HB

36

<TARGET><BILL>HB 36</BILL><SUBJECT>HB
36</SUBJECT><COMM>HEDC29</COMM></TARGET>

Representative Scott Jiu Wo Kawasaki

Alaska State Legislature District 1 Fairbanks

MEMORANDUM

Date: February 8, 2015

To: Representative Wes Keller
Chairman, House Education Committee

From: Representative Scott Kawasaki
District 1 Fairbanks

RE: Hearing Request for House Bill 36: Prekindergarten School Programs

I respectfully request a hearing for House Bill 36: An Act relating to the establishment of pre-kindergarten programs. As this will be the first committee of referral, no changes have yet been made to the bill.

There will be various testimonies given from multiple locations from around the state. At this point in time, we have not confirmed the list of witnesses that will be present when the bill receives a hearing.

I have included the following items with this request:

- Sponsor Statement
- Sectional Analysis
- Copy of the bill
- Supporting documents

Please let me know if there's anything else I can provide for you. I look forward to presenting HB 36 to the House Education Committee.

In Juneau ○ State Capitol Juneau, Alaska 99801
In Fairbanks ○ 1292 Sadler Way Fairbanks, Alaska 99701
Juneau ○ (907) 465-3466 ○ Fax (907) 465-2937 ○ **Fairbanks** ○ (907) 456-7423 ○ Fax (907) 451-9293
Email: Rep.Scott.Kawasaki@akleg.gov

Representative Scott Jiu Wo Kawasaki
Alaska State Legislature District 1 Fairbanks

House Bill 36
Sponsor Statement

"An Act relating to the establishment of pre-kindergarten programs."

Alaska remains one of the only states that does not provide pre-Kindergarten (pre-K) education to children on a statewide basis. Children who participate in early education programs earn more money as adults, enter the job market in much larger numbers, obtain a college education in higher numbers, remain off of public assistance and are more likely to stay out of jail.

A study by the National Institute for Early Education Research in 2013 found that Alaska ranked 37 out of 40 states who provided access to pre-kindergarten through a pilot program. In 2014 Alaska dropped to 39th. Unless Alaska addresses public access to prekindergarten we will continue to fall. A Harvard study shows that intensive preschool interventions can be highly cost effective and have positive impacts into adulthood. Young children who receive high quality early education do better in school academically and are more likely to stay in school, graduate and go on to attend college.

The beneficial impact of early education also extends to the economy. An ongoing study of 40 year old adults in Michigan who participated in the 1962 Perry Pre-school Project found that adults with pre-K were less likely to be to need special education services, more likely to be employed and earn more, and less likely to be arrested.

Alaska has a responsibility to provide the best education possible for its children. Currently, outside of a few school district classrooms, the state only provides pre-K education through Head Start programs and through the Best Beginnings partnership. Head Start is underfunded and only available to the poorest students. Due to underfunding, the Alaska Head Start Association estimates that more than 50% of the children who qualify cannot receive Head Start education. Providing early public education is a crucial stepping stone to brightening the future of young Alaskans.

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Email: Rep.Scott.Kawasaki@akleg.gov

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Alaska State Legislature District 1 Fairbanks

Sectional Summary
HB 36

Prekindergarten School Programs/Plans

Please note that this summary should not be considered a comprehensive or authoritative interpretation of the bill, and the bill itself is the best statement of its contents.

Section 1: adds a prekindergarten program to the elementary school curriculum as defined in AS 14.03.060(a)

Section 2: amends AS 14.03.060(e), adding to the general provisions of public schools a prekindergarten program and removing the clause excluding pre-elementary students from a school's average daily membership (ADM) count.

Section 3: adds a new section to AS 14.03 allowing a school district to create a prekindergarten program. Requires the program be optimal for the student, supervised by the Department of Education and Early Development, and consistent with existing regulations. Prekindergarten students will be counted as no more than a half-time student for the school's ADM count.

Section 4: amends AS 14.03.080 defining the age requirement for prekindergarten students as four years old on or before September 1 following the beginning of the school year.

Section 5: changes the word "assure" to "ensure" in AS 14.07.020(a) concerning state standards for safety conditions in public and private schools. Adds general supervision of prekindergarten programs to the duties of the Department of Education and Early Development. Requires the development of a statewide early child education plan that incorporates previous curriculums and provides for the coordination with optional prekindergarten programs, including Head Start.

Section 6: amends AS 14.07.020(c), adding a prekindergarten program to the definition of "pre-elementary school."

Section 7: adds to AS 14.07.165(a), adopting regulation concerning prekindergarten programs to the duties of the Department of Education and Early Development

Section 8: AS 14.17.905(a) is amended. Communities with an ADM between 101 and 425 have a prekindergarten program added to the elementary school for purposes of counting schools.

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Section 9: creates a section in AS 14.17.905 that disallows students four years of age from inclusion in the average daily membership count, who are enrolled in a program that receives funding from another source other than those provided for in the chapter.

Section 10: the Department of Education and Early Development will submit an early childhood education plan to the legislature on or before January 15, 19 2016. (This date has passed and will need to be amended and updated)

Section 11: The act will take effect July 1, 2015. (This date will need to be amended and updated)

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Email: Rep.Scott.Kawasaki@akleg.gov

NIEER

NATIONAL INSTITUTE FOR EARLY EDUCATION RESEARCH

Expanding Access to Quality Pre-K is Sound Public Policy

W. Steven Barnett, Ph.D.

National Institute for Early Education Research

Rutgers, The State University of New Jersey

December 2013

Executive Summary

In 2013, preschool education received more attention in the media and public policy circles than it has for some time, in part because of a series of high-profile proposals to expand access to quality pre-K. The scientific basis for these proposed expansions of quality pre-K is impressive. This paper brings to bear the full weight of the evidence to address the following questions:

- What does *all* the evidence say about effective preschool education and long-term cognitive benefits? A statistical summary of studies since 1960 demonstrates that effects persist, and provides evidence about what works (intentional teaching with small groups).
- What are the estimated effects of state and local pre-K programs in more recent years? We provide estimated effect sizes for school readiness at K and later achievement for studies from the last couple of decades. Effects vary across programs, but are overwhelmingly positive. Long-term achievement gains tend to be smaller, but still can be substantial.
- Is Head Start ineffective? A national randomized trial of children who attended Head Start in 2002 found modest initial effects and failed to detect lasting impacts. That study underestimates effects by design, its greatest limitation; nevertheless, the results were disappointing. Since then Head Start has been subject to reform, including a Bush Administration emphasis on improving literacy and more teachers with college degrees. Data collected in 2003, 2006 and 2009 show large increases in the size of Head Start children's language and literacy gains between 2003 and 2009.
- Can government improve the quality of public preschool education? Head Start provides one example, as described above. New Jersey provides another. It raised standards and implemented a continuous improvement system that transformed early care and education in 31 cities from bad to good over eight years. The latest follow up on the New Jersey children finds large gains in achievement and school success through grade 5.
- If states expand pre-K with temporary federal matching funds, what happens to state education budgets when that federal money is not available? NIEER projects that in 2030 all but 1 state would spend less on education from pre-K through grade 12 under federal proposals that incentivize states to raise pre-K quality standards, offer a full school day, and serve all children under 200 percent of the federal poverty level. Idaho is the only state that might have to pay a little more, because it has relatively low grade repetition and special education costs.

Given the answers to these questions it seems self-evident that local, state, and federal governments should expand access to quality pre-K and other enhancements of early education, especially for children in low-income families.

Expanding Access to Quality Pre-K is Sound Public Policy

In 2013, preschool education received more attention in the media and public policy circles than it has for some time, in part because of a series of high profile proposals to expand access to high quality pre-K. The President was among those leading the way with a new proposal highlighted in his State of the Union Address. A bipartisan group in the Congress recently introduced legislation (the Strong Start for America's Children Act) that builds on the President's proposal. Meanwhile, several governors put forward their own proposals to expand access to pre-K, including Rick Snyder of Michigan and Jay Inslee of Washington. Cities have stepped up as well, with pre-K expansion and improvement initiatives in New York City, San Antonio, and Seattle among others.

The scientific basis for these proposed expansions of quality pre-K is impressive. It is well established that the first five years are a time of rapid development that is especially sensitive to a child's experiences. It is equally well established that some children have far less optimal conditions for their development, with the least access to good early education by children whose parents have the lowest incomes and education (Barnett & Nores, 2013). In 2005, a national study of the quality of pre-K found that most programs were not good, and quality was lowest for those children whose parents had the least education (Barnett & Nores, 2013). Yet, rigorous studies find that strong preschool education programs can meaningfully enhance early learning and development and thereby produce long-term improvements in school success and social behavior that generate benefits to individuals and the broader society far exceeding costs. Studies also find that not all programs are equally successful, and this has led to a push for policies to expand access to public pre-K and other early education programs more closely resembling the most effective models.

All of this activity has brought out opponents who strenuously object to public funding to improve the educational quality of pre-K. They raise the specter of government kidnapping young children and mind control. Yet, participation in every public pre-K program is entirely voluntary. All of the major recent proposals for pre-K improvement and expansion offer substantial parental choice and include private providers, as do most existing state-funded pre-K programs. Federal proposals call for no permanent federal role and actually reduce federal control over programs for 4-year-olds. Still opponents appear to prefer the status quo or public funding for low-quality child care with no expectation of positive outcomes for children to quality preschool education.

To bolster their arguments these critics pick through the research Goldilocks-like to choose the few they find "just right," dismissing other studies as too small, too old, too specialized, and so forth. This is not a valid way to summarize the science on pre-K in order to inform policy development. In particular, policymakers should not look at the results first in deciding which studies to rely on, and, looking at the critics' choices, it seems that this is how they proceed. It would be particularly dangerous for the public and policymakers to ignore the evidence that policies which encourage poor quality child care can actually harm the development of children. Such evidence comes from the United States, Canada, and Europe (Barnett, 2008).

A more valid approach is to statistically summarize the results of all the studies, regardless of their results. Such a meta-analysis has been conducted (Camilli et al., 2010), and it finds that on average preschool programs have substantial positive impacts on cognitive development. It also finds that effects decline over time, with long-term effects half the size of initial impacts. It follows that to obtain substantial long-term gains pre-K policies must support higher quality programs that produce large initial impacts. The meta-analysis also points to intentional teaching, particularly one-on-one and with small groups, as a means to produce larger cognitive gains, a finding unlikely to surprise either teachers or parents.

Of course, this meta-analysis includes all types of preschool programs, and today's large scale publicly funded pre-K might not produce the same results as other programs. In fact, by and large, public programs on average have been less effective than better funded, more rigorous small-scale programs, which is precisely why we must raise the quality of public programs. However, this does not mean that current public programs are completely ineffective, or that their benefits do not exceed their (lower) costs. One way to assess how well future public programs might perform is to examine the results of relatively recent studies of state and locally funded pre-K.

