Approaches toward learning importance: Blair (2002); Blair and Razza (2007); Heckman, Stixrud, and Urzua (2006); and Li-Grining et al. (2010). Cognition, general knowledge, and language development importance: Alon and Tienda (2007); Bastedo and Jaquette (2011); Dale and Krueger (2011); Duncan et al. (2007); and Oreopoulos and Petronijevic (2013). Physical well-being and motor development importance: Alliance for Early Success (2015) and Hair et al. (2006). Social and emotional development importance: Duncan et al. (2007); Hair et al. (2006); and Heckman, Stixrud, and Urzua (2006).

How Early Childhood Education Supports Improved Child Outcomes

A large and growing evidence base indicates that high-quality early childhood education programs can have a meaningful impact on children's early development and can set the stage for better outcomes over their lives. In general, findings on short-term outcomes (those measured at the conclusion of a program) are clearer—and patterns are more consistent across programs—than findings on long-term outcomes. Nonetheless, cost-benefit analyses suggest the long-term economic and social benefits of these programs can substantially outweigh their costs.

What Types of ECE Programs Form the Evidence Base?

For those considering a PFS ECE project, the preponderance of evidence most likely to be relevant comes from evaluations of four types of programs.

- Early demonstration programs were implemented on a limited scale to explore the potential benefits of model interventions. Two of the most widely cited ECE programs in this category are the Perry Preschool Project, first implemented in 1962 (Schweinhart et al. 2005), and the Carolina Abecedarian Project, first implemented in 1972 (Campbell et al. 2012). Program developers and evaluators carefully monitored implementation to ensure high quality, and both projects included a rigorous experimental evaluation design. Findings from these two demonstration programs are a primary source of information about potential long-term outcomes of comprehensive center-based early childhood interventions.

- Head Start and Early Head Start are federally funded programs operated by local grantees that must meet federal performance standards. They include classroom-based instruction and supportive services for children and families. Head Start has been extensively evaluated, with numerous quasi-experimental studies and one recent experimental impact evaluation.

- State and district preschool or prekindergarten programs are implemented by states or localities, serving 4-year-olds and in some cases 3-year-olds. In some states, school systems operate all the classrooms. In other states, publicly funded prekindergarten is offered through a mix of public schools, private preschools, and child care programs, all of which adhere to either identical or very similar service delivery standards. Program design and requirements vary widely across jurisdictions. In most cases, these programs place less emphasis on comprehensive supportive services for children and families than Head Start or the early

demonstration programs. Recent evaluations of state and local public preschool programs serve as a primary source of information for estimating the potential effects of new early childhood interventions launched through PFS projects. Most evaluations have quasi-experimental designs, and only a few are able to offer information about longer-term impacts into elementary school or beyond (tables A.2–A.5).

- Other program models include interventions that have characteristics of early demonstration programs but have been implemented more recently and on a wider scale. For example, the longitudinal evaluation of the Chicago Public Schools Child-Parent Centers (CPCs) is another important source of information regarding potential long-term ECE outcomes. The CPC model included center-based preschool, ongoing supportive services for children through age 9, and an intensive family support component.[5] Funded through public-private partnerships, Educare is a different model, delivering center-based ECE services to children from infancy through preschool. Educare's goal is to reduce the income achievement gap in low-income communities.[6] A rigorous evaluation of Educare's impacts is currently under way.[7]

- PFS projects will likely rely on evidence from both meta-analyses and individual program evaluations. Conclusions drawn from meta-analyses, which assess results across multiple studies, are useful in making a general case for investments in ECE. But because they combine findings from programs with different characteristics that were implemented in different contexts, meta-analyses only suggest the type and size of outcomes any given ECE program might expect. In the next section we describe high-level findings from meta-analyses and from individual evaluations of state and district prekindergarten programs (box 2).

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[5] Chicago established the CPCs in 1967 and implemented the longitudinal study among children enrolled in the 1988-89 school year. CPCs are still in operation today, at a larger scale and with less emphasis on services in the elementary-school years. In 2014, the city launched a PFS project expanding the number of children served in its CPCs.

[6] In 2015, the Educare Learning Network was made up of 20 schools in 17 cities across the country.

[7] Previous Educare research studies examine the program's implementation (Yazejian and Bryant 2012) and describe program participant outcomes (Educare Learning Network Research and Evaluation Committee 2014; Stein et al. 2013).

BOX 2

WHY DOES THIS REPORT FOCUS ON STATE AND DISTRICT PRESCHOOL AND PREKINDERGARTEN PROGRAMS?

Among current ECE program models that PFS projects are likely to draw on, the most comprehensive evidence available is on the effects of state and district prekindergarten programs.

