

# When Does Preschool Matter?

---

*Hirokazu Yoshikawa, Christina Weiland, and  
Jeanne Brooks-Gunn*

---

## Summary

We have many reasons to invest in preschool programs, including persistent gaps in school readiness between children from poorer and wealthier families, large increases in maternal employment over the past several decades, and the rapid brain development that preschool-age children experience. But what do we know about preschool education's effectiveness?

In this article, Hirokazu Yoshikawa, Christina Weiland, and Jeanne Brooks-Gunn report strong evidence that preschool boosts children's language, literacy, and math skills in the short term; it may also reduce problem behaviors such as aggression. Over the elementary school years, however, test scores of children who were exposed to preschool tend to converge with the scores of children who were not. Many factors may explain this convergence. For example, kindergarten or first-grade teachers may focus on helping children with lower levels of skills get up to speed, or children may lose ground when they transition from high-quality preschools into poor-quality elementary programs. Taking a longer view, some studies have found that attending preschool boosts children's high school graduation rates and makes them less likely to engage in criminal behavior. Overall, higher-quality preschool programs are associated with larger effects.

How might preschools produce larger effects that last longer? Developmentally focused curricula, combined with intensive in-service training or coaching for teachers, have been shown to improve the quality of preschool instruction. Focusing on fundamental skills that both predict long-term outcomes and are less likely to be gained in the first years of school might also produce longer-lasting effects. And improving instructional quality in early elementary school and better aligning the preschool and elementary curricula may be another way to sustain the boost that quality preschool education can provide. Above all, the authors write, if we want to see sustained improvements in children's development and learning, we need to increase the quality of—not just access to—preschool education.

[www.futureofchildren.org](http://www.futureofchildren.org)

---

Hirokazu Yoshikawa is the Courtney Sale Ross University Professor of Globalization and Education at New York University. Christina Weiland is an assistant professor at the University of Michigan School of Education. Jeanne Brooks-Gunn is the Virginia and Leonard Marx Professor of Child Development and Education at Teachers College and College of Physicians and Surgeons at Columbia University and co-director of the National Center for Children and Families. Yoshikawa's work on this article was supported by funding from the NYU Abu Dhabi Research Institute to the NYU Global TIES for Children Center, which he co-directs.

Janet Currie of Princeton University reviewed and critiqued a draft of this article.

---

Several factors together present a strong rationale for investing in children's learning before age five, when children enter primary school in the United States. First, family income–based gaps in cognitive skills are already large when children enter school. These gaps don't grow substantially as schooling goes on, suggesting that to reduce achievement gaps, we may need to intervene before children begin school.<sup>1</sup>

Second, during early childhood, the brain is especially sensitive to environmental enrichment. Early experiences in children's homes, in other care settings, and in their communities interact with their genes to shape their brains. Their neuronal systems undergo very rapid growth and then pruning, based on environmental inputs such as activities, language, and other people's responsiveness. Environmentally influenced brain development supports a range of early skills, including cognitive skills (language, literacy, and math), social skills (understanding others' behaviors and motivations, prosocial behaviors, and understanding and display of emotions), and self-regulation and executive function (voluntary control of attention and behavior).

Third, large increases in maternal employment over the past several decades, especially among lower-income families, mean that more children experience care by others besides parents early in life. Finally, the majority of US parents prefer preschool to home-based care for their three- and four-year old children. Polling suggests that 70 percent of Americans support legislation to make preschool available to all young children.<sup>2</sup>

The rationale for preschool education involves both preparing children to be

ready for elementary school and reducing achievement and behavior gaps between children whose parents have more and less education or higher and lower income. Underlying the focus on all preschoolers is the assumption that children will get more out of K–12 education if they master a number of skills before they start. These skills include knowledge of letters and phonemic properties; early language skills such as expanded vocabulary and oral comprehension; early numeracy, geometry, and problem solving; and the ability to pay attention, interact cooperatively with peers, and adjust behavior when experiencing strong emotions or conflict. Though children acquire these skills in their homes to some degree, high-quality preschool education can enhance them. Underlying the focus on gaps is the assumption that children in poorer families or those who have less-educated parents tend to have fewer of the types of opportunities that promote early learning and development. Disparities certainly exist vis-à-vis perinatal health; health conditions in the first years of life; access to books and other cognitively stimulating materials; and neighborhood exposure to violence and environmental toxins, to name a few. Many preschool programs were developed to offset these disparities by enhancing the development of children from specific backgrounds.

According to one study, in 2010 about 70 percent of US four-year-olds were enrolled in preschool. The Census Bureau's Current Population Survey, which defines preschool somewhat more restrictively, found that in 2013 about 66 percent of four-year-olds and 43 percent of three-year-olds were enrolled.<sup>3</sup> Children from lower-income families were less likely to be enrolled than were children from higher-income families. Enrollment

rates also varied by racial/ethnic group. As of 2010, Latino children showed the lowest enrollment levels—18 percentage points lower than those of whites.

In the following sections, we summarize what research shows about preschool education's effectiveness across a number of developmental domains. We look at effects across three time frames: immediately after preschool, during elementary and middle school, and during adolescence and adulthood. We describe how effects vary according to how intensive the preschool programs are and how long they last, family and child characteristics, and program quality. Finally, we highlight the strongest findings and discuss what we still need to know to help both policy makers and educators.