Tables 1 and 2, as well as Figures 1 through 4, present the results of research on state and locally funded pre-K programs from the last two decades. To display all of the variation among studies we report standardized effect sizes for each study rather than simply presenting averages. Effect sizes translate effects into standard deviation units. To evaluate them, it may help to know that the achievement gap between disadvantaged children and others is about 1 standard deviation. Thus, an effect size of .10 is equivalent to 10 percent of the achievement gap. Figure 1 displays the number of effect sizes of each size for immediate impacts of which there are many. Figures 2-4 report one effect size for each study in each of three grade ranges 1-2, 3-6, and 7-8. When a study has more than one effect size in a grade range we report an average. As can been seen, recent research on public pre-K provides substantial data on outcomes in all but the last grade range.

Two points are clear. First, state and local pre-K programs, almost without exception, are found to improve academic readiness for school, sometimes quite a lot. Second, there is substantial evidence of persistent impacts on achievement well beyond school entry, even though these are somewhat smaller than short-term impacts. More traditional reviews that scan the entire literature rather than relying on a few selected studies produce a similar picture with the addition of a more balanced view of Head Start effects(Barnett, 2008; Yoshikawa et al., 2013)

In my view, some slippage between initial and later effects should be expected from any pre-K program (Barnett, 2011). Ask Jeff Gordon if leading for the first 30 laps at Daytona is enough to guarantee a win. Pre-K prepares children to start off well. It does not guarantee that nothing later on will interfere with their progress. We should not conclude from this that pre-K does not matter. Schools spend a lot of time and money helping children who are behind catch up at least part way, and reducing the need for this spending is part of what good pre-K is all about. Moreover, just as an early lead does not guarantee a win, it is equally true that you cannot fall far behind the leader's pace for 30 laps and count on making up all of the difference later, whether at Daytona or in school.

That some public pre-K programs seem to perform much better than others is an issue of concern. The major preschool proposals that have drawn the most interest this year all focus on improving public programs. They emphasize raising standards and putting in place continuous improvement and accountability systems to ensure the new programs deliver strong results. None of them are satisfied with business as usual. While it would be foolish to assume that we know everything about how to make pre-K highly effective, we do know how to create more effective policies with continuous improvement and accountability systems that will generate the information each teacher, community, and state needs to improve from there on. There is no denying that such an approach actually works. Under court order to provide quality pre-K to all children in 31 cities, New Jersey raised standards and implemented a continuous improvement system that demonstrably transformed quality from poor-to-mediocre, to primarily good-to-excellent over eight years. Follow-ups with the children through grade five found substantial improvements in achievement and school success all along (Barnett, Jung, Youn, & Frede, 2013).

One study that receives considerable attention in the debates on these new pre-K proposals (despite the fact that it is not a study of state funded pre-K) is the national evaluation of Head Start's impacts. Without question the results were disappointing, though not as disappointing as the critics portray by focusing on figures known to underestimate Head Start's effects. The Camilli et al. (2010) meta-analysis clearly predicts disappointing results as it suggests two key reasons for Head Start's modest effects. One is that Head Start did not focus on intentional teaching and, at least in my own experience, sometimes actually discouraged it. The other is that Head Start has been given a huge mission with a very broad range of family and child outcomes; it has been asked to do too much with too little. It is important that Congress and others not repeat these mistakes with the new initiatives.

That is why the President's proposal and the Strong Start for America's Children Act focus on improving teaching and school readiness, not just in pre-K, but in other programs that receive federal funds. We can do better, and we will, if proposals like these become law. Interestingly, evidence from this comes not just from state efforts like the New Jersey example discussed above, but also from Head Start. The Head Start national impact evaluation was conducted on children who attended that program more than a decade ago. Since then Congress and the Administration have mandated reforms. Not all of these have been fully implemented yet, but Head Start has focused more on school readiness, and raised its standards. Results from more recent years may surprise Head Start's critics.

Head Start's Family and Child Experience Surveys (FACES) measured children's learning during a year of Head Start in the 2003, 2006, and 2009 school years. The national impact evaluation was conducted on children entering Head Start in the 2002 school year. FACES 2003 provides the closest FACES measure of how much children gained in Head Start at the time of the national impact study. The latter two FACES surveys allow us to compare children's gains in later years on the same tests administered in the same way to a similar sample. (The national impact study sample was restricted in several ways and includes only centers with excess applicants who could be randomly assigned.) FACES average test score gains in language, literacy, and math for 2003, 2006 and 2009 are reported by age and ethnicity in Table 3, and displayed graphically in Figures 5 through 7.

As shown in Table 3, children made greater gains in language and literacy in 2006 and 2009 than in 2003. Language and literacy gains are larger for all three major ethnic groups in 2009 compared to 2003, sometimes two or more times as large. This suggests that policy changes, particularly the Bush Administration's literacy push, may be responsible. Other data from FACES indicate that the frequency of intentional literacy activities and the percentage of teachers with a 4-year college degree both increased by 2009 (Hulsey et al., 2011). For math, the results are erratic in ways that are hard to explain, and there is no clear pattern, raising questions about the adequacy of that test. The strong 2009 language and literacy gains are especially notable, since families had been negatively affected by the recession, which might be expected to depress growth. It seems fair to conclude that some learning gains for Head Start children have greatly improved since the Impact Study, and this improvement is plausibly attributed to reforms including those specifically focused on language and literacy.

One challenge faced by state policy makers when they seek to raise quality and expand access, is that the cost of quality pre-K must be paid up front, while most of the benefits accrue many years later. This poses a cash flow problem for state governments that want to expand quality pre-K even when the long-term cost-savings to a state would eventually lead to lower costs. This is a key reason that temporary federal funding for quality pre-K--as proposed by the President and the Strong Start for America's Children Act--makes sense. It creates no permanent federal obligation and leaves states in charge of pre-K, but helps states cover costs of improving access to quality pre-K until substantial offsetting cost savings are returned to the state.

Naturally, state leaders are concerned about what would happen to their costs in the long-term if a federal government program provided only 10 years of funding as has been recently proposed. At the end of 10 years, states would have higher standards and expanded enrollment that raised the costs of pre-K, but no continued federal support. To what extent would the cost-savings in K-12 generated by pre-K be expected to offset increased state expenditures? To answer that question, NIEER estimated for each state the net impact of the President's proposal on state education expenditures pre-K through grade 12 in the year 2030 after any federal cost sharing had stopped. These projections only address the long-term state budget question. They are not benefit-cost analyses, and they focus only on cost savings to K-12 while ignoring other long-term benefits found for pre-K (e.g., increased achievement, decreased risky behaviors and crime, increased earnings).

Our projections require a number of estimates and assumptions. To estimate expenditures for pre-K we use cost-per-child figures for each state, calculated for a full day pre-K program meeting all 10 of the quality standards benchmarks employed in NIEER's annual survey of state pre-K (Barnett, Carolan, Fitzgerald & Squires, 2012). We use 2030 population estimates from the Census to account for changes in the number of children in each state, and assume that states serve all children under 200 percent of the federal poverty level (FPL), plus any additional children eligible under their current laws.

Cost savings in each grade level are estimated assuming that new, improved pre-K programs produce the same percentage decreases in grade repetition and special education as one year of New Jersey's Abbott pre-K program at grade 5. For example, in a state with 10 percent retention in 3rd grade, the estimated reduction for children who attended pre-K is 4 percentage points. In a state with 5 percent

retention in 3rd grade, the estimated reduction for children who attended pre-K is about 2 percentage points. This is a conservative assumption in one respect as children under 200 percent of FPL have rates of grade repetition and special education that typically exceed the state average. On the other hand, as the New Jersey model we rely on has not produced data on prevention of high school dropout, we do not project any cost increase from a greater number of students in the later grades. This could lead to underestimation of future costs.

Finally, we net out the impacts of current state pre-K programs by assuming that current cost savings from pre-K are proportional to current expenditures per child. In other words, if a state pre-K program currently serves 10,000 children at half the projected cost of a quality full-day program, then projected future cost-savings for the first 10,000 children enrolled are reduced by half.

We present our projections in Table 4. Remarkably, *we project that in 2030 with no continuing federal support, every state except Idaho would spend less money on education from pre-K through grade 12 if they met the quality standards, operated for a full school day, and served all children under 200 percent of FPL*. For Idaho the estimated cost increase is small, and possibly overestimated. Annual cost reductions varied from about $25 million in Arkansas, which already has a relatively large, higher quality program, to over $1 billion in the large states of California, Florida, and New York. Figure 8 maps the savings project by 2030 across the United States.

Policy makers and the public should consider all the evidence when evaluating proposals to expand access to quality pre-K and other early education programs. They should not be dissuaded by the many red herrings that will be drawn across this path to greater school readiness and success. Sure, some at-risk children will succeed without access to high quality preschool. We have all heard stories of people who smoked their whole lives and never developed cancer or emphysema; who were thrown from a car while not wearing a seat belt and suffered no injury; who dropped out of school and went on to great success; and, who took a long shot from half-court to score the winning basket. We also all know better than to think these stories are a guide to success in our personal lives or basketball. Policy makers need to apply the same type of good sense to pre-K and take the high percentage shot. Invest in policies that enable all children, especially those in low-income families, to access quality pre-K.

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Table 1. State and Local Pre-K Effect size at End of Pre-K or Beginning of Kindergarten

Reference	State	Year	Learning outcome		
			Math	Language	Literacy
Jung, et al.(2013)	Arkansas	end of pre-k	.27	.28	1.00
Weiland & Yoshikawa (2013)	Boston	K	.59	.44	.62
Barnett, et al.(2013)	California	end of pre-k	.34	.39	1.19
Reynolds, Temple, & Ou (2010)	Chicago	K	.35	.21	
King, Cappellini, & Rohanie (1995)	Florida(*)	K	.25	.23	
Peisner-Feinberg, Schaaf, & LaForett (2013)	Georgia	end of pre-k	.18	.06	.14
Wong et al. (2008)	Michigan	K	.47	-.13	.96
Barnett, Lamy, & Jung (2005)	Michigan	K	.44	.21	.96
Florian, Schweinhart, & Epstein (1997)	Michigan	K	.51	.45	
Peisner-Feinber & Shaaf, 2008	North Carolina	end of pre-k	.30	.19	.21
Peisner-Feinberg & Schaaf (2011)	North Carolina	K	.07	.27	.93
Wong et al. (2008)	New Jersey	K	.23	.36	.50
Frede, Jung, Barnett, & Figueras (2009)	New Jersey	K	.13-one year .29-two years	.22-one year .41-two years	.11-one year .14-two years
Barnett et al.(2013)	Oklahoma	end of pre-k	.51	.32	.71
Wong et al. (2008)	Oklahoma	K	.34	.29	.42
Gormley et al. (2008)	Tulsa, OK	K	.36		.99
Barnett et al.(2013)	South Carolina	end of pre-k		.05	.78
Wong et al. (2008)	South Carolina	K		.04	.79
Lipsey, Hofer, Dong, Faran, & Bilbrey (2013)	Tennessee	end of pre-k	.32	.31	.46
Lipsey, Hofer, Dong, Faran, & Bilbrey (2013)	Tennessee	K	.02	-.09	.04
Barnett et al. (2013)	West Virginia	end of pre-k	.13	.15	.71
Wong et al. (2008)	West Virginia	K	.06	.16	.92
Magnuson, Ruhm, & Waldfogel (2004)	National representative sample	K	.40	.73	