Because it is important for PFS stakeholders to accurately estimate expected effects, they must look to evaluations of programs that are as similar as possible to the planned intervention. Meta-analytic findings typically draw on evaluations covering many decades and diverse program models, including the early demonstration projects. Researchers have observed that the reported effects of ECE programs have declined over the past half-century and that early demonstration evaluation results likely overstate the impact that can realistically be expected from most interventions being implemented today (Bassok et al. 2015; Duncan and Magnuson 2013).

Experts cite several factors contributing to the decline. The early demonstration programs were carefully implemented on a small scale, with program components (e.g., intensive home visiting) and high per child expenditures that are not typically replicated in today's larger-scale ECE programs. In addition, because of increases in ECE participation and improvements in home environments, children in more recent comparison groups may be experiencing better developmental trajectories, thus raising the bar against which today's ECE interventions are measured (Bassok et al. 2015; Duncan and Magnuson 2013).

Note: A great deal of current research is also available for the Head Start and Early Head Start program models. Although some local jurisdictions may choose to supplement the federal program with local funding for additional children, we do not cover Head Start–specific individual studies in this report.

What Is the Evidence on the Benefits of ECE?

SHORT-TERM OUTCOMES IN THE FIVE DOMAINS OF DEVELOPMENT

When we look at the evidence as a whole, short-term early math and reading scores show the largest and most consistent effects. These results are seen in both meta-analyses (table A.3) and in evaluations of individual programs (tables A.3–A.6). For example, one meta-analysis found that, on average, children participating in ECE programs had cognitive test scores around one-third of a grade of learning higher than children in comparison groups (Duncan and Magnuson 2013; Yoshikawa et al. 2013). Similarly, most individual evaluations of state and district preschool programs find meaningfully large effects on children's math, early literacy, and language skills at the end of the first year (see tables A.3–A.5 for specific results and citations).

Another meta-analysis carried out by the Washington State Institute for Public Policy suggests that cognitive and language impacts are largest for early demonstration programs and smallest for Head Start, with state and district prekindergarten programs falling in between (Kay and Pennucci 2014).

Findings on short-term impacts of early care and education in other developmental domains—including social and emotional development and approaches to learning—tend to be more mixed, with smaller effects than in the cognitive and language domains (Kay and Pennucci 2014). In general, the evidence base for other domains is smaller, with fewer outcomes measured or reported than in the cognitive and language domains.[8]

LONGER-TERM OUTCOMES IN THE FIVE DOMAINS OF DEVELOPMENT

More widespread use of administrative data and other advances have lowered some costs of tracking longer-term outcomes. Even so, evidence for state prekindergarten programs is generally more limited for longer-term outcomes than for short-term outcomes, partly because "following" children for evaluation after they leave a program is challenging. Nonetheless, both meta-analysis (e.g., Camilli et al. 2010) and individual evaluations of state prekindergarten programs have demonstrated ongoing impacts on cognitive and language ability into the early elementary grades. Table A.5 summarizes the evidence from state prekindergarten program evaluations on children's elementary school outcomes in language and literacy, math, social skills, and behavior.

Evaluations of ECE interventions that measure development over time often show convergence in outcomes among children receiving and not receiving the treatment. Because of this convergence in test scores, the positive impacts in math and reading scores typically appear to fade out by first or second grade (Duncan and Magnuson 2013; Yoshikawa et al. 2013).

SCHOOL PROGRESS AND OTHER LIFE OUTCOMES

Even when academic test scores converge in the early elementary years, evaluations have demonstrated ECE interventions can have other medium- and long-term benefits. Multiple studies document improved progress in school measured by on-time grade promotion, high school graduation, years of schooling, or reduced need for special education services; one meta-analysis shows an average effect of 10 to 13 percentage points on these outcomes (McCoy et al. 2015).

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[8] Evaluations of ECE programs rarely measure or report on outcomes in the physical development and health domain. These outcomes are typically addressed only in Head Start or Early Head Start studies, or in evaluations of specific interventions implemented within ECE programs to target physical health and development.

Fewer individual program evaluations document improved economic and social outcomes for participants in demonstration ECE programs, including more consistent employment, higher earnings, less use of cash assistance programs, lower rates of teen pregnancy and crime involvement, and improved health and health behaviors (Conti, Heckman, and Pinto 2015; Reynolds et al. 2011; Schweinhart et al. 2005).

What Does Cost-Benefit Analysis Say about the Value of ECE Investments?

When programs show positive outcomes, an important follow-up question is whether their effect sizes yield a total benefit that outweighs the cost of the intervention. Table 2 summarizes a range of reported benefit-to-cost ratios for various types of ECE programs. Some estimates in the table are based on individual program evaluation results, and some are based on meta-analytic estimates of program impacts.