For the most part, evaluations of preschool education have used *randomized* designs, meaning that children whose parents have agreed to let them be considered for admission to a particular preschool program are assigned (randomized) to either a treatment group that participates in the program or a control group that does not. Children and families are assessed at this point to make sure that the groups are equivalent before the intervention begins. A random assignment study can provide strong evidence for a preschool program's effects. Another well-regarded design is called *regression discontinuity*. Here, children who miss the cutoff age for admission into a program (typically one that is universal or being offered to a large proportion of a particular population) are compared to those who just made the cutoff, on the assumption that these two groups of children are similar in most ways. Regression discontinuity has been used to evaluate public prekindergarten

programs. In this article, we review evidence mostly from studies that use one of these two designs. On occasion, we refer to studies that compare siblings who had different child-care experiences. Another approach is to attempt to match groups of children receiving different types of child care; this approach is limited by the fact that it's difficult to identify all possible differences among the groups of interest.

## Short-Term Effects

### Cognitive Outcomes

A recent meta-analysis quantitatively synthesized several decades of preschool evaluations that had strong causal research designs. One year of preschool education had an average impact on cognitive skills that represented three months of additional learning beyond the normal levels of skill acquisition that occur among four-year-olds without access to preschool.<sup>4</sup> The studies covered in the meta-analysis looked mostly at early language, preliteracy (spelling and letter-word identification) and math outcomes. Among language and literacy outcomes, preschool's effects were strongest on print concepts (for readers familiar with statistical analysis, the average effect size was .54, or roughly one half year of additional learning) and early reading (average effect size .44), and weaker on more broadband skills such as vocabulary (average effect size .22).<sup>5</sup>

Rigorous evaluations of preschool education have mostly been conducted on small-scale programs (the best known being the Perry Preschool and Abecedarian programs). Recently, several large-scale public prekindergarten programs have been evaluated using regression-discontinuity designs. These studies show a pattern of

impacts consistent with the meta-analytic study.<sup>6</sup> The large-scale programs produced the largest effects on narrowly defined skills such as those in the literacy domain, with statistically significant effects in seven out of eight states or cities that were studied (effect sizes ranged from 0.32 to 1.10, with an average effect of 0.63, or roughly two-thirds of a year of additional learning). Four out of seven programs showed effects on broader skills such as vocabulary (across all seven, effects ranged from -0.13 to 0.44, an average effect of 0.18) and math (ranging from 0.06 to 0.59, with an average effect of 0.34). Higher-quality programs tended to produce larger effects. Programs in Boston, MA, and Tulsa, OK, showed particularly strong results, with effect sizes in the medium to large range. The instructional quality of these two large-scale programs was considerably higher than what we typically see (for example, in large-scale Head Start and public prekindergarten studies, levels of instructional quality are in the low range).<sup>7</sup> (See the article in this issue by Robert Pianta, Jason Downer, and Bridget Hamre for a detailed look at preschool classroom quality.)

### **Socioemotional, Self-Regulation, and Executive Function Outcomes**

Relatively few causal evaluation studies of general preschool (that is, preschool that lacks a specific behavior-focused component) have measured socioemotional outcomes, which include positive behaviors that show empathy, cooperation, or a prosocial orientation, as well as problem behaviors that show antisocial, aggressive, hyperactive, impulsive, withdrawn, depressed, or anxious tendencies. Compared to measures of achievement, language, and cognition, socioemotional

measures are more varied in the content they cover and the quality of measurement.

Evaluations that include this domain most often focus on aggressive, antisocial, and hyperactive behaviors. The Perry Preschool program, for example, was found to reduce acting out and aggressive behaviors once participating children reached elementary school.<sup>8</sup> More recently, the National Head Start Impact Study found that one year of Head Start reduced acting-out behaviors for the full sample and hyperactivity among three-year-olds.<sup>9</sup> However, a national study using matching methods to approximate the conditions of a randomized experiment found that children who attended Head Start programs had greater social competence and fewer outward-directed problem behaviors than did children who attended other center-based care programs.<sup>10</sup> In Tulsa, an evaluation found that children who attended prekindergarten were less timid and more attentive than children who attended neither prekindergarten nor Head Start, suggesting greater engagement in the classroom. However, no differences were seen in aggressive or hyperactive behavior.<sup>11</sup> Preschool programs may need to pay explicit attention to this domain of behavior. A meta-analysis that summarized preschool's effects on aggression found small reductions in children's aggressive behavior (effect size -.10), but only among programs that made improving children's behavior a clear-cut goal.<sup>12</sup>

Several recent experiments have examined whether targeted curricula can improve the three principal dimensions of executive function in early childhood: cognitive flexibility, or the ability to switch focus and attention across different kinds of tasks; inhibitory control, or the ability to substitute a desired behavior for a more automatic type of response; and working memory, or the

ability to hold information in short-term memory and recall or manipulate it). The Tools of the Mind program, which targets these skills with a variety of activities, has shown mixed results. One evaluation found medium-sized increases in executive function skills, but three others showed no effects.<sup>13</sup> A kindergarten version of the program has shown positive effects on a variety of measures of executive function, as well as on reading and math skills.<sup>14</sup>

Math curricula may be another pathway for improving executive function, not to mention language skills. Arithmetic problems, for example, can build working memory and cognitive flexibility.<sup>15</sup> The Building Blocks curriculum—in which children express their mathematical ideas and thinking through language—has shown positive impacts on executive function skills both in small-scale experiments and in one larger-scale regression-discontinuity study (see Julie Sarama and Douglas Clements’s article in this issue). Finally, social-cognitive approaches to behavior management, which train children to substitute prosocial responses for impulsive or antisocial behaviors, may also increase executive function.<sup>16</sup> (See the article in this issue by Cybele Raver and Clancy Blair for a detailed look at executive function.)