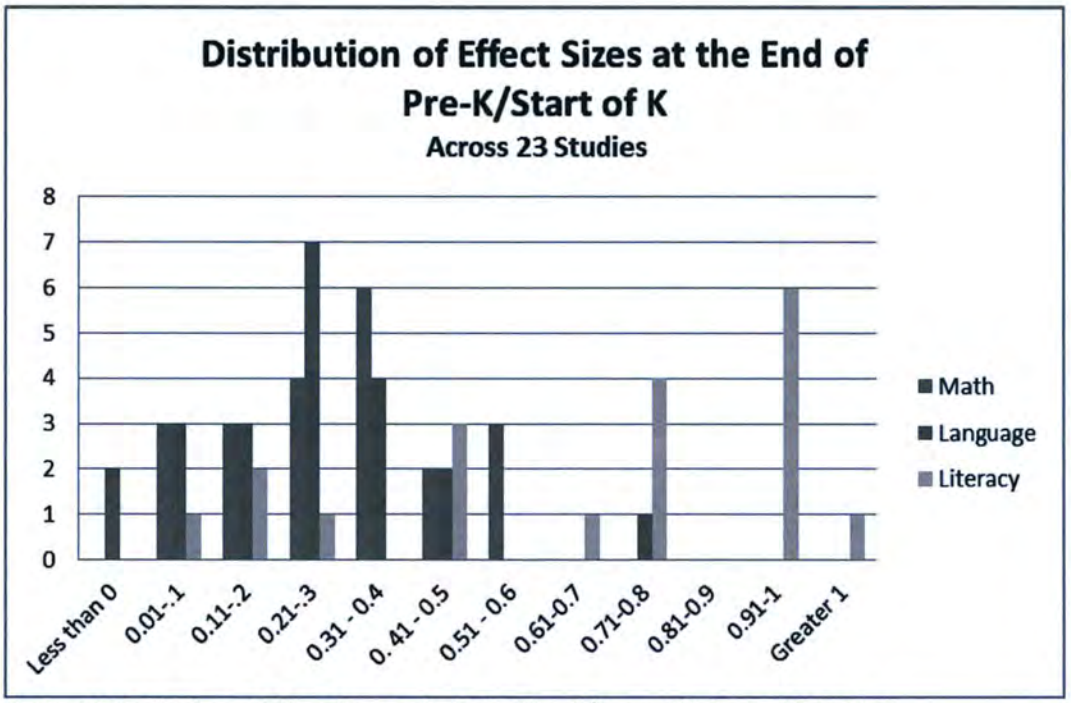


Figure 1: Distribution of Effect Sizes at the End of Pre-K/Start of K, Across 23 Studies

Table 2.State and Local Pre-K Effect Sizes in 1st Grade and Beyond

Reference	State	Year	Learning outcome	
			Math	Language/Literacy
Lipsey, Hofer, Dong, Faran, & Bilbrey, (2013)	Tennessee	1st grade	-0.05	-0.01
Magnuson, Ruhm, & Waldfogel (2007)	National representative sample	1st grade	0.05	0.03
Frede, Jung, Barnett, & Figueras (2009)	New Jersey	1st & 2nd grade (avg)	0.21	0.185
Pilcher & Kaufman-McMurrain (1996)	Georgia	1st grade		0.24
Kuhne (2008)	Texas	3rd - 6th grade	0.03	0.0375
Magnuson, Ruhm, & Waldfogel (2007)	National representative sample	3rd grade	0.07	0.06
Texas Education Agency (1995)	Texas	3rd grade	0.09	0.08
Peisner-Feinber & Shaaf (2010)	North Carolina	3rd grade	0.12	0.14
Hill, Gormley, & Adelstein, (2012)	Tulsa, OK	3rd grade	0.18	0.09
Ladd, Muschkin, & Dodge (2012)	North Carolina	3rd grade	0.24	0.17
Reynolds (2000)	Chicago	3rd-6th grade (avg)	0.25	0.26
Barnett, Jung, Youn, & Frede, (2013)	New Jersey	4th & 5th grade (avg)	0.155	0.15
Fitzpatrick (2008)	Georgia	4th grade	0.025	0.025
Bartik (2013)	Georgia	4th grade	0.19	0.19
Kuhne (2008)	Texas	7th - 8th grade	0.01	0.02
Cascio &Schanzenbach (2013)	Georgia/Oklahoma	8th grade	0.063	NS[b]
Reynolds (2000)	Chicago	8th grade	0.17	0.18

a. The effect size was recalculated based on the result of Fitzpatrick (2008)
b. Effect size was not statistically significant and was not reported.

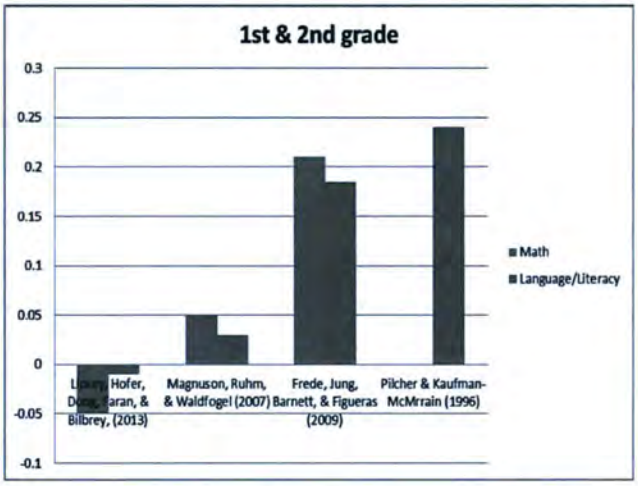


Figure 2: State and Local Pre-K Effect Sizes in 1st & 2nd Grade

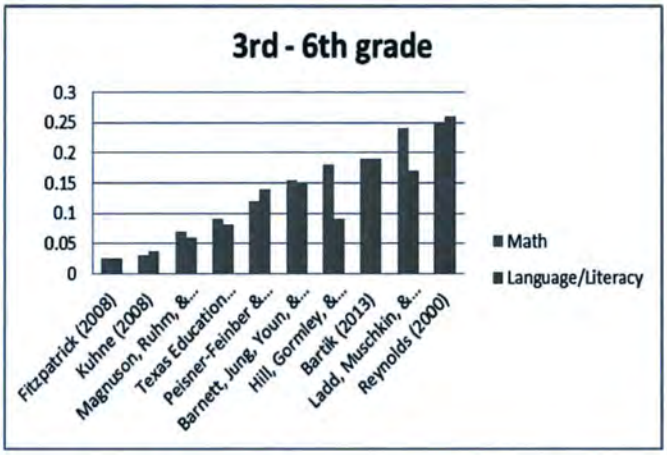


Figure 3: State and Local Pre-K Effect Sizes in 3rd - 6th grade

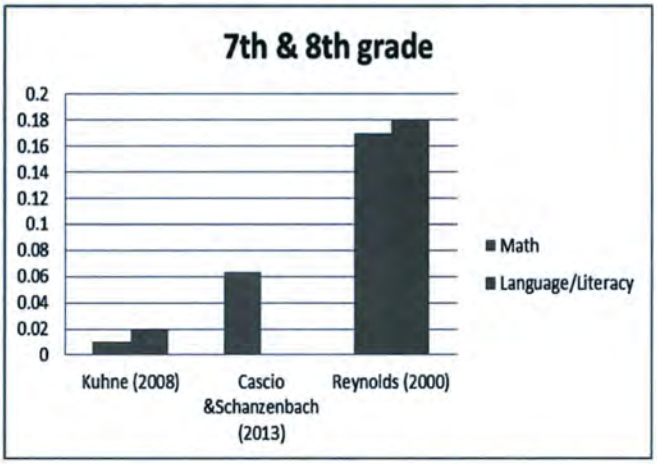


Figure 4: State and Local Pre-K Effect Sizes in 7th & 8th grade

Table 3. Achievement Gains in Head Start FACES Studies by Age and Ethnicity: 2003-09

	2003		2006		2009	
Language	PPVT-3		PPVT-4		PPVT-4	
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
White	2.052	1.712	1.688	3.442	2.748	3.351
Black	0.946	1.659	0.967	3.488	2.561	4.315
Hispanic	3.545	5.857	4.344	6.582	6.239	8.723
Literacy	WJ-LW-3		WJ-LW-Revised		WJ-LW-Revised	
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
White	1.514	3.426	4.568	5.095	6.826	4.305
Black	3.088	4.606	8.585	5.689	7.508	4.802
Hispanic	1.697	3.705	6.298	5.122	6.802	5.265
Math	WJ-AP-3		WJ-AP-Revised		WJ-AP-Revised	
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
White	4.786	4.153	0.887	8.053	2.615	1.371
Black	3.519	2.604	0.323	3.034	1.621	0.576
Hispanic	5.7	2.456	-.441	3.256	3.083	4.152

NIEER calculations from FACES 2003, 2006, 2009 data.