Estimates show that the costs of serving young children in ECE programs are outweighed by the long-term benefits to participants, taxpayers, and society at large. These estimates vary greatly, with the Perry Preschool Project showing the largest benefits.[9] The Washington State Institute for Public Policy performed a cost-benefit analysis based on meta-analytic findings; the analysis suggests that, on average, state and district ECE programs return an estimated $5.19 for every $1.00 spent. In general, the largest benefits accrue from increased participant earnings associated with higher educational attainment and from reduced justice system and victim costs associated with lower incidence of criminal activity.[10] Other factors—including avoided costs for special education and grade repetition—make a smaller contribution to overall benefits.

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[9] Estimated benefit-to-cost ratios vary across studies because actual impacts and costs differ from one program to another, but also because the analyses use different methods. That is, they capture different sets of child outcomes on different time horizons with different counterfactuals and assumptions about the valuation of benefits, their persistence over time, generalizability, discount rates, and other factors.

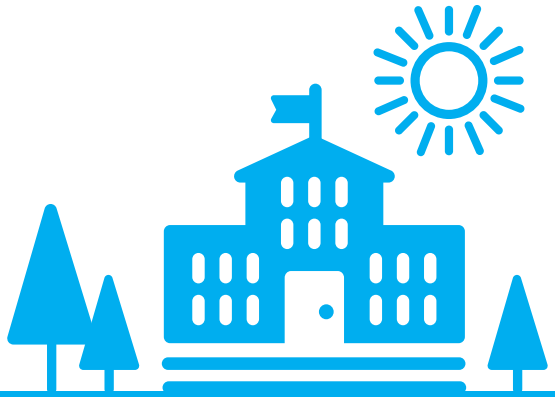

TABLE 2

Cost-Benefit Analysis Results for Selected Early Childhood Education Interventions

	REPORTED AVERAGE BENEFITS PER DOLLAR INVESTED	AVERAGE ANNUAL SPENDING PER CHILD
Early demonstration programs and other program models		
Perry Preschool	$6.60–$16.14	$13,040
Carolina Abecedarian	$2.49–$3.20	$18,188
Chicago Parent-Child Centers	$10.83	$6,394
Head Start	$1.84–$3.09	$8,861.77
State and district preschool programs		
Washington State Institute for Public Policy meta-analysis	$5.19	$7,323
Tulsa, Oklahoma	$1.42–2.06[a]	$6,951

Sources: For Perry Preschool: "Perry Preschool Project," Coalition for Evidence-Based Policy, accessed June 16, 2016, http://evidencebasedprograms.org/1366-2/65-2; Heckman et al. (2009); and Schweinhart et al. (2005). For Carolina Abecedarian: Barnett and Masse (2007); Elango et al. (2015); and "The Abecedarian Project," Promising Practices Network, last reviewed May 2011, http://www.promisingpractices.net/program.asp?programid=132. For Chicago Parent-Child Centers: Barnett and Masse (2007) and "Child-Parent Centers," Promising Practices Network, last reviewed September 2008, http://www.promisingpractices.net/program.asp?programid=98. For Head Start: Kline and Walters (2015); WSIPP (2015); and Administration for Children and Families (2016). For state and district preschool programs: Bartik, Gormley, and Adelstein (2012); and WSIPP (2015).

Notes: Annual spending per child estimates have been adjusted for inflation using the consumer price index and are reported in 2016 dollars.

[a] Estimated benefits are based on only one outcome: increased earnings expected as a result of higher achievement test scores in elementary school. The benefit range for the Tulsa program is caused by differences in child outcomes by length of program day and children's family income.

[10] The Carolina Abecedarian Project is an exception. Unlike Perry Preschool and the Chicago Parent-Child Centers, Abecedarian did not have significant impacts on criminal behavior. As a result, economic benefits are smaller, and they primarily accrue from increased earnings and improved adult health outcomes.

What Are the Characteristics of the Most Effective ECE Programs?

When using evidence from other program evaluations to estimate the expected benefits of a new PFS project, stakeholders need to consider the generalizability of the evidence, or how the characteristics of the proposed ECE project compare to the characteristics of programs with demonstrated effectiveness, including the populations of children served by those programs and related contextual factors. Selected characteristics of the state prekindergarten programs discussed earlier in the report, and in tables A.3, A.4, and A.5, are summarized in table A.6.

Research offers some evidence about which program characteristics may be most important to consider (box 3). Yet, numerous gaps in knowledge remain because establishing causal links between program characteristics and child outcomes comes with practical and methodological difficulties. Most conclusions about what defines a high-quality program are drawn from correlational studies, which explore either common characteristics across successful programs or the association between child outcomes and various program elements (Karoly and Auger 2016).

Rich teacher-child interactions and programming that relies on "intensive, developmentally focused curricula" are considered by many ECE experts to be the best predictors of better child outcomes (Duncan and Magnuson 2013; Karoly and Auger 2016; Mashburn et al. 2008; Yoshikawa et al. 2013, 8).