## **Health Outcomes**

Preschool’s effects on children’s health have been rigorously investigated only in the Head Start program—possibly because Head Start, unlike most preschool programs, directly targets children’s health outcomes. The program includes preventive dental care, comprehensive health screening, tracking of well-child visits and required immunizations, and assistance with finding a regular medical

provider. During Head Start’s early years, a regression-discontinuity study showed that the program reduced child mortality—in particular, it reduced deaths from causes related to Head Start’s immunization and screening services (such as measles, whooping cough, and respiratory problems).<sup>17</sup> More recently, the national Head Start Impact Study found somewhat mixed effects on children’s health between the end of the program and the end of first grade. At some but not all post-program time points, Head Start had small positive impacts on some indicators of physical health and health care use, such as getting dental care, having health insurance, and parents’ reports of children being in good health. On the other hand, at the end of first grade Head Start had no impact on whether children had received care for an injury within the last month or whether they needed ongoing care.

## **Medium-Term and Long-Term Effects**

Evaluations of preschool’s medium-term effects (during elementary and middle school) most often measure achievement test scores, special education placement, and grade retention. Researchers have examined a smattering of other outcomes, but here we focus on those three.

### **Medium-Term Effects**

Test scores of children who were exposed to preschool and of children who were not tend to converge over the elementary school years. Preschool’s effects on test scores diminish every year (at a rate of .02 effect sizes per year), but the decline is steepest in the first two years after a preschool program ends—in other words, during the first years of primary schooling.<sup>18</sup> Most recently, an evaluation of Tennessee’s prekindergarten

program found that preschool attendance led to small *negative* effects on children's academic achievement at the end of third grade, concentrated among English language learners.<sup>19</sup> A follow-up evaluation of the Tulsa CAP Head Start program into eighth grade showed positive effects on math achievement using a similar matching approach.

Experimental evaluations have also shown that preschool exposure reduces grade retention and special education placement in the K–12 years. A recent meta-analysis showed average reductions in the available studies of 0.04 standard deviations or 6.0 percentage points for grade retention rates and 0.33 standard deviations or 7.5 percentage points for special education placement.<sup>20</sup>

### Long-Term Effects

Only a few studies have examined preschool's effects in late adolescence and adulthood. A recent meta-analysis found an 11.7 percentage-point increase in high school graduation rates, on average.<sup>21</sup> A few small-scale experiments (the Perry Preschool program being the most well-known), as well as national sibling studies that followed children from the same family who did and did not attend Head Start, have observed reductions in juvenile or adult crime. One of these national studies found that Head Start had an effect of .23 standard deviations on an index of young-adult outcomes comprising high school graduation, college attendance, joblessness, crime, teen parenthood, and health.<sup>22</sup>

The long-term experimental evaluations of Perry Preschool and the Abecedarian Project examined health outcomes in adulthood. Adults who participated in either program as children were less likely to use

drugs, tobacco, and alcohol. Abecedarian participants also had fewer depressive symptoms. When members of Abecedarian's research sample reached their mid-30s, those in the treatment group has lower rates of metabolic syndrome than those in the control group.<sup>23</sup> Descriptive analyses examining how these long-term effects come about suggest that higher educational attainment may play a mediating role.<sup>24</sup>

### Variation in Effects

How do preschool education's effects vary according to policy and demographic factors? We consider three major categories: dosage (how much time children spend in preschool); characteristics of children or their families; and program quality. We also review findings from an emerging area of research on how impacts vary across preschool centers and what factors predict that variation.

### Dosage and Duration

Only a few studies have examined whether preschool education has larger effects if it lasts for two years instead of one. The evidence isn't strong (none of these studies randomly assigned children to one versus two years of preschool), and the findings aren't clear. Focusing on disadvantaged children, the studies find that children who experience more years of preschool see larger gains. But the added gains of an additional year are often smaller than the gains that four-year-olds typically experience from one year of participation.<sup>25</sup> Why would an additional year generally produce smaller gains? For one thing, children who attend an additional year of preschool may experience the same curriculum across the two years rather than a sequenced two-year curriculum. Mixed-age classrooms (of three- and four-year olds) may magnify this problem.

Another measure of dosage is whether children spend a full day or a half day in preschool. Two recent studies, one experimental and one quasi-experimental, found that full-day preschool programs produced stronger cognitive and socioemotional outcomes than did half-day programs.<sup>26</sup> An experimental study that examined full-day versus half-day kindergarten (but not preschool) found better literacy outcomes from full-day exposure (effect size .31).<sup>27</sup>

### **Family and Child Characteristics**

It's difficult to estimate how preschool affects poor and better-off children differently, because virtually all preschool evaluations over the past decades have focused on poor families. Two recent evaluations are exceptions. Evaluations of the Tulsa and Boston prekindergarten programs, which were made available to all families, showed larger positive short-term effects on literacy and math skills (and in Boston on vocabulary) for poor children—although better-off children also saw small to large positive effects on these outcomes (a range of 0.30 to 0.75 standard deviations).<sup>28</sup> The Boston evaluation also found small positive impacts overall on executive function skills and the ability to recognize emotion, but among poor children, the executive function effects were larger than they were among better-off children.