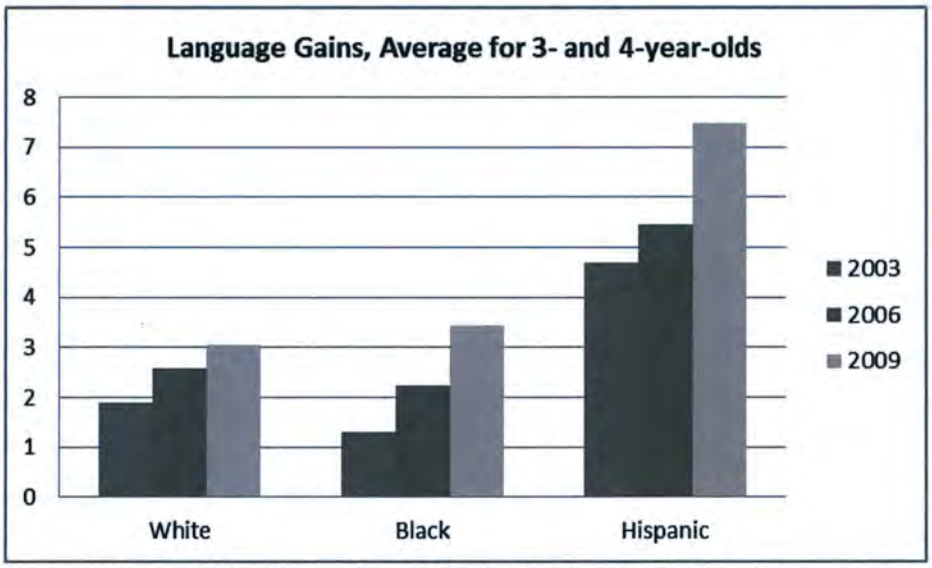


Figure 5: Language Gains in Head Start FACE Studies, Average for 3- and 4-year-olds

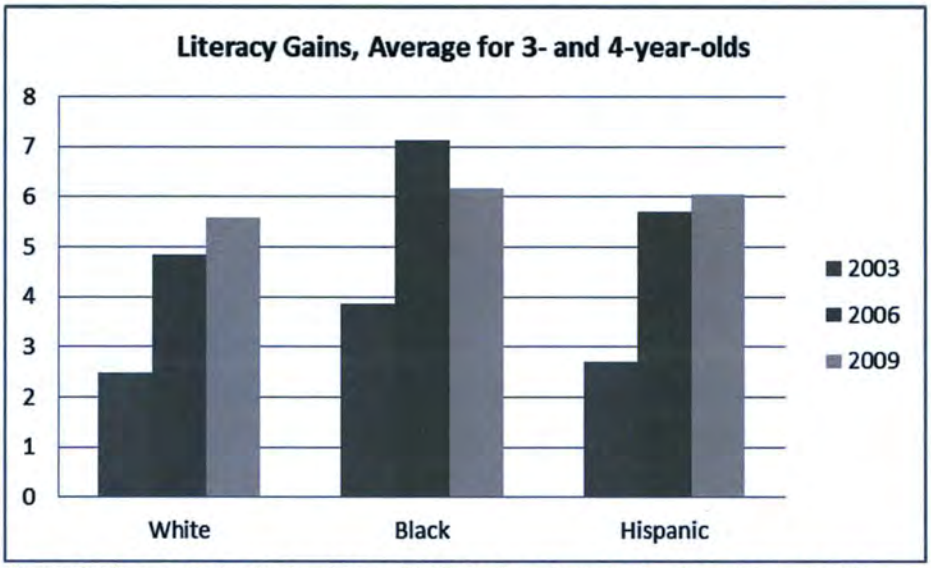


Figure 6: Literacy Gains in Head Start FACE Studies, Average for 3- and 4-year-olds

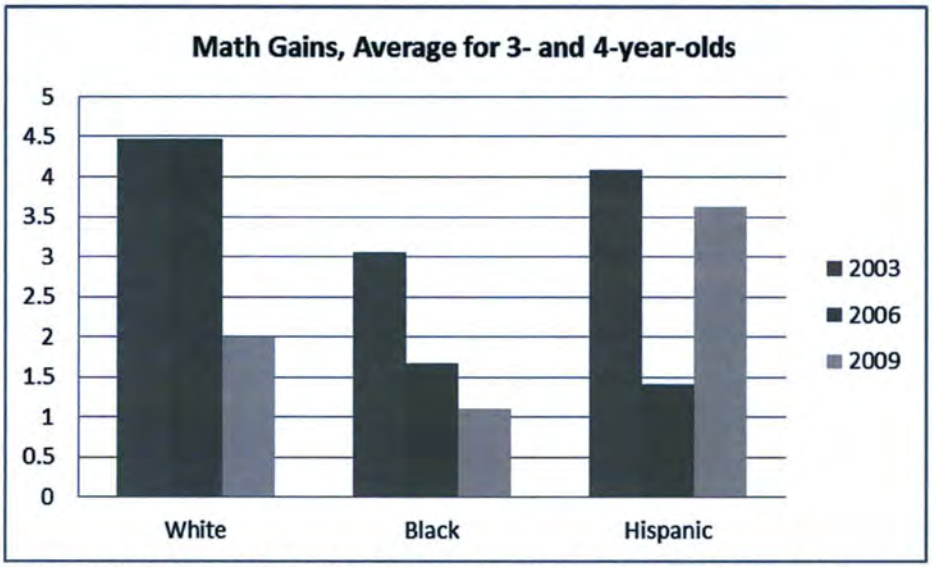


Figure 7: Math Gains in Head Start FACE Studies, Average for 3- and 4-year-olds

Table 4. Budgetary Impact of Providing Quality Pre-K to All Children Under 200% FPL by State

State	Net Effect on P-12 Spending	State	Net Effect on P-12 Spending
AL*	-470,692,301	MT***	-34,570,050
AK	-161,520,118	NE	-111,696,399
AZ	-319,434,680	NV*	-208,184,995
AR	-26,672,819	NH***	-157,044,124
CA	-1,197,043,751	NJ**	-854,522,954
CO	-161,597,162	NM*	-101,551,650
CT	-327,046,665	NY*	-1,788,631,804
DE	-83,783,090	NC	-576,839,717
FL*	-1,251,967,809	ND***	-28,982,888
GA*	-208,005,379	OH	-829,760,621
HI***	-53,693,939	OK*	-35,828,928
ID***	8,507,601	OR	-346,072,972
IL*	-641,409,465	PA**	-1,130,479,788
IN***	-292,168,007	RI*	-126,055,097
IA**	-93,943,117	SC	-110,636,977
KS	-144,326,556	SD***	-31,062,091
KY	-85,334,506	TN	-242,504,435
LA**	-247,849,417	TX	-1,711,819,395
ME*	-122,111,305	UT***	-72,416,132
MD	-313,336,050	VT**	-39,080,933
MA	-676,030,993	VA*	-607,613,290
MI	-470,585,414	WA	-494,402,606
MN	-594,734,060	WV*	-48,321,308
MS***	-48,804,427	WI**	-112,896,655
MO*	-248,270,476	WY***	-55,478,679

No star: Means-tested program
* Open to all regardless of income
** Mixed programs (Means-tested and non-means-tested)
*** No program in 2013

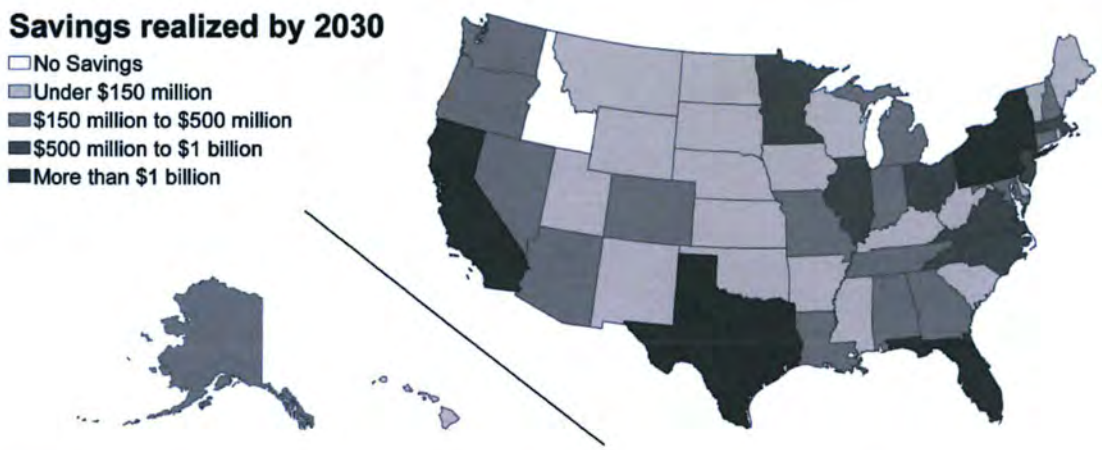


Figure 8: Budgetary Impact of Providing Quality Pre-K to All Children Under 200% FPL by State

2013 State of Child Care Centers in Alaska

Total Score: 88/150	Total Percentage: 59%	Overall Rank: 35
Oversight Score: 10/40	Oversight Percentage: 25%	Oversight Rank: 44
Program Standards Score: 78/110	Standards Percentage: 71%	Program Standards Rank: 20

2011 Annual Child Care Center Costs	
For an Infant:	$9,336
For a 4-Year-Old:	$8,856

Program Standards	Meets
1. A comprehensive background check is required, including using fingerprints to check state and FBI records, checking the child abuse registry and checking the sex offender registry.	●
2. Child care center directors are required to have a bachelor's degree or higher in early childhood education or a related field.	◑
3. Lead teachers are required to have a Child Development Associate (CDA) credential, college courses in early childhood education or an associate degree in early childhood education or a related field.	○
4. Child care center providers are required to have an orientation and initial training in specific topics.	●
5. Child care center providers are required to have 24 hours or more of annual training in specific topics.	◕
6. Child care centers are required to plan learning activities that address specific developmental domains.	●

Program Standards	Meets
7. Child care centers are required to follow recommended health practices in 10 specific areas.	●
8. Child care centers are required to follow recommended safety practices in 10 specific areas. Corporal punishment is prohibited.	●
9. Child care centers are required to encourage parent involvement, communicate regularly with parents, allow parents access to the center and give written policies to parents.	◕
10. Staff:child ratio requirements comply with NAEYC accreditation standards for seven age groups.	◔
11. 1Group size requirements comply with NAEYC accreditation standards in seven age groups.	◑

Oversight Standards	Meets
1. Child care centers are inspected at least four times per year, including visits by licensing, health and fire personnel.	○
2. Programs to licensing staff ratio does not exceed 50:1.	●
3. Licensing staff have a bachelor's degree in early childhood education or a related field.	○
4. Online inspection and complaint reports are available to parents on the Internet.	○

Key ● Fully Meets ◕ Substantially Meets ◑ Partially Meets ◔ Marginally Meets ○ Does not meet

2013 State of Child Care Centers in Alaska

Strengths

- Providers are required to undergo a comprehensive background check that includes using fingerprints to check state and federal criminal records and checks of child abuse and neglect registry and sex offender registry.
- Providers are required to offer activities addressing all developmental domains.
- Health standards address 10 of 10 basic standards.
- Safety standards address 10 of 10 basic standards.
- Child care licensing staff have an average caseload of 50 programs or fewer.

Weaknesses

- Providers are not required to have a high school diploma or GED.
- Group size requirements do not meet NAEYC accreditation standards for five age groups.
- Staff:child ratio requirements do not meet NAEYC accreditation standards for six age groups.
- Licensing inspections of child care centers are required once every two years.
- Child care licensing staff are not required to have a bachelor's degree.
- Neither complaint nor inspection reports are online.

Recommendations

- Require lead teachers to have a minimum of a Child Development Associate (CDA) credential or a degree in early childhood education or related field.
- Require centers to comply with NAEYC accreditation standards for group size in all seven age groups.
- Require centers to comply with NAEYC accreditation standards for staff:child ratios in all seven age groups.
- Increase licensing inspections of child care centers to at least once a year.
- Require licensing staff to have a bachelor's degree in early childhood education or related field.
- Make both inspection and complaint reports available online.

State Note: By regulation, Alaska inspects facilities once every two years; however, Alaska has an internal practice of conducting at least one announced and one unannounced inspection per facility per year. We recommend this practice be required by regulation or policy.