Evidence is also accumulating to suggest that provisions for **ongoing professional development for teachers, including coaching and mentoring**, are another essential ingredient of high-quality programs (Duncan and Magnuson 2013; Karoly and Auger 2016; Yoshikawa et al. 2013).

The research shows mixed evidence on the importance of **staff-to-child ratios, staff qualifications**, and other, more structural indicators of quality (Kelley and Camilli 2007; Zaslow et al. 2010). It appears that at least some of these factors may be an essential ingredient for program success, but they do not ensure it (Barnett and Ackerman 2006; Duncan and Magnuson 2013; Mashburn et al. 2008; Yoshikawa et al. 2013; Zaslow et al. 2010).

Other considerations that may influence a program's impact include whether the intervention offers **comprehensive services** (such as health screening or parenting supports) in addition to classroom-based instruction, **full-day versus part-day programming, one versus two years of services** (Duncan and Magnuson 2013; Karoly and Auger 2016; Yoshikawa et al. 2013), and whether the services are **provided universally or targeted to children experiencing greater disadvantage** (Elango et al. 2015; Karoly 2016; Yoshikawa et al. 2013).

BOX 3

MAIN TAKEAWAYS: EFFECTIVENESS OF EARLY CHILDHOOD EDUCATION PROGRAMS

- *A large evidence base indicates that ECE can support improved child outcomes in multiple domains of development.*
- *The strongest and most consistent evidence of impacts is found in children's cognitive and language achievement at the end of preschool. The evidence also suggests that at least some ECE programs may have positive effects on children's outcomes in other domains of development, later school success, and adult outcomes.*
- *Most cost-benefit analyses find positive economic benefits from ECE interventions.*
- *Program quality—particularly the quality of teacher-child interactions and use of an intensive, developmentally focused curriculum—matters for children's outcomes. But more research is needed to really understand the program features that produce the best outcomes.*

Challenges and Opportunities in Financing ECE through a PFS Model

PFS projects depend on quantifiable outcomes that can be assigned a dollar value for determining repayments to investors. As stakeholders work to select outcomes for repayment, they must ensure that expected outcomes meet the following criteria:

- relevant and important to the community,
- affected by the planned intervention,
- pose a minimal risk of introducing perverse incentives,
- substantial enough to motivate funders and other stakeholders,
- occur within an acceptable time horizon, and
- large enough to yield statistically significant effect sizes.

Projects can further benefit if we better understand the probability of achieving their outcomes. If a PFS project is at risk of not achieving its outcomes, this can motivate the stakeholders to consider a multifaceted funding structure, such as leveraging philanthropic grants to help fund the project.

Although PFS projects in early childhood education show great promise—including strong evidence that ECE programs can yield high returns that accrue to both key project stakeholders

and society at large—they also have obstacles:[11]

The wrong pockets problem. Returns on investments in ECE do not accrue only to the entity paying for ECE. Instead, the total return is divided among program participants, public schools, child and public welfare services, criminal justice, and other systems. Although PFS is designed to help overcome this "wrong pockets" problem, it adds complexity to determining which agencies can and should issue success payments, and in which amounts, to investors.

Long time horizons. The largest returns to ECE accrue over the long term. This presents a challenge to stakeholders implementing projects in which the governmental entities that realize benefits ideally make repayments to funders within a three-to-five-year time frame.

Need for more evidence. Investors in PFS projects need to understand and minimize the risk associated with a given project, which may be a challenge given the current state of the ECE evidence base. Although ECE programs in certain communities have demonstrated impacts, and the evidence base offers some clues as to which factors might matter in replicating or taking those programs to scale, the mixed nature of results underscores that outcomes depend on community context and the population served, and also likely depend on certain implementation factors that have not yet been conclusively identified.

Comparison groups. Most communities offer a diverse range of ECE programs. This means that even the most rigorous designs for calculating a PFS project's impact will, in all likelihood, be assessing the impact of that program compared with alternative programs available in the community, not compared with a no-treatment condition. In addition, without a comparison group, it can be difficult to determine how much growth should be attributed to the intervention, as children generally demonstrate developmental growth over time.

Despite these challenges, PFS offers states and localities new and promising opportunities to expand and strengthen their ECE systems. Over the past two decades, public investments in ECE have grown, but the need is still far from met. The PFS model offers additional resources in the form of private and philanthropic funding to complement existing funding streams and a structure that can support innovation, ensure resources are allocated to the program models most likely to achieve community goals, and rapidly build better understanding of which program models yield the greatest benefits.

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[11] See ICS (2014a) for another viewpoint on key obstacles.