What about differences by children's gender? Overall, we see no clear pattern. A study of three demonstration projects (Perry Preschool, Abecedarian, and the Early Training Project) suggested that long-term effects on a variety of outcomes pertained largely to girls rather than boys.<sup>29</sup> However,

a meta-analytic study found that this pattern didn't hold true for the larger set of rigorous preschool evaluations over the past several decades.<sup>30</sup>

Turning to other characteristics, few studies have had samples diverse enough to let researchers examine preschool programs' effects by race/ethnicity or by English language learner or immigration status. The samples in many of the landmark studies with long-term follow-up comprised nearly 100 percent low-income black children. More recent studies have analyzed more diverse samples, using regression-discontinuity approaches. For example, the Tulsa and Boston evaluations examined differences by race/ethnicity. The Boston study found larger impacts on language, literacy, early mathematics, executive function, and emotional skills among Asian, black, and Hispanic children than among white children (although the white children did show small gains in all those domains except emotional skills). In the Tulsa study, effects on children's literacy and mathematics skills were larger for Hispanic and Native American children than for white children, although whites also saw positive effects. Impacts were similar for white and black children in Tulsa on one test of early literacy, larger for whites on a different early literacy test, and larger for blacks for early mathematics. In both Boston and Tulsa, positive effects were strongest for Hispanic children (versus whites) and for English language learners (versus monolingual English speakers; the assessments were conducted only in English).<sup>31</sup>

Similarly, the Head Start Impact Study showed significantly larger effects on cognitive outcomes among Latino and English language learner children (who were

from Spanish-speaking households).<sup>32</sup> A second analysis of Head Start Impact Study data found that language and mathematics benefits were concentrated among English language learners who had the lowest skills when they entered the program.<sup>33</sup> A recent evaluation of Tennessee's prekindergarten program also found much larger short-term cognitive impacts for English language learners than for monolingual English speakers; the effects were particularly pronounced for English language learner children whose mothers had less than a high school degree.<sup>34</sup>

Three large-scale studies examined preschool's effects among children with disabilities. In studies of Head Start and the Tulsa and Boston prekindergarten programs, children with disabilities experienced positive short-term effects on cognitive skills. Although Head Start had no effects on their socioemotional skills, the Tulsa program reduced attention-seeking behavior and problem behaviors in interactions with peers for children with disabilities that attended prekindergarten. The Boston program strongly enhanced the impulse control of children with disabilities.<sup>35</sup> It's likely that the children identified in these studies had mild to moderate disabilities, rather than severe ones (children with severe disabilities are most often placed in specialized programs not included in these evaluations; see the article in this issue by Kathleen Hebbeler and Donna Spiker).

## Quality of Programs

For research purposes, preschool quality falls into two broad categories—structure and process. Structural quality includes features such as teacher education, group size, and staff-child ratio. Process quality

refers to children's interactions primarily with teachers, though also with other children. Structural quality sets the stage for higher-quality interactions to occur, although it doesn't guarantee that they will. Nationally, structural quality tends to be moderate, emotional support quality is good, and instructional quality is quite low.<sup>36</sup>

---

*Higher quality appears to be associated with larger gains in children's skills.*

---

Higher quality appears to be associated with larger gains in children's skills. The weight of nonexperimental evidence suggests that children make stronger gains in school readiness skills when they attend higher-quality preschool programs.<sup>37</sup> Moreover, particularly successful programs, like those in Boston and Tulsa, demonstrate higher instructional quality than typical US programs do.<sup>38</sup> In a recent set of 14 randomized trials, preschool curricula that focus on specific child developmental skills, that have a specific scope and sequence, and that were supported by high-quality teacher professional development such as in-classroom coaching have increased classroom quality and improved targeted child outcomes.<sup>39</sup> Combining focused curricula with supports for teachers in this way may help to raise the relatively low instructional quality of many large-scale preschool systems.

Preschool's effects on children's development depend not just on the quality of the preschool program they attend but also on the quality of alternatives to which a

preschool program is compared. A high-quality preschool program will show larger effects if we compare it to a low-quality setting, and smaller or no impacts if we compare it to another high-quality program. Empirically, several studies have found that Head Start has larger effects on children's cognitive outcomes when the alternative is parental or relative care, versus an alternative of another center-based preschool program.<sup>40</sup>

### **Variation across Preschool Centers**

Using data from the national Head Start Impact Study, two recent studies looked for statistically significant variation in impacts across Head Start centers.<sup>41</sup> Both found substantial variation. Some Head Start centers were much less effective than their local alternatives, and some were much more effective. One of the studies found that Head Start centers varied in their effects on language, literacy, self-regulation, and acting-out behaviors, but not their effects on math.<sup>42</sup> It may be that preschool teachers feel less comfortable teaching math than teaching language or literacy; spend less time teaching math than teaching other topics; or limit their math instruction to simple skills such as counting and recognizing shapes or numerals.