Notes:

1. The total maximum points a state could receive is 150. Ranks out of 52, including 50 states, the District of Columbia and the Department of Defense (DoD).
2. In addition to orientation, topics of initial training are child development, child guidance, child abuse prevention, emergency preparation, licensing regulations, learning activities, health and safety, safe sleep, shaken baby prevention, CPR and first aid.
3. Topics of annual training are child development, child guidance, child abuse prevention, emergency preparation, licensing regulations, learning activities, health and safety, safe sleep, shaken baby prevention, CPR and first aid.
4. Planning learning activities includes language/literacy, dramatic play, active play, cognitive/math, self-help skills, creative activities, limit screen time, social development, emotional development and culturally sensitive activities.
5. Ten health areas are hand washing/diapering/toileting, nutritious meals and snacks, immunizations, exclusion of ill children, universal health precautions, administration of medications, toxic/hazardous substances, sanitation, weekend/evening care and incident reporting.
6. Ten safety areas are SIDS prevention, discipline/guidance, fire drills, outdoor playground surfaces, emergency plans, electrical hazards, water hazards, supervision, transportation (with head count), firearms (prohibited or access controlled). Prohibiting corporal punishment is scored separately. States that permit parents to authorize the use of corporal punishment receive a zero for the safety benchmark.
7. Source for regulatory information: State regulations reviewed by staff at Child Care Aware® of America and by state licensing staff and are current as of February 1, 2013.

Source for cost of care information is 2011-2013 data from Child Care Aware® of America. (2012). *Parents and the High cost of Child Care: 2012 Update* http://www.naccrra.org/about-child-care/cost-of-child-care.

Executive Summary

STATE PRE-K: A RETURN TO GROWTH?

The 2013-2014 school year offered hope of a recovery for state-funded pre-K after the dismal effects of the recession. State funding for pre-K increased by nearly $120 million in 2013-2014, adjusted for inflation. This is the second year in a row that state pre-K has seen a real funding increase, though programs have yet to fully recover from the impacts of half a billion dollars in cuts in 2011-2012.

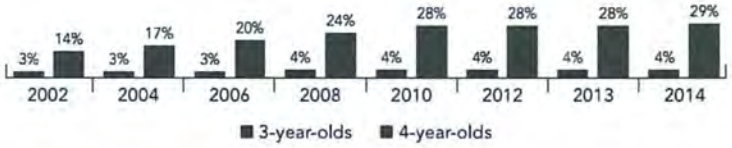
Enrollment growth also resumed in 2013-2014, albeit modestly. Total enrollment increased by 8,535, and nearly half this increase was required to recoup the loss of 4,000 seats in 2012-2013.

State pre-K quality standards improved notably in 2013-2014. Three programs – Oregon, Pennsylvania HSSAP, and Wisconsin Head Start – now meet the requirement that assistant teachers have at least a Child Development Associate credential thanks to the increased requirements of the Head Start program, which apply to these programs. Two Pennsylvania programs that had previously lost benchmarks regained them this year as temporary moratoria on professional development were lifted. In two additional changes, West Virginia met the benchmark for lead teacher Bachelor degree after a gradual phase in of increased requirements, and Michigan met the benchmark for site visits.

WHAT'S NEW?

- Total state funding for pre-K programs increased by more than $116 million across the 40 states plus D.C. that offered pre-K for the full 2013-2014 year, a 1 percent increase in real dollars.
- State pre-K funding per child increased by $61 (inflation-adjusted) from the previous year to $4,125.
- In January 2014, Mississippi became the first state in four years not yet funding pre-K statewide to create a new program. It spent $3 million to enroll 1,774 children, and met all 10 of NIEER's quality standards benchmarks. While not included in the rankings because the program did not operate for the first half the school year, it is a noteworthy addition.

PERCENT OF NATIONAL POPULATION ENROLLED



AVERAGE STATE SPENDING PER CHILD ENROLLED (2013 DOLLARS)

- State funding per child for pre-K increased by at least one percent in 19 of the 41 states with programs, when adjusted for inflation. In 20 states, per-child funding fell by at least 1 percent, adjusted for inflation. Among these states, some fared much worse or better than others. In five states per-child spending fell by 10 percent or more from the previous year; in 5 states, per-child spending increased by the same margin.
- Only 15 states could be verified as providing enough per-child funding to meet all 10 benchmarks for quality standards. As only 13 percent of the children enrolled in state-funded pre-K attend those programs, the vast majority of children served in state-funded pre-K are in programs where funding per child may be inadequate to provide a quality education.
- More than 1.3 million children attended state-funded pre-K, 1.1 million at age 4.
- Enrollment increased by 8,535 children. Four percent of 3-year-olds and 29 percent of 4-year-olds were served in state-funded pre-K, representing a slight increase in percent of 4-year-olds served.
- Combining general and special education enrollments, 32.4 percent of 4-year-olds and 7.4 percent of 3-year-olds are served by public pre-K. When including Head Start programs as well, 41.5 percent of 4-year-olds and 14.5 percent of 3-year-olds are served in these publicly funded programs. These percentages are similar to last year, indicating that enrollment in publicly-funded programs more generally has stagnated. These figures are not completely unduplicatied. We have tried to unduplicate special education. Some Head Start children are also part of state pre-K, which can lead to overstating the number of children served. Comparison with the current population survey preschool enrollment estimates indicates that our national totals are reasonable. Individual state totals my be more problematic, especially for states with universal programs that largely incorporate special education and Head Start.
- Seventeen states increased enrollment, with increases ranging from 1 percent in Nevada to 63 percent in Rhode Island. Sixteen states reduced enrollment, from 1 percent in Arkansas, Illinois, Louisiana, Kentucky and Texas, to 16 percent in Alaska.
- An unprecedented seven programs improved their quality standards and gained against NIEER's Quality Standards Benchmarks checklist.
- Five states (now including Mississippi) plus one of Louisiana's three programs continue to meet all 10 benchmarks for state pre-K quality standards. Seventeen states met eight or more.
- More than half a million children, or 40 percent of nationwide enrollment, were served in programs that met fewer than half of the quality standards benchmarks.

[1] For the sake of comparison, the District of Columbia will be referred to as a "state" throughout this report. Hence, there is a total of 41 states providing state-funded pre-K.

NATIONAL ACCESS

Total state preschool enrollment, all ages 1,347,072

State-funded preschool programs .....53 programs in 40 states and D.C.[1]

Income requirement .....29 state programs have an income requirement

Minimum hours of operation .....16 part-day; 14 school-day; 1 extended-day; 22 determined locally[2]

Operating schedule.....39 academic year, 14 determined locally

Special education enrollment, ages 3 & 4 425,445

Federal Head Start enrollment, ages 3 & 4.....719,731[3]

Total federal Head Start enrollment, all ages .....768,478[3]

State-funded Head Start enrollment, ages 3 & 4 .....53,393[4]

STATE PRE-K AND HEAD START ENROLLMENT AS PERCENTAGE OF TOTAL POPULATION

† Some Head Start children may also be counted in state pre-K.
†† Estimates children in special education not also enrolled in state pre-K or Head Start.

NATIONAL QUALITY STANDARDS CHECKLIST SUMMARY

POLICY	BENCHMARK	OF THE 53 STATE-FUNDED PRE-K INITIATIVES, NUMBER MEETING BENCHMARKS
Early learning standards	Comprehensive	53
Teacher degree	BA	30
Teacher specialized training	Specializing in pre-K	45
Assistant teacher degree	CDA or equivalent	18
Teacher in-service	At least 15 hours/year	43
Maximum class size 3-year-olds 4-year-olds	20 or lower	45
Staff-child ratio 3-year-olds 4-year-olds	1:10 or better	46
Screening/referral and support services	Vision, hearing, health; and at least 1 support service	35
Meals	At least 1/day	25
Monitoring	Site visits at least every five years	32

NATIONAL RESOURCES

Total state preschool spending .....$5,556,840,884[6]

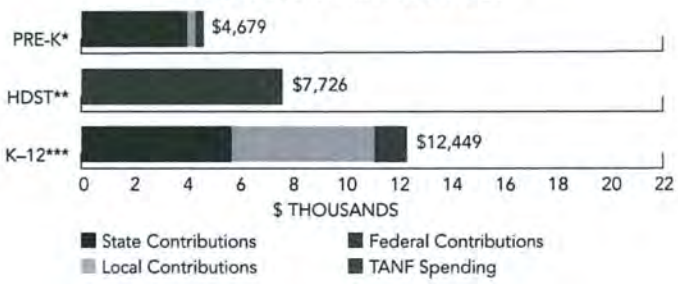
Local match required?.....13 state programs require a local match

State Head Start spending $156,140,148

State spending per child enrolled.....$4,125

All reported spending per child enrolled* $4,679

SPENDING PER CHILD ENROLLED



* Pre-K programs may receive additional funds from federal or local sources that are not included in this figure.

** Head Start per-child spending for the 2013-2014 year includes funding only for 3- and 4-year-olds served. Past years figured have unintentionally included funds for Early Head Start.

*** K–12 expenditures include capital spending as well as current operating expenditures.

Data are for the '12-'13 school year, unless otherwise noted.

[1] Throughout this report, the District of Columbia is included like a state for the first time. Figures indicating change over time have been adjusted to reflect 50 state plus D.C. totals. D.C. is also included in rankings as a "state," creating a list of 41 states for rankings. In January, Mississippi began offering a state-funded pre-K program enrolling 1,774 children. Because it was not operating for the full year, these children are not included in the enrollment total.

[2] NIEER's definitions of hours of operations are as follows: part-day programs serve children for fewer than 4 hours per day; school-day programs serve children at least 4 hours but fewer than 8 hours per day; and extended-day programs serve children for 8 or more hours per day. Some pre-K initiatives offer multiple hours of operation, such as a combination of part-day and school-day programs, but only the minimum one offered is listed here.

[3] The enrollment figure for federal Head Start, ages 3 and 4, includes children enrolled in the program in all 50 states, D.C., and the U.S. territories, as well as enrollment in the Migrant and American Indiana/Alaskan Native programs. Past years did not include the enrollment of children in the territories. The enrollment figure for total federal Head Start, all ages, includes all children served in any location, including the U.S. territories, and migrant and American Indian programs. These numbers do not include children funded by state match.

[4] This figure includes children who attended programs that were considered to be state-funded preschool initiatives. These children are also counted in the state-funded preschool enrollment total.

[5] In January, Mississippi began offering a state-funded pre-K program with all 10 of NIEER's quality standards benchmarks. Because it was not operating for the full year, this program is not reflected in the quality standards benchmarks.

[6] This figure includes federal TANF funds directed toward preschool at states' discretion. In January, Mississippi began offering a state-funded pre-K program with $3 million in state funding. Because it was not operating for the full year, these funds are not reflected in the funding total.