Appendix A

TABLE A.1

Key Early Childhood Education Outcomes

OUTCOME DOMAINS	MEASURES COMMONLY USED AT THE CONCLUSION OF ECE INTERVENTIONS	MEASURES COMMONLY USED IN MEDIUM-TERM EVALUATIONS	MEASURES COMMONLY USED IN LONGER-TERM EVALUATIONS
Approaches toward learning	• Head, toes, knees, shoulders task (HTKS) • Pencil tap • Forward and backward digit span • Dimensional Change Card Sort • Task orientation questionnaire (attention, impulse control) • Early Learning Scale • Teaching Strategies GOLD	• Cooper-Farran behavioral rating scales • Academic and classroom behavior record • Parent-reported measures	• Crime • Educational attainment
Cognition and general knowledge	• Woodcock-Johnson IV • Research-Based Early Mathematics Assessment, Short Form • Early Learning Scale • Teaching Strategies GOLD	• National Assessment of Educational Progress (4th grade) • State standardized test scores	• National Assessment of Educational Progress (8th grade) • State standardized test scores
Language development	• Peabody Picture Vocabulary Test, 3rd edition • Woodcock-Johnson IV • Early Learning Scale • Teaching Strategies GOLD	• National Assessment of Educational Progress (4th grade) • State standardized test scores	• National Assessment of Educational Progress (8th grade) • State standardized test scores
Physical well-being and motor development	Typically not measured in short- and medium-term "whole program" evaluations		• Health in adulthood
Social and emotional development	• Emotion recognition • Task orientation questionnaire (Positive Emotion) • Early Learning Scale • Teaching Strategies GOLD	• Cooper-Farran behavioral rating scales • Academic and classroom behavior record • Parent-reported measures	• Crime • Family relationships • Drug use
Other measures of school progress	• Grade retention • Special education placement	• Grade retention • Special education placement	• Grade retention • Special education placement • High school graduation
Economic productivity			• Employment • Earnings

Source: Urban Institute, 2016.

TABLE A.2

Early Childhood Education Program Effects

Summary of meta-analytic findings

	EFFECT SIZE				
	DUNCAN AND MAGNUSON 2013[a]	CAMILLI ET AL. 2010[a,b]	MCCOY ET AL. 2015[a]	KAY AND PENNUCCI 2014 (HEAD START)	KAY AND PENNUCCI 2014 (PRE-K)
Outcome domains					
Cognition, general knowledge, language	0.35 (*n*=84)	0.23 (*n*=306)		0.17 (*n*=7)	0.32 (*n*=17)
Social, emotional, approaches to learning		0.16 (*n*=113)			
Self-regulation				0.16 (*n*=1)	0.21 (*n*=4)
Emotional development				0.03 (*n*=2)	0.04 (*n*=5)
School progress		0.14 (*n*=60)	0.28 (*n*=59)		
K–12 grade repetition or retention[c]			-0.28 (*n*=33)	-0.08 (*n*=5)	-0.39 (*n*=4)
K–12 special education[c]			-0.40 (*n*=15)		-0.23 (*n*=3)
High school graduation			-0.27 (*n*=11)	-0.18 (*n*=2)	-0.23 (*n*=2)
Number of studies	84	106	18	11	26

n=number of effect sizes included in analysis.

[a] These meta-analyses include results from early demonstration programs, which tend to have larger effect sizes than those from Head Start and state and district preschool programs.

[b] Camilli et al. (2010) report effect sizes for two types of contrasts: comparisons between two alternative treatments (T/A) and comparisons between a group receiving and not receiving the treatment (T/C). The effect sizes reported here are for the T/C contrasts.

[c] For consistency with the other sources, we reversed the sign on McCoy et al.'s (2015) effect-size estimates for these outcomes. Negative effect sizes reflect that the children receiving the intervention show less special education and grade retention or repetition.

TABLE A.3

State Prekindergarten Program Effects on Children's Outcomes at the Start of Kindergarten:
NIEER studies using regression discontinuity design

	ARKANSAS	CALIFORNIA[a]	MICHIGAN[b]	NEW JERSEY[c]	NEW MEXICO	OKLAHOMA[d]	SOUTH CAROLINA[d]	WEST VIRGINIA
Effect sizes[e] *Language and literacy outcomes*								
PPVT (receptive vocabulary)	0.28*	0.39*	0.19+	0.30*	0.18*	0.32*	0.05+	0.15+
Pre-CTOPP Print Awareness	1.00*	1.19*	–	0.56*	1.06*	0.71*	0.78*	0.71*
WJ Letter-Word Identification	–	–	1.52**	–	–	–	–	–
Math outcomes								
WJ Applied Problems	0.27*	0.34*	0.93**	0.38*	0.33*	0.51*	–	0.13+
Sample design								
Treatment year	2005–06	2005–06	2007–08	2005–06	2003–04	2003–04	2003–04	2003–04
Sample size	**901**	**1,630**	**634**	**1,538**	**1,333**	**836**	**777**	**720**

Source: Barnett et al. 2015.
NIEER=National Institute for Early Education Research. PPVT=Peabody Picture Vocabulary Test, 3rd edition. Pre-CTOPP= Preschool Comprehensive Test of Phonological and Print Processing. WJ=Woodcock-Johnson Tests of Achievement, 3rd edition.