In nonexperimental analyses, centers produced larger effects on cognitive skills if they offered full-day rather than half-day care or served a larger percentage of English language learners with low baseline vocabulary skills. And centers that offered more than three home visits a year showed stronger positive impacts on a socioemotional skills composite than did centers that offered fewer visits. On the other hand, factors such as having a teacher

with a BA or teaching license, the center director's experience level, and the child-teacher ratio weren't related to variation in the size of a center's impacts.<sup>43</sup>

### **Why Do Long-Term Effects Vary?**

What might explain preschool programs' long-term effects on adult outcomes such as educational attainment, health, crime, and earnings? One puzzle we need to solve concerns the role of achievement effects, which tend to dissipate in the medium term, with the most rapid drops in the early elementary school years.<sup>44</sup>

Several factors may help explain the circumstances under which this convergence occurs, or those under which long-term effects occur.

First, the quality of the early elementary schooling that follows preschool may explain whether short-term effects are sustained. One study using matching methods found that when children transitioned to higher-quality schools, effects of preschool were more likely to be sustained. When children attended lower-quality schools, effects disappeared more quickly.<sup>45</sup>

Second, kindergarten or first-grade teachers may focus on helping children with lower levels of skills get up to speed; among such children, those who didn't attend preschool may be overrepresented. The no-preschool children may thereby catch up to their preschool-exposed peers, so that the relative benefits of preschool fall rapidly across the early primary grades. However, we don't have enough data to support or reject this hypothesis.

Third, aligning instructional content in the early elementary grades with that of

preschool may also be important. One study found that the boost in early math skills that children get from an early childhood mathematics curriculum lasted into early elementary school only when kindergarten instruction was aligned with preschool instruction. The study achieved alignment by bringing together preschool, kindergarten, and first-grade teachers to discuss what students learn in each grade, with the goal of minimizing repeated content.<sup>46</sup>

---

*If preschool education doesn't affect more fundamental or broad-based skills such as vocabulary, we may not see differences later in important domains such as reading comprehension.*

---

Fourth, if preschool targets skills that children would develop anyway later in schooling, it wouldn't be surprising if comparison groups catch up during the elementary grades. For example, by third grade children almost universally achieve language decoding skills such as alphabet recognition. If preschool education doesn't affect more fundamental or broad-based skills such as vocabulary, we may not see differences later in important achievement domains such as reading comprehension. Similarly, by the end of elementary school, almost all children master the skills that many preschool math curricula focus on—number recognition, relative magnitude, and basic arithmetic and geometry. We don't have enough evidence to say whether math

skills taught in preschool are related to later skills that help children achieve higher math skills such as algebra in middle school and high school. We may need to learn which fundamental aspects are causally related to long-term outcomes and then teach those skills in early childhood, rather than focus on the elementary math skills that virtually all children achieve in the first years of primary school.<sup>47</sup> It's also possible that some of the roots of long-term impacts lie in areas of development that achievement tests in middle childhood don't typically capture. In the Perry Preschool evaluation, for example, the degree to which children exhibited acting-out behaviors appeared to play the strongest explanatory role in middle childhood.<sup>48</sup>

Fifth, if the control (or no-preschool) group is particularly deprived of basic instruction and access to learning the skills taught in preschool, then preschool's effects may be longer-lasting. That may be why more recent studies show slightly smaller effects on average than older studies do.<sup>49</sup> In evaluations of preschool education experienced in the 1960s and '70s, members of control groups were likely to remain at home rather than attend other center-based care or preschools. Three recent studies show that the cognitive effects of Head Start are larger when Head Start children are compared to children staying at home, rather than to children in other centers.<sup>50</sup> That finding implies that any given preschool program's effects would get smaller over the decades, as more children began attending preschool. However, other aspects of the control group have also changed over time. The National Assessment of Educational Progress shows that third-grade math and reading scores increased substantially between 1978 and 2008 (the equivalent of

two years' worth of typical learning in math, and one year's worth of learning in reading). On the home front, the best available national data show that between 1998 and 2010, parents increased their investments in home educational resources and children were more often involved in enriching activities at home.<sup>51</sup> These increases occurred among families of all income levels, but they were particularly pronounced for low-income families. Across the same time span, national data also show increases in children's literacy and mathematics skills when they entered kindergarten, particularly among children from low-income and black families.<sup>52</sup> We don't yet know what best explains the pattern of convergence after preschool—changes over time in preschool or early primary-grade instruction, in parenting quality, or in parents' investments in children's learning.

## **Conclusions**

The evidence suggests that preschool education produces consistent and positive short-term effects on early language, literacy, and math skills. Short-term effects on socioemotional outcomes such as aggressive behaviors are less consistent, but they appear to be positive (for example, lower aggression) when preschools use behaviorally oriented curricula and programming. In the medium term, we find evidence of small reductions in grade retention and use of special education—6 to 8 percentage points, on average. Some studies have found long-term positive effects on high school graduation and criminality, though only in the context of very high-quality, small-scale programs, or of large-scale programs implemented in the 1960s, '70s and '80s, when comparison

groups had less access to other centers or preschools than they do today. The jury is still out on long-term effects of more recent large-scale programs, because we simply haven't had enough time to assess their impacts.