TABLE 1: STATE RANKINGS AND QUALITY CHECKLIST SUMS

STATE	Access for 4-Year-Olds Rank	Access for 3-Year-Olds Rank	Resource Rank Based on State Spending	Resource Rank Based on All Reported Spending	Quality Standards Checklist Sum (Maximum of 10)
Alabama	32	None served	19	13	**10**
Alaska	39	None served	9	14	**10**
Arizona	34	22	41	41	**5**
Arkansas	12	5	13	21	**9**
California	26	8	18	22	**4**
Colorado	22	9	35	31	**6**
Connecticut	29	12	3	3	**6**
Delaware	35	None served	7	10	**8**
District of Columbia	1	1	1	1	**8**
Florida	3	None served	36	37	**3**
Georgia	7	None served	23	29	**8**
Illinois	20	3	31	30	**8**
Iowa	8	17	32	34	**6.9**
Kansas	25	None served	38	38	**6**
Kentucky	17	10	30	11	**9**
Louisiana	15	None served	16	23	**8**
Maine	14	None served	33	15	**5**
Maryland	13	16	17	24	**8**
Massachusetts	28	18	25	27	**6**
Michigan	21	None served	12	19	**8**
Minnesota	41	24	6	7	**9**
Missouri	38	20	39	39	**7**
Nebraska	16	6	37	36	**6**
Nevada	37	None served	34	35	**7**
New Jersey	18	4	2	2	**8.8**
New Mexico	19	None served	28	32	**8**
New York	10	26	22	28	**7**
North Carolina	24	None served	14	9	**10**
Ohio	36	21	21	26	**4**
Oklahoma	4	None served	26	8	**8**
Oregon	31	14	4	6	**9**
Pennsylvania	30	15	10	18	**6.5**
Rhode Island	40	None served	5	4	**10**
South Carolina	11	11	40	40	**5.6**
Tennessee	23	25	15	16	**9**
Texas	9	13	29	33	**2**
Vermont	2	2	20	25	**4**
Virginia	27	None served	24	17	**6**
Washington	33	19	8	12	**9**
West Virginia	5	7	11	5	**9**
Wisconsin	6	23	27	20	**5.1**
Hawaii	No program	No program	No program	No program	No program
Idaho	No program	No program	No program	No program	No program
Indiana	No program	No program	No program	No program	No program
Mississippi	No program	No program	No program	No program	No program
Montana	No program	No program	No program	No program	No program
New Hampshire	No program	No program	No program	No program	No program
North Dakota	No program	No program	No program	No program	No program
South Dakota	No program	No program	No program	No program	No program
Utah	No program	No program	No program	No program	No program
Wyoming	No program	No program	No program	No program	No program

Executive Summary *(continued)*

ENROLLMENT INCREASES

State-funded pre-K served 1,347,272 children in 2013-2014. State pre-K continues to be largely a program for 4-year-olds, with 4's accounting for more than 1.1 million, or about 86 percent, of the children enrolled.

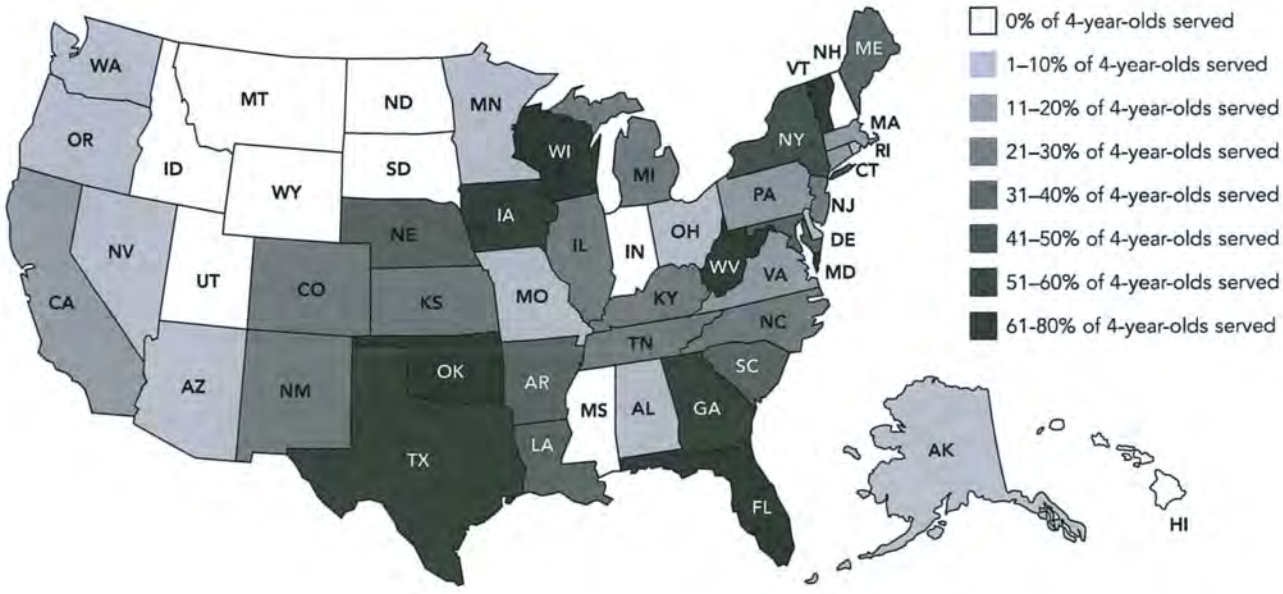
Across the nation, 29 percent of 4-year-olds were enrolled in state-funded pre-K programs and only 4 percent of 3-year-olds were similarly enrolled, percentages that have changed little since the 2010-2011 school year. Total enrollment increased by 8,535 from the prior year. While the additional enrollment is positive, about half of it was need just to offset the previous year's 4,300 cut in enrollment. Table 2 shows both numbers enrolled and enrollment as a percentage of total population by state. Table 3 reports enrollment changes in numbers of children and percentage of the total population for 3- and 4-year-olds from the prior year as well as back to 2001-2002.

Since states also serve children in preschool special education, the total number of children served by states is somewhat larger than indicated by state-funded pre-K enrollment alone. Table 4 presents numbers and percentages of children enrolled in state pre-K and special education programs; it also shows totals that include students in the federal Head Start program. These are unduplicated estimates in that children served by multiple programs are only counted once. Including both state pre-K and special education programs brings state enrollment up to 32.4 percent at age 4 and 7.4 percent at age 3. These figures should be interpreted cautiously for two reasons. First, while every effort is made to ensure children are not double counted, we may not have perfectly unduplicated the counts. Second, and more important, some children in preschool special education receive limited therapeutic services and are not enrolled in a quality pre-K in which all of their educational needs are met. Adding in the federal Head Start program, enrollment in all public programs is 41.5 percent at age 4 and 14.5 percent at age 3. Again there may be some duplication we have not eliminated and our prior caveat regarding special education services applies.

Enrollment in state-funded pre-K programs varies widely from state-to-state. Figure 1 displays state pre-K enrollment at age 4 by state. The District of Columbia served the highest percentage of children at both ages 3 and 4. Among states, Florida, Oklahoma, and Vermont ranked at the top with each serving over 75 percent of the state's 4-year-olds.

Other states enrolling more than half of 4-year-olds include Georgia, Iowa, Texas, West Virginia, and Wisconsin. On the other end of the spectrum, 11 states with programs served fewer than 10 percent of 4-year-olds, while 10 more had no program, prior to the start of Mississippi's program in January. Several other states including Michigan, Nebraska, and Ohio have embarked on additional noteworthy expansions since the end of the 2013-2014 school year. Further increases in enrollment are expected in 2015-2016, as states that received federal Preschool Development and Expansion grants are

FIGURE 1: PERCENT OF 4-YEAR-OLDS SERVED IN STATE PRE-K



expected to enroll more than 18,000 additional children. States that received these grants in 2014 are: Alabama, Arizona, Arkansas, Connecticut, Hawaii, Illinois, Louisiana, Maine, Maryland, Massachusetts, Montana, Nevada, New Jersey, New York, Rhode Island, Tennessee, Vermont, and Virginia.

State-funded pre-K programs remain primarily the domain of 4-year-olds, and the number of 3-year-olds served increased by just 334 in 2013-2014. However, there are several notable exceptions. Washington, D.C. serves 69 percent of 3-year-old residents. Vermont serves a quarter of its 3-year-olds, while Illinois and New Jersey serve about 20 percent at age 3. Nebraska, and West Virginia all serve 10 percent or more at this age. Of the 26 states that enroll 3-year-olds in state-funded pre-K, 14 states increased their enrollment of 3-year-olds from the previous year while 11 states reduced enrollment in 2013-2014.

Enrollment changes among the states in 2013-2014 were highly uneven. Alabama, Arizona, Michigan, New Mexico, Ohio, and Vermont showed the largest increases in the percentage of population served. Vermont made by far the largest percentage gain. Unfortunately, gains were somewhat offset by decreases in some states, particularly New York, North Carolina, South Carolina, and Texas. Mississippi provided services for half of the school year when it initiated a state-funded pre-K program in January 2014. Though not included in this year's state comparisons because of its part-year status, the program served roughly 4 percent of Mississippi 4-year-olds.

QUALITY STANDARDS

The Yearbook compares each state program's standards against a checklist of 10 research-based quality standards benchmarks. The benchmarks track state progress in quality standards, but they are not, in themselves, guarantees of quality. Arguably some of them are quite low (e.g., hours of professional development), even though many states do not meet them. Moreover, they are primarily indicators of the resources available to programs, not whether these resources are used well. In addition to high standards, effective pre-K programs require adequate funding and the continuous improvement of strong practices. For example, requirements that every teacher be highly qualified mean nothing if pre-K teacher salaries are not competitive with other educational sectors and occupations. Nor do the required hours of professional development matter if they consist of one-shot workshops on barely relevant topics.

While the benchmarks are derived from research, setting them is not an exact science, and they are not all equally important, or important for the same reasons. For example, some state policy makers do not consider it desirable to require meals in part-day programs. In our view, as most programs target disadvantaged children who all too often experience food insecurity and poor nutrition, it is desirable to offer them a healthy meal no matter how short the day. Good teachers make mealtime a learning time broadly, and teach about healthy eating habits, so there is no loss of "instructional time." However, this clearly is a crude indicator of whether programs adequately address children's nutritional needs. A list of benchmarks and a summary of the supporting research are provided on page 22.

Figure 2 displays the percentage of programs meeting each of the quality standards from 2001-2002 through 2013-2014. Seven states' policy changes resulted in gains against an additional benchmark in 2013-2014: Michigan, Oregon, three of Pennsylvania's programs, West Virginia, and Wisconsin Head Start. Michigan now meets the benchmark for site visits, while West Virginia now requires that lead teachers have a Bachelors degree. Two of Pennsylvania's programs, EABG and K4, now require 15 hours per year of professional development, after previously implementing a moratorium on such professional development. Three programs reported increased assistant teacher credentials as a result of changes in federal Head Start requirements: Oregon, Pennsylvania HSSAP, and Wisconsin Head Start.