Notes: The estimates reported here differ from those previously published because they rely on slightly different statistical methods and, in some cases, more recent data.

[a] The sample only included public school providers.

[b] Detroit did not participate in the study.

[c] The study only included the 21 largest (of 31 total) Abbott districts.

[d] The vast majority of study classrooms were in public schools.

[e] Results vary with the functional form of the equation used in estimation. This table reports effect size values for linear, cubic, or quadratic functional forms, whichever Barnett et al. (2015) determined was the best fitting for each estimate.

+ not statistically significant at the .05 level, which means there is a 5 percent or greater probability of drawing a sample with a program and comparison group difference at least as large as was observed when there is not actually an underlying difference between the program and comparison groups.

* $p<.05$, ** $p<.01$

TABLE A.4

State/District Prekindergarten Program Effects on Children's Outcomes at the Start of Kindergarten

Other studies using regression discontinuity design

	BOSTON, MASSACHUSETTS[a]	GEORGIA	NORTH CAROLINA	TENNESSEE[a,b]	TULSA, OKLAHOMA
Effect sizes					
Language and literacy outcomes					
PPVT (receptive vocabulary)	0.44***		0.06+		
WJ Letter-Word Identification[c]	0.62***	1.05***	1.14***	0.82***	0.99***
WJ Word Attack[c]		1.20***			
WJ Sound Awareness[c]		0.59***			
WJ Picture Vocabulary[c]		0.01+		0.48***	
WJ Spelling[c]				0.99***	0.74***
WJ Oral Comprehension[c]				0.26+	
Naming letters		0.89***			
TOPEL Phonological Awareness[c]			0.56***		
TOPEL Print Knowledge[c]			1.16***		
Math outcomes					
WJ Applied Problems	0.59***	0.51***	0.34*	0.48***	0.36***
WJ Quantitative Concepts				0.50***	
REMA short form[c]	0.50***				
Counting task		0.86***	0.81***		
Executive functioning outcomes					
Pencil tapping	0.21*				
Backward digit span	0.24*				
Forward digit span	0.24**				
Dimensional Change Card Sort	0.28**				
TOQ Attention[c]	0.11+				
Social/emotional outcomes					
Emotion Recognition Questionnaire	0.19*				
TOQ Positive Emotion[c]	0.03+				
TOQ Impulse Control[c]	0.20+				
SSIS Social Skills[c]		0.23+			
SSIS Problem Behaviors[c]		0.10+			
Other outcomes					
Social awareness task		0.43***			
Sample design					
Treatment year	2008–09	2011–12	2008–09	2009–10	2005–06
Sample size	2,018	1,181	1,010	1,358	2,756
Study participation rate (%)[d]	54	52	n/r	95	76

Sources: Boston: Weiland and Yoshikawa (2013). Georgia: Peisner-Feinberg et al. (2014). North Carolina: Peisner-Feinberg and Schaaf (2011). Tennessee: Lipsey et al. (2011). Tulsa: Gormley, Phillips, and Gayer (2008).

PPVT = Peabody Picture Vocabulary Test, 3rd edition (4th edition in North Carolina). REMA = Research-Based Elementary Mathematics Assessment. SSIS = Social Skills Improvement System.

TOPEL = Test of Preschool Early Literacy. TOQ = Task Orientation Questionnaire. WJ = Woodcock-Johnson Tests of Achievement, 3rd edition.

[a] Results vary depending on the "bandwidth" (number of days from the cutoff date for kindergarten entry a child could have a birthday and still be included in the analysis). For Boston, this table reports effect size values for the bandwidth Weiland and Yoshikawa (2013) determined was preferred for each estimate. For Tennessee, this table reports effect size values for a bandwidth of +/- 12 months, as re-reported in Farran and Lipsey (2015).

[b] The Tennessee study only represents one of four regions (the Central West region).

[c] Subscale from WJ, TOPEL, REMA, TOQ, or SSIS.

[d] Study participation rates are approximate. In some cases, study authors did not directly report a participation rate but provided disaggregated information that allowed us to estimate an overall study participation rate.

+ not statistically significant at the .05 level, which indicates there is a 5 percent or greater probability of drawing a sample with a program and comparison group difference at least as large as was observed when there is not actually an underlying difference between the program and comparison groups.