Overall, higher quality is associated with larger effects. In the United States, the quality of emotional support in preschool classrooms appears relatively strong when compared to the quality of instructional support. Recent experimental studies showed that efforts to improve instructional support through developmentally focused curricula, combined with intensive in-service training or coaching, can lead to small to large increases in targeted domains of child learning (amounting to roughly a couple of months to half a year of additional learning beyond business-as-usual preschool).

What factors might produce effects that are both larger and more sustained? Our review indicates several possibilities, although evidence is limited. First, we find relatively strong support for combining focused curricula with onsite help for teachers. Second, preschool's effects may last longer if we focus on fundamental skills that both predict long-term outcomes and are less likely to be gained in the first years of school. Third, better instructional quality and curricular alignment in early primary school may sustain the boost that quality preschool education can provide. All of these approaches suggest that if we want to see sustained improvements in children's development and learning, we need to increase the quality of—not just access to—preschool education.

## ENDNOTES

1. Sean F. Reardon and Ximena Portilla, "Recent Trends in Racial and Socioeconomic School Readiness Gaps at Kindergarten Entry," Stanford University, Palo Alto, CA, 2014, <http://cepa.stanford.edu/sites/default/files/reardon%20portilla%20school%20readiness%20gap%20trends%2014jan2015.pdf>.
2. Jeffrey M. Jones, "In U.S., 70% Favor Federal Funds to Expand Pre-K Education," accessed June 20, 2015, <http://www.gallup.com/poll/175646/favor-federal-funds-expand-pre-education.aspx>.
3. Information from "School Enrollment," US Census Bureau, accessed February 2, 2016, <http://www.census.gov/hhes/school/data/cps/2014/tables.html>.
4. Restricting only to experimental, regression-discontinuity, and sibling comparison (fixed-effects) studies, a weighted average effect size of .25 in Weilin Li et al., "Is Timing Everything? How Early Childhood Education Program Impacts Vary by Starting Age, Program Duration and Time since the End of the Program," University of California, Irvine, 2016.
5. Jenya Kholoptseva, "Effects of Center-Based Early Childhood Education Programs on Children's Language, Literacy, and Math Skills: A Comprehensive Meta-Analysis," Harvard Graduate School of Education, Harvard University, Cambridge, MA, 2016.
6. William T. Gormley Jr. et al., "The Effects of Universal Pre-K on Cognitive Development," *Developmental Psychology* 41 (2005): 872–84, doi: 10.1037/0012-1649.41.6.872; Mark W. Lipsey et al., *Evaluation of the Tennessee Voluntary Prekindergarten Program: End of Pre-K Results from the Randomized Control Design* (Nashville, TN: Peabody Research Institute, Vanderbilt University, 2013); Christina Weiland and Hirokazu Yoshikawa, "Impacts of a Prekindergarten Program on Children's Mathematics, Language, Literacy, Executive Function, and Emotional Skills," *Child Development* 84 (2013): 2112–30, doi: 10.1111/cdev.12099; Vivian C. Wong et al., "An Effectiveness-Based Evaluation of Five State Pre-Kindergarten Programs," *Journal of Policy Analysis and Management* 27 (2008): 122–54, doi: 10.1002/pam.20310.
7. According to the commonly used CLASS measure, average instructional support was 3.20 in Tulsa: Deborah A. Phillips, William T. Gormley, and Amy E. Lowenstein, "Inside the Pre-Kindergarten Door: Classroom Climate and Instructional Time Allocation in Tulsa's Pre-K Programs," *Early Childhood Research Quarterly* 24 (2009): 213–28, doi: 10.1016/j.ecresq.2009.05.002; 4.30 in Boston: Christina Weiland et al., "Associations between Classroom Quality and Children's Vocabulary and Executive Function Skills in an Urban Public Prekindergarten Program," *Early Childhood Research Quarterly* 28 (2013): 199–209, doi: 10.1016/j.ecresq.2012.12.002; 2.3 in an 11-state pre-K study: Andrew Mashburn et al., "Measures of Classroom Quality in Prekindergarten and Children's Development of Academic, Language and Social skills," *Child Development* 79 (2008): 732–49, doi: 10.1111/j.1467-8624.2008.01154.x; and 2.08 in a national Head Start sample: Emily Moiduddin et al., *Child Outcomes and Classroom Quality in Head Start FACES 2009* (Washington, DC: Administration for Children and Families, Office of Planning, Research and Evaluation, 2012); Howard S. Bloom and Christina Weiland, "Quantifying Variation in Head Start Effects on Young Children's Cognitive and Socio-Emotional Skills Using Data from the National Head Start Impact Study," working paper, MDRC, New York, NY, 2015.
8. James Heckman, Rodrigo Pinto, and Peter A. Savellyev, "Understanding the Mechanisms through Which an Influential Early Childhood Program Boosted Adult Outcomes," working paper no. 18581, National Bureau of Economic Research, Cambridge, MA, 2012.
9. Michael Puma et al., *Head Start Impact Study: First Year Findings* (Washington, DC: US Department of Health and Human Services, Administration for Children and Families, 2005).
10. Fuhua Zhai, Jeanne Brooks-Gunn, and Jane Waldfogel, "Head Start and Urban Children's School Readiness: A Birth Cohort Study in 18 Cities," *Developmental Psychology* 47 (2011): 134–52, doi: 10.1037/a002078.