At the start of the 2013-2014 school year, only five state programs met all 10 benchmarks: Alabama, Alaska, North Carolina, Rhode Island, and one Louisiana program (NSECD). Mississippi adds a sixth, as its new program also meets all 10 benchmarks for standards. Nine other states have programs that meet nine of 10 benchmarks – Arkansas, Kentucky, Minnesota, New Jersey (Abbott pre-K only), Oregon, Pennsylvania HSSAP, Tennessee, Washington and West Virginia.

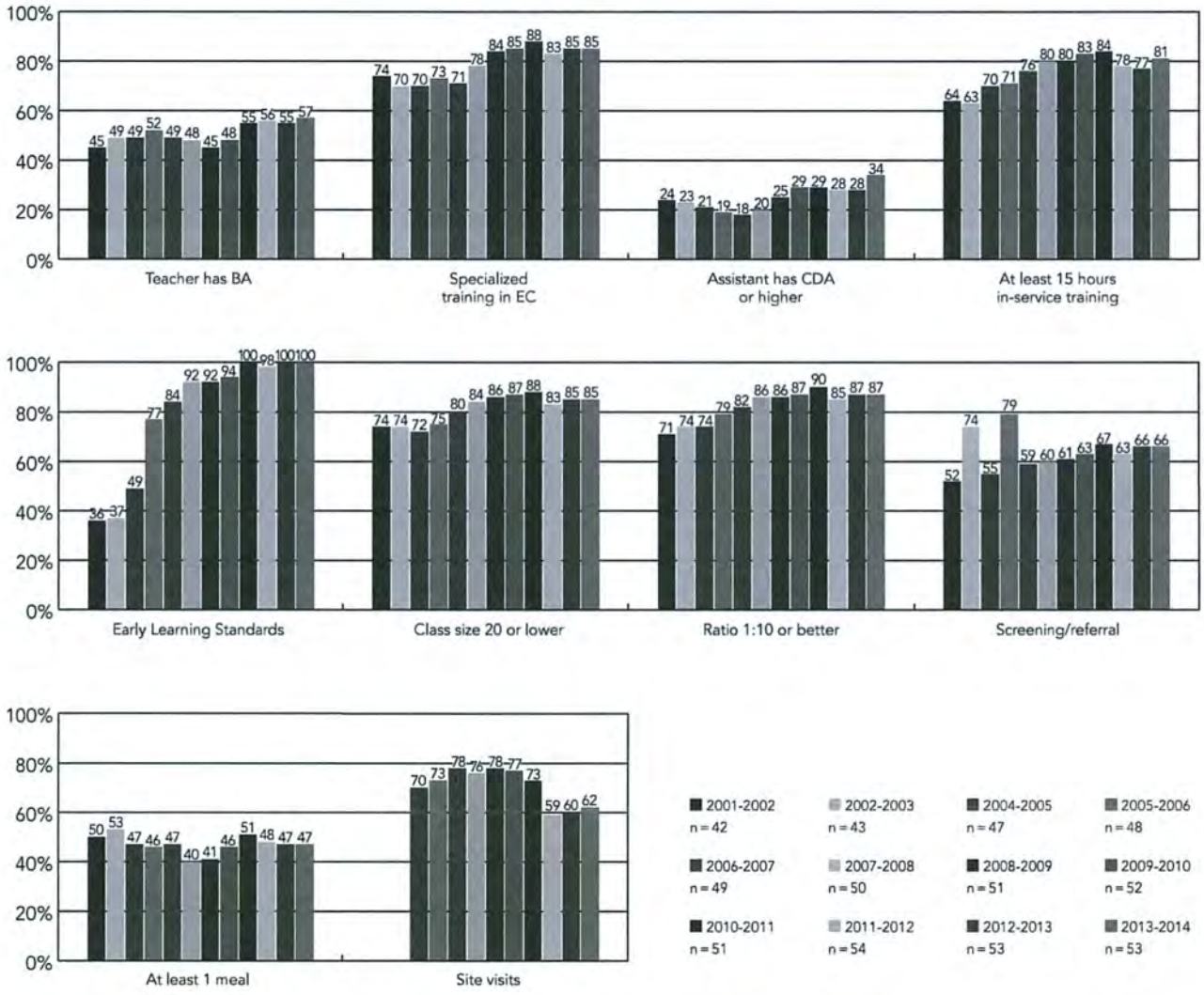
At the other end of the spectrum, six states meet fewer than half of the 10 benchmarks – California, Ohio, and Vermont met four; Florida met three; and Texas met only two benchmarks. Pennsylvania's K4 program meets three benchmarks this year, making it the only program in Pennsylvania that meets fewer than half of the 10 benchmarks. Particularly concerning, Texas and Pennsylvania's K4 program not only miss the class size and staff-child ratio benchmarks, they set no limits on these at all.

RESOURCES: DO SMALL INCREASES SIGNAL THE START OF A RECOVERY?

In 2013-2014, 40 states plus D.C. spent more than $5.56 billion on pre-K, not including special education funds. When Mississippi launched its pre-K program in January, it added another $3 million to state expenditures on pre-K, a modest start that does not appreciably alter the total once it is rounded to the nearest $10 million. The remaining states did not contribute to this total, as they had no pre-K initiative meeting our definition of state-funded prekindergarten at the start of the 2013-2014 school year. (See page 21 for our explanation of what constitutes a state-funded pre-K program.)

As might be expected, total spending by states varies considerably by state size, though this is clearly not the only determinant. Among states with programs, Rhode Island spent the least at $1.9 million while Texas spent the most, $787 million, eclipsing the larger state of California. Across the 40 states and D.C. funding pre-K, total state spending increased by $116 million, a 2 percent increase in real spending from the 2012-2013 school year. Average spending per child increased by $61 (inflation-adjusted) to $4,125. D.C. spends the most per-child at $15,372, with New Jersey behind it at $12,157. South Carolina and Arizona report the lowest state spending per child, both under $2,000.

FIGURE 2: PERCENT OF STATE PRE-K PROGRAMS MEETING BENCHMARKS 2002-2014



Many state-funded pre-K programs utilize additional funds from local and federal sources to help fund pre-K programs. In some, states and local education agencies share the costs through a formula just as they do for K-12 education. As a result, funding from all sources is a more complete indicator of the total resources available to support pre-K (though not a better indicator of state financial commitment). Unfortunately, not all states can fully, or even partially, report spending at the local level. This means that the all-reported funding figures understate total spending nationally and that comparisons across states are distorted by differences in reporting.

Nevertheless, the figures reported in Table 7 indicate that local schools and federal funds added at least $746 million to state pre-K funds in the 2013-2014 school year, or $554 per child. All-source reported spending totals $6.3 billion, an increase of about $49 million from the 2012-2013 school year. The majority of reported non-state funds come from non-TANF federal spending, at $331 million. Required local spending adds $211 million while non-required local spending adds $204 million in 2013-2014. This is less than was reported in the 2012-2013 year. The extent to which this is a real change or simply a difference in reporting we cannot determine. Reported spending per-child from all sources was $4,679 nationwide, up slightly from the previous year's $4,672 (inflation-adjusted).

Although funding does not guarantee quality, inadequate funding can harm quality and effectiveness. As can be seen in Table 7, we can have confidence that reported funding per child is sufficient to meet all 10 benchmarks and offer a quality program in only 15 states (taking into account the current operating schedules of those programs, as funding requirements vary with length of day). As our estimates of the amount required are inexact and some funding is unreported, it seems likely that some additional states have adequately funded programs. However, a number of states have reported funding levels so far below what is estimated as required that funding adequacy is high questionable.

RECOMMENDATIONS

State pre-K programs may have turned a corner in 2013-2014, but progress remains slow. If pre-K is to be made available to even all children under 200 percent of the poverty level within the next 20 years, state investments will have to grow at a much faster pace. At the 2013-2014 growth rate it would take about 75 years for states to reach 50 percent enrollment at age 4 and 150 years to reach 70 percent enrollment. Even a return to the average rate of growth since 2001-2002 would leave the nation 25 years away from enrolling 50 percent of 4-year-olds in state funded pre-K.

States should set goals to increase enrollment much more rapidly than has been the case in the past, while raising quality standards and providing funding at the level needed to support those high standards. Every state is capable of delivering high quality pre-K to all 4-year-olds within 10 years, if they set high standards and commit adequate resources. Many states could reach this goal in less than 10 years.

Many states need to raise their quality standards for pre-K and implement policies to ensure continuous improvement. Without sufficient quality, programs will not fulfill their promise with respect to children's learning and development or long-term economic returns. NIEER's 10 benchmarks for quality standards are a starting place for state policy.

Particularly worrying is the number of states with inadequate requirements for preschool teacher preparation. A new Institute of Medicine and National Research Council report calls for all teachers of young children to have a four-year college degree and specialized training. States should create a timeline to ensure that all teachers in state-funded preschool programs obtain these qualifications and that their compensation is comparable to that for K-12 teachers with similar qualifications.

The federal government should offer financial incentives for states to set and achieve ambitious goals for enrollment, quality standards, and adequate funding.

When states do not adequately support high-quality pre-K, communities should act on their own as cities across the nation from New York to Seattle have already done.