* $p<.05$, ** $p<.01$, *** $p<.001$

TABLE A.5

Longitudinal Effects of State Prekindergarten Programs on Children's Outcomes

Studies using quasi-experimental designs other than regression-discontinuity

	ARKANSAS	MICHIGAN[a]	NEW JERSEY ONE YEAR	NEW JERSEY TWO YEARS	TENNESSEE	TULSA, OKLAHOMA	WASHINGTON
Developmental domain and grade							
Receptive vocabulary (PPVT)							
Kindergarten			0.22*	0.41*			
Grade 1	0.23**		0.18*	0.38**			
Grade 2	0.23**		0.22*	0.40**			
Grade 3	0.18+						
Other language and literacy outcomes							
Kindergarten		0.37**	[b]	[b]	0.02+[c]		
Grade 1	0.24*		[b]	[b]	-0.04+[c]		
Grade 2	0.20**		[b]	[b]	-0.15*[c]		
Grade 3	0.22*				-0.13+[c]	0.09+[d]	0.17*
Grade 4		[e]	0.12+	0.26*			0.26**
Grade 5			0.18*	0.22+			0.23*
Math outcomes							
Kindergarten		0.15+	[b]	[b]	[c]		
Grade 1	0.28*		[b]	[b]	[c]		
Grade 2	0.32**		[b]	[b]	[c]		
Grade 3	0.24+				[c]	0.18*	0.14+
Grade 4		[e]	0.17+	0.37**			0.16*
Grade 5			0.14+	0.29*			0.16*
Other developmental domains: Social/peer skills/relations							
Kindergarten		-0.13+[f]			0.04+		
Grade 1		-0.12+			-0.05+		
Grade 2					0.04+		
Grade 3		0.05+			0.19+		
Grade 4		-0.09+					
Approaches to learning							
Kindergarten		0.34**			0.20*		
Grade 1					-0.20*		
Grade 2					0.00+		
Grade 3					0.08+		
Other school success measures							
Cumulative grade retention[g,h]	-0.11+	-0.25**	-0.12*	-0.20*			
On-time high school graduation		0.30**					
Preparedness for grade							
Kindergarten		0.27*			0.22*		
Grade 1		0.23*			-0.17+		
Grade 2					0.05+		
Grade 3		0.17*			-0.01+		
Grade 4		0.27*					
Study design							
Preschool years evaluated	2004–05 & 2005–06	1995–96	2004–05	2003–04 & 2004–05	2009–10 & 2010–11	2005–06	2003–04 to 2008–09
Comparison group composition	Children entering kindergarten in study school districts without any preschool experience	Low-income children who did not attend any type of preschool	Children entering same kindergarten classrooms as children who attended the preschool program		Randomly selected from among program applicants in study schools	Children entering TPS kindergarten who did not attend TPS or Tulsa Head Start the previous year	Low-income children with Washington public school test scores[i]
Method of controlling for selection bias[j]	Upward adjustment of estimates based on RDD results	Demographic covariates included in model	Demographic covariates included in model		Propensity score matching[k]	Propensity score matching	Instrumental variable modeling
Sample size[l]	1,334	596			1,076	1,574	51,619

Sources: Arkansas: Jung et al. (2013). Michigan: Schweinhart et al. (2012); Xiang and Schweinhart (2002). New Jersey: Frede et al. (2009); Barnett et al. (2013). Tennessee: Lipsey, Farran, and Hofer (2015). Tulsa: Hill, Gormley, and Adelstein (2012). Washington: Bania et al. (2014).

Notes: Blank cells indicate that a study did not report data on that measure at that grade level.

PPVT = Peabody Picture Vocabulary Test, 3rd edition. RDD = regression discontinuity design.

[a] Effect sizes for Michigan's program and grade retention in all states were calculated by the Urban Institute using statistics reported in the original studies.

[b] Study includes findings on multiple individual early literacy and math subscales. Results were mixed, with some subscales showing positive effects for preschool participants and some subscales not showing evidence of effects.

[c] Results for Tennessee's composite measure, which combines math and literacy subscales, are reported under language and literacy outcomes. Separate composite measures combining only language/literacy and only math subscales were not available. Results for individual math and literacy subscales were generally similar to results for the overall composite measure.

[d] Effect size not directly reported by study authors; value is estimated from a bar chart.

[e] The study included analysis of the program's effect on children's fourth-grade standardized achievement test scores in math and literacy. Children participating in the program were more likely than comparison group children to have satisfactory achievement test scores. However, results are not reported in the table because most of the difference between the groups comes about as children in the comparison group were more likely to have been retained and not yet taken the achievement test.

[f] The social skills results presented in the table come from a scale based on teacher-reports in kindergarten and first, third, and fourth grades. A different measure, used only in kindergarten, showed that children participating in the program had significantly higher scores than comparison group children.