11. William T. Gormley Jr. et al., "Social-Emotional Effects of Early Childhood Education Programs in Tulsa," *Child Development* 82 (2011): 2095–109, doi: 10.1111/j.1467-8624.2011.01648.x.
12. Holly S. Schindler et al., "Maximizing the Potential of Early Childhood Education to Prevent Externalizing Behavior Problems: A Meta-Analysis," *Journal of School Psychology* 53 (2015): 243–63.
13. Adele Diamond et al., "Preschool Program Improves Cognitive Control," *Science* 318, no. 5855 (2007): 1387–8, doi: 10.1126/science.1151148; Sandra Jo Wilson and Dale C. Farran, "Experimental Evaluation of the Tools of the Mind Preschool Curriculum," *Society for Research on Educational Effectiveness* (2012); Douglas H. Clements et al., "The Efficacy of an Intervention Synthesizing Scaffolding Designed to Promote Self-Regulation with an Early Mathematics Curriculum: Effects on Executive Function," University of Denver, Denver, CO, 2015; Pamela Morris et al., *Impact Findings from the Head Start CARES Demonstration: National Evaluation of Three Approaches to Improving Preschoolers' Social and Emotional Competence. Executive Summary* (Washington, DC: Administration for Children and Families, 2014).
14. Clancy Blair and C. Cybele Raver, "Closing the Achievement Gap through Modification of Neurocognitive and Neuroendocrine Function: Results from a Cluster Randomized Controlled Trial of an Innovative Approach to the Education of Children in Kindergarten," *PLOS One* 9 (2014): e112393, doi: 10.1371/journal.pone.0112393.
15. Douglas H. Clements, Julie Sarama, and Carrie Germeroth, "Learning Executive Function and Early Mathematics: Directions of Causal Relations," *Early Childhood Research Quarterly* 36 (2016): 79–90, doi: 10.1016/j.ecresq.2015.12.009.
16. Karen L. Bierman et al., "Executive Functions and School Readiness Intervention: Impact, Moderation, and Mediation in the Head Start REDI Program," *Development and Psychopathology* 20 (2008): 821–43, doi: 10.1017/S0954579408000394.
17. Janet Currie and Duncan Thomas, "Does Head Start Make a Difference?" *American Economic Review* 85 (1995): 341–64; Jens Ludwig and Douglas L. Miller, "Does Head Start Improve Children's Life Chances? Evidence from a Regression Discontinuity Design," *Quarterly Journal of Economics* 122 (2007): 159–208, doi: 10.1162/qjec.122.1.159.
18. Li et al., "Is Timing Everything?"; Andrés Hojman, "Evidence on the Fade-Out of IQ Gains from Early Childhood Interventions: A Skill Formation Perspective," University of Chicago, Chicago, IL, 2015.
19. Mark W. Lipsey, Dale Farran, and Kerry G. Hofer, "A Randomized Control Trial of the Effects of a Statewide Voluntary Prekindergarten Program on Children's Skills and Behaviors through Third Grade," Vanderbilt University, Nashville, TN, 2015.
20. Dana C. McCoy et al., "Long-Term Impacts of Early Childhood Education Programs on High School Graduation, Special Education, and Grade Retention: A Meta-Analysis," Harvard University, Cambridge, MA, 2015; Deborah Phillips, William Gormley, and Sara Anderson, "The Effects of Tulsa's CAP Head Start Program on Middle-School Academic Outcomes and Progress," *Developmental Psychology* 52 (2016): 1247–61, doi:10.1037/dev0000151.
21. Ibid.
22. David Deming, "Early Childhood Intervention and Life-Cycle Skill Development: Evidence from Head Start," *American Economic Journal: Applied Economics* (2009): 111–34, doi: 10.1257/app.1.3.111.
23. Frances Campbell et al., "Early Childhood Investments Substantially Boost Adult Health," *Science* 343, no. 6178 (2014): 1478–85, doi: 10.1126/science.1248429.
24. Michelle M. Englund, "Health Outcomes of the Abecedarian, Child-Parent Center, and HighScope Perry Preschool Programs," in *Health and Education in Early Childhood: Predictors, Interventions, and Policies*, ed. Arthur J. Reynolds, Arthur J. Rolnick, and Judy A. Temple (Cambridge, UK: Cambridge University Press, 2014): 257–92.