[g] Cumulative grade retention reflects whether children have been retained in any grade. The number of years included in the cumulative grade retention measure and percent of children retained is as follows: Arkansas, grade 3 (9.9% program and 13.3% no pre-K comparison); Michigan, grade 12 (36.8% program and 49.2% comparison); New Jersey, grade 2 (7.2% one program year, 5.3% two program years, and 10.7% comparison).

[h] Effect sizes for Michigan's program and grade retention in all states were calculated by the Urban Institute using statistics reported in the original studies.

[i] The evaluation focuses on outcomes among children whose families had applied for Basic Food.

[j] All the studies relied on demographic covariates as a method of controlling for selection bias.

[k] Although Tennessee randomly assigned children to treatment and comparison groups, the results reported here are based on quasi-experimental analysis rather than on the experimental design.

[i] Sample sizes are presented to offer a general sense of each study's scope but represent slightly different underlying measures. Some are reflective of the total number of children who entered the study. Others are reflective of the analytic sample size during one of the earliest phases of data collection. In some studies with multiple cohorts, the sample size for the last year or two of results is substantially smaller than the figure reported because data were not yet available for all cohorts.

+ not statistically significant at the .05 level, which means there is a 5 percent or greater probability of drawing a sample with a program and control group difference at least as large as was observed when there is not actually an underlying difference between the program and comparison groups.

* $p<.05$, ** $p<.01$

TABLE A.6

Characteristics of Selected State and District Prekindergarten Programs

2013–14 school year

STATE/DISTRICT PROGRAM (YEAR ESTABLISHED)	PUBLIC SCHOOL SETTINGS ONLY?	INCOME ELIGIBILITY REQUIREMENT[a]	BA AND SPECIALIZED ECE TRAINING REQUIRED FOR ALL TEACHERS?	MAXIMUM CHILD: STAFF RATIO (4-YEAR-OLDS)	SPENDING PER CHILD SERVED
Arkansas Better Chance (1991)	No	200% FPL	BA: No Specialized: Yes	10:1	$9,240[b]
Boston Public Schools K1 (2005)	Yes[c]	Universal	BA: Yes Specialized: No	1:11	$10,000–$15,000
California State Preschool (1965)	No	70% SMI	BA: No Specialized: Yes	8:1	$4,298
Chicago Child-Parent Centers (1967)	Yes	Residence in Title I school area	BA: Yes Specialized: Yes	17:2	$8,512
Georgia Pre-K (1993)[d]	No	None	BA: Yes Specialized: Yes	11:1	$3,746
Michigan Great Start Readiness (1985)	No	250% FPL[e]	BA: Yes Specialized: Yes	8:1	$5,704
New Jersey Abbott Preschool (1998)	No	None[f]	BA: Yes Specialized: Yes	15:2	$13,337
North Carolina Pre-K (2001)	No	75% SMI	BA: Yes Specialized: Yes	9:1	$7,351
New Mexico Pre-K (2005)	No	None[g]	BA: No Specialized: Yes	10:1	$3,555
Oklahoma Pre-K (1990)[h]	No[i]	Universal	BA: Yes Specialized: Yes	10:1	$7,698
South Carolina 4K (1984)	Yes[j]	185% FPL	BA: No Specialized: Yes	10:1	$798
Tennessee Voluntary Pre-K (2005)[k]	No	185% FPL	BA: Yes Specialized: Yes	10:1	$5,895
Washington ECE and Assistance (1985)	No	110% FPL	BA: No Specialized: Yes	9:1	$6,658
West Virginia Pre-K (1983)[l]	No	None	BA: Yes Specialized: Yes	10:1	$8,799

Sources: Barnett et al. (2016). Boston: Muenchow; Weinberg (2016) and Sachs and Weiland (2010). Chicago: Reynolds et al. (2011).

Notes: Boston figures from 2009–10 school year. Chicago costs reported in 2007 dollars.

BA=bachelor of arts degree. ECE=early childhood education. FPL=federal poverty level. NIEER=National Institute for Early Education Research.

SMI=state median income.

[a] Most programs not offered universally nevertheless admit families with other risk factors, even if they do not meet the income eligibility requirement.

[b] Urban Institute rough funding-level estimate. NIEER-reported state funding per child is $5,544, and local programs must provide a 40 percent match in cash or through in-kind services (Barnett et al. 2016).

[c] From 2012 to 2015, Boston operated a pilot program expanding prekindergarten to community-based programs,

[d] Universal in 1995.

[e] 90 percent of families must meet the income eligibility requirement.

[f] The Abbott Preschool Program only operated in the lowest-income school districts.

[g] Funding preference is given to programs in low-income communities.

[h] Started on a limited basis in 1980, statewide funding allocated in 1990, universal in 1998.

[i] Teachers for the program in private settings are public school employees, and children are considered public school enrollees.

[j] School districts may partner with Head Start programs.

[k] Limited-scale pilot project began in 1998.

[l] Universal in 2010.

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