25. Irma A. Arteaga et al., “One Year of Preschool or Two? Is It Important for Adult Outcomes? Results from the Chicago Longitudinal Study of the Chicago Parent-Child Centers,” *Economics of Education Review* (forthcoming); Katherine A. Magnuson et al., “Inequality in Preschool Education and School Readiness,” *American Educational Research Journal* 41 (2004): 115–57, doi: 10.3102/00028312041001115.
26. Arthur J. Reynolds et al., “Association of a Full-Day vs Part-Day preschool Intervention with School Readiness, Attendance, and Parent Involvement,” *JAMA* 312 (2014): 2126–34, doi: 10.1001/jama.2014.15376; Kenneth B. Robin, Ellen C. Frede, and W. Steven Barnett, *Is More Better? The Effects of Full-Day vs. Half-Day Preschool on Early School Achievement* (New Brunswick, NJ: National Institute on Early Education Research, 2006).
27. Chloe Gibbs, “Experimental Evidence on Early Intervention: The Impact of Full-Day Kindergarten,” working paper, EdPolicyWorks, University of Virginia, Charlottesville, VA, 2014.
28. Gormley et al., “Effects of Universal Pre-K”; Weiland and Yoshikawa, “Impacts of a Prekindergarten Program.”
29. Michael L. Anderson, “Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects,” *Journal of the American Statistical Association* 103 (2008): 1481–95, doi: 10.1198/016214508000000841.
30. Katherine A. Magnuson et al., “Do the Effects of Early Childhood Education Programs Differ by Gender? A Meta-Analysis,” *Early Childhood Research Quarterly* 36 (2016): 521–36, doi: 10.1016/j.ecresq.2015.12.021.
31. Weiland and Yoshikawa, “Impacts of a Prekindergarten Program.”
32. Puma et al., *Final Report*.
33. Bloom and Weiland, “Quantifying Variation.”
34. Lipsey et al., “Randomized Control Trial.”
35. Bloom and Weiland, “Quantifying Variation”; Deborah A. Phillips and Mary E. Meloy, “High-Quality School-Based Pre-K Can Boost Early Learning for Children with Special Needs,” *Exceptional Children* 78 (2012): 471–90, doi: 10.1177/001440291207800405; Mary Elizabeth Meloy, Anna D. Johnson, and Deborah A. Phillips, “Impacts of the Tulsa Pre-K Program on the Social Development of Children with Special Needs,” paper presented at the Biennial Meeting of the Society for Research in Child Development, Philadelphia, PA, March 19–21, 2015; Christina Weiland, “Impacts of the Boston Prekindergarten Program on the School Readiness of Young Children with Special Needs,” *Developmental Psychology* (forthcoming).
36. Hirokazu Yoshikawa et al., *The Evidence Base on Preschool Education* (Ann Arbor, MI: Society for Research in Child Development and New York: Foundation for Child Development, 2013).
37. Margaret Burchinal, Kirsten Kainz, and Yaping Cai, “How Well Do Our Measures of Quality Predict Child Outcomes? A Meta-Analysis and Coordinated Analysis of Data from Large-Scale Studies of Early Childhood Settings,” in *Quality Measurement in Early Childhood Settings*, ed. Martha Zaslow et al. (Baltimore, MD: Brookes, 2011), 11–31; Margaret Burchinal et al., “Threshold Analysis of Association between Child Care Quality and Child Outcomes for Low-Income Children in Pre-Kindergarten Programs,” *Early Childhood Research Quarterly*, 25 (2010): 166–76, doi: 10.1016/j.ecresq.2009.10.004.
38. Phillips, Gormley, and Lowenstein; Weiland et al., “Associations.”
39. The relevant studies are cited in Yoshikawa et al., *Investing in Our Future*.
40. Patrick Kline and Christopher Walters, “Evaluating Public Programs with Close Substitutes: The Case of Head Start,” working paper 21658, National Bureau of Economic Research, Cambridge, MA, 2015; Fuhua Zhai, Jeanne Brooks-Gunn, and Jane Waldfogel, “Head Start and Urban Children’s School Readiness,” *Developmental Psychology* 47 (2011): 134–52, doi: 10.1037/a0020784.

41. Bloom and Weiland, "Quantifying Variation"; Christopher Walters, "Inputs in the Production of Early Childhood Human Capital: Evidence from Head Start," working paper 20639, National Bureau of Economic Research, Cambridge, MA 2014.
42. Bloom and Weiland, "Quantifying Variation."
43. Walters, "Inputs."
44. Hojman, "Fade-Out of IQ Gains."
45. Fuhua Zhai, C. Cybele Raver, and Stephanie M. Jones, "Academic Performance of Subsequent Schools and Impacts of Early Interventions: Evidence from a Randomized Controlled Trial in Head Start Settings," *Children and Youth Services Review* 34 (2012): 946–54, doi: 10.1016/j.childyouth.2012.01.026;
46. Jade M. Jenkins et al., "Preventing Preschool Fadeout through Instructional Intervention in Kindergarten and First Grade," Graduate School of Education, University of California, Irvine, 2015.
47. Drew Bailey et al., "State and Trait Effects on Individual Differences in Children's Mathematical Development," *Psychological Science* 25 (2014): 217–26, doi: 10.1177/0956797614547539.
48. Heckman et al., 2012.
49. In Li et al., "Is Timing Everything?," a rate of -.0024 effect sizes per year.
50. Zhai, Brooks-Gunn, and Waldfogel, "Urban Children's School Readiness"; Kline and Walters, "Evaluating Public Programs"; Avi Feller et al., "Compared to What? Variation in the Impact of Early Childhood Education by Alternative Care-Type Settings," Harvard University, Cambridge, MA, 2014.
51. Daphna Bassok et al., "Socioeconomic Gaps in Early Childhood Experiences, 1998 to 2010," working paper, EdPolicyWorks, University of Virginia, Charlottesville, VA, 2015.
52. Daphna Bassok and Scott Latham, "Kids Today: Changes in School Readiness in an Early Childhood Era," working paper, EdPolicyWorks, University of Virginia, Charlottesville, VA, 2014.