TABLE 2: PRE-K ACCESS BY STATE

ACCESS FOR 4-YEAR-OLDS RANK	STATE	PERCENT OF CHILDREN ENROLLED IN STATE PREKINDERGARTEN (2013-2014)			NUMBER OF CHILDREN ENROLLED IN STATE PREKINDERGARTEN (2013-2014)		
		4-year-olds	3-year-olds	Total (3s and 4s)	4-year-olds	3-year-olds	Total (3s and 4s)
1	District of Columbia	98.6%	69.3%	82.9%	6,616	5,364	11,980
2	Vermont	90.6%	25.8%	58.7%	5,592	1,549	7,142
3	Florida	79.5%	0.0%	39.7%	170,266	-	170,266
4	Oklahoma	76.4%	0.0%	38.2%	40,823	-	40,823
5	West Virginia*	69.2%	11.3%	40.3%	14,149	2,306	16,455
6	Wisconsin	65.8%	1.1%	33.6%	46,323	733	47,056
7	Georgia	60.2%	0.0%	30.1%	81,453	-	81,453
8	Iowa	59.7%	3.9%	31.9%	23,864	1,535	25,399
9	Texas	52.0%	5.7%	28.9%	203,648	22,565	226,213
10	New York	43.8%	0.1%	21.7%	98,695	215	98,910
11	South Carolina	38.6%	6.5%	22.7%	23,251	3,886	27,137
12	Arkansas*	37.7%	12.8%	25.3%	14,632	4,898	19,530
13	Maryland	36.1%	4.3%	20.2%	26,358	3,173	29,531
14	Maine	35.1%	0.0%	17.7%	4,721	-	4,721
15	Louisiana	31.8%	0.0%	15.9%	19,768	-	19,768
16	Nebraska	30.3%	12.5%	21.4%	7,995	3,291	11,286
17	Kentucky	30.0%	7.4%	18.6%	16,470	4,088	20,558
18	New Jersey	29.3%	19.3%	24.3%	31,138	20,669	51,807
19	New Mexico	27.4%	0.0%	13.7%	7,674	-	7,674
20	Illinois	27.1%	19.4%	23.2%	43,778	31,225	75,003
21	Michigan	26.3%	0.0%	13.2%	30,552	-	30,552
22	Colorado	22.3%	7.7%	15.0%	15,259	5,194	20,453
23	Tennessee	22.1%	0.7%	11.5%	17,893	601	18,494
24	North Carolina	21.2%	0.0%	10.6%	26,617	-	26,617
25	Kansas	20.5%	0.0%	10.2%	8,268	-	8,268
26	California	17.8%	8.6%	13.2%	88,708	43,055	131,763
27	Virginia	17.8%	0.0%	8.9%	18,021	-	18,021
28	Massachusetts	14.1%	3.6%	8.8%	10,201	2,597	12,798
29	Connecticut	13.6%	6.1%	9.9%	5,381	2,347	7,728
30	Pennsylvania	11.8%	5.3%	8.6%	17,025	7,585	24,610
31	Oregon	9.8%	5.6%	7.7%	4,627	2,582	7,209
32	Alabama	9.2%	0.0%	4.6%	5,505	-	5,505
33	Washington	7.9%	1.9%	4.9%	7,055	1,686	8,741
34	Arizona*	6.9%	1.2%	4.1%	6,117	1,084	7,201
35	Delaware	5.8%	0.0%	2.9%	635	0	635
36	Ohio*	4.1%	1.6%	2.8%	5,789	2,199	7,988
37	Nevada	3.8%	0.0%	1.9%	1,401	-	1,401
38	Missouri	3.5%	1.6%	2.6%	2,628	1,246	3,874
39	Alaska	2.7%	0.0%	1.4%	291	-	291
40	Rhode Island	2.1%	0.0%	1.1%	234	-	234
41	Minnesota	1.3%	0.9%	1.1%	940	661	1,601
	Hawaii	0.0%	0.0%	0.0%	0	0	0
	Idaho	0.0%	0.0%	0.0%	0	0	0
	Indiana	0.0%	0.0%	0.0%	0	0	0
	Mississippi**	0.0%	0.0%	0.0%	0	0	0
	Montana	0.0%	0.0%	0.0%	0	0	0
	New Hampshire	0.0%	0.0%	0.0%	0	0	0
	North Dakota	0.0%	0.0%	0.0%	0	0	0
	South Dakota	0.0%	0.0%	0.0%	0	0	0
	Utah	0.0%	0.0%	0.0%	0	0	0
	Wyoming	0.0%	0.0%	0.0%	0	0	0
	United States	**29.1%**	**4.4%**	**16.7%**	**1,160,361**	**176,334**	**1,336,695**

For details about how these figures were calculated, see the Methodology section and Roadmap to the State Profile Pages.

[1] Nationwide, an additional 10,376 children of other ages were enrolled in state prekindergarten, for a total enrollment of 1,347,072.

* These states report a significant number of 5-year-olds enrolled in their programs. Upon further clarification, these are children who were essentially 4-year-olds but barely missed the age cut off. They are counted as 4-year-olds in this table.

** Though not included in this year's state comparisons because of its part-year status, Mississippi served 1,774 4-year-olds or roughly four percent of 4-year-olds in its pre-K program.

TABLE 3: CHANGE IN PRESCHOOL ENROLLMENT OVER TIME

	ENROLLMENT CHANGES FROM 2001-2002 TO 2013-2014				ENROLLMENT CHANGES FROM 2012-2013 TO 2013-2014			
	Change in 3-year-olds		Change in 4-year-olds		Change in 3-year-olds		Change in 4-year-olds	
STATE	Number	Percentage Point	Number	Percentage Point	Number	Percentage Point	Number	Percentage Point
Alabama	0	0%	4,749	8%	0	0%	1,608	3%
Alaska	0	0%	291	3%	0	0%	-54	0%
Arizona*	1,084	1%	-903	-2%	-1,001	-1%	442	1%
Arkansas	3,956	10%	10,362	26%	-605	-1%	-654	0%
California	32,131	6%	44,174	9%	-4,408	-1%	9,234	2%
Colorado	4,464	6%	6,939	8%	713	1%	470	1%
Connecticut	812	3%	964	4%	-170	0%	79	1%
Delaware	1	0%	-208	-2%	1	0%	-208	-2%
D.C.	4,239	49%	3,605	55%	-37	-11%	98	5%
Florida	0	0%	170,266	80%	0	0%	-3,879	1%
Georgia	0	0%	17,840	7%	0	0%	-230	2%
Hawaii	0	0%	0	0%	0	0%	0	0%
Idaho	0	0%	0	0%	0	0%	0	0%
Illinois	17,127	11%	4,876	6%	1,244	1%	-1,546	0%
Indiana	0	0%	0	0%	0	0%	0	0%
Iowa	1,024	3%	22,308	56%	73	0%	-846	0%
Kansas	0	0%	6,038	15%	0	0%	-246	0%
Kentucky	-784	-2%	3,653	6%	-90	0%	-169	1%
Louisiana	0	0%	12,249	20%	0	0%	-103	1%
Maine	0	0%	3,281	25%	0	0%	-129	1%
Maryland	1,765	2%	7,984	11%	168	0%	-44	1%
Massachusetts*	-6,835	-8%	769	3%	-69	0%	-298	0%
Michigan	0	0%	4,075	7%	0	0%	6,005	6%
Minnesota*	-154	0%	-330	-1%	-26	0%	-104	0%
Mississippi	0	0%	0	0%	0	0%	0	0%
Missouri	-1,300	-2%	-1,058	-1%	269	0%	-70	0%
Montana	0	0%	0	0%	0	0%	0	0%
Nebraska	3,167	12%	7,639	29%	312	1%	1,081	5%
Nevada	-111	0%	1,080	3%	-107	0%	129	1%
New Hampshire	0	0%	0	0%	0	0%	0	0%
New Jersey	7,884	8%	7,257	9%	-37	0%	118	1%
New Mexico	-470	-2%	7,304	26%	0	0%	2,343	9%
New York	-5,620	-2%	35,196	19%	0	0%	-4,437	-1%
North Carolina	0	0%	25,377	20%	0	0%	-2,955	-2%
North Dakota	0	0%	0	0%	0	0%	0	0%
Ohio	-7,515	-5%	-9,113	-6%	839	1%	1,315	1%
Oklahoma	0	0%	14,944	21%	0	0%	709	2%
Oregon	1,473	3%	2,038	4%	133	0%	-89	0%
Pennsylvania*	7,585	5%	14,475	10%	143	0%	-885	0%
Rhode Island	0	0%	234	2%	0	0%	90	1%
South Carolina*	3,536	6%	7,601	9%	1,338	2%	-1,678	-2%
South Dakota	0	0%	0	0%	0	0%	0	0%
Tennessee	-241	0%	16,135	20%	0	0%	0	1%
Texas	2,824	0%	76,065	13%	445	0%	-1,408	0%
Utah	0	0%	0	0%	0	0%	0	0%
Vermont*	1,180	21%	4,972	82%	282	5%	991	19%
Virginia	0	0%	12,143	12%	0	0%	708	1%
Washington	537	0%	2,270	2%	536	1%	-186	0%
West Virginia	538	3%	8,958	44%	394	2%	649	6%
Wisconsin*	45	0%	32,819	47%	-5	0%	2	2%
Wyoming	0	0%	0	0%	0	0%	0	0%
U.S.	**72,342**	**2%**	**595,230**	**15%**	**335**	**0%**	**11,764**	**1%**

* At least one program in these states did not break down total enrollment figures into specific numbers of 3- and 4-year-olds served. As a result, the figures in this table are estimates.

TABLE 4: 2013-2014 ENROLLMENT OF 3- AND 4-YEAR-OLDS IN STATE PRE-K, PRESCHOOL SPECIAL EDUCATION, AND FEDERAL AND STATE HEAD START

	Pre-K + Pre-K Special Education				Pre-K + Pre-K Special Education + Head Start††			
	3-year-olds		4-year-olds		3-year-olds		4-year-olds	
STATE	Number Enrolled	Percent of State Population	Number Enrolled	Percent of State Population	Number Enrolled	Percent of State Population	Number Enrolled	Percent of State Population
Alabama	907	1.5%	7,062	11.8%	6,466	10.7%	16,462	27.5%
Alaska*	346	3.3%	886	8.5%	1,325	12.4%	2,344	22.5%
Arizona	4,147	4.4%	10,592	11.9%	9,240	10.4%	21,350	24.0%
Arkansas	7,037	18.5%	18,538	47.8%	11,104	29.5%	22,826	58.9%
California*	57,216	11.5%	108,588	21.8%	93,648	18.7%	159,723	32.1%
Colorado	7,757	11.5%	19,091	27.9%	11,828	17.5%	24,411	35.6%
Connecticut*	3,976	10.3%	7,497	19.0%	6,655	17.2%	10,626	26.9%
Delaware†	355	3.2%	1,219	11.1%	972	8.7%	2,142	19.4%
District of Columbia	5,319	68.7%	6,602	98.5%	6,493	83.9%	6,697	99.8%
Florida	5,864	2.7%	172,442	80.5%	19,337	9.0%	192,291	89.8%
Georgia	2,267	1.7%	82,974	61.4%	13,835	10.5%	92,702	68.4%
Hawaii	572	3.2%	703	4.0%	1,424	8.1%	2,504	14.3%
Idaho	635	2.7%	891	3.7%	1,569	6.8%	3,081	12.9%
Illinois	33,054	20.4%	48,855	30.2%	48,038	29.4%	68,098	42.2%
Indiana	3,565	4.2%	4,940	5.8%	8,565	10.1%	12,340	14.4%
Iowa*	2,202	5.6%	24,578	61.5%	4,868	12.5%	28,055	70.5%
Kansas	2,279	5.6%	11,644	28.4%	5,386	13.5%	14,933	36.5%
Kentucky	4,088	7.4%	16,470	30.0%	9,449	17.1%	25,022	45.6%
Louisiana*	650	1.0%	20,865	33.6%	11,969	19.3%	29,159	46.9%
Maine*	600	4.6%	5,363	39.9%	1,574	11.9%	6,978	51.9%
Maryland	6,052	8.3%	30,385	41.7%	10,532	14.4%	34,712	47.6%
Massachusetts*	5,812	8.0%	13,210	18.3%	10,090	13.9%	18,930	26.2%
Michigan	3,676	3.2%	30,552	26.3%	15,522	13.4%	46,049	39.4%
Minnesota†	3,231	4.6%	4,954	7.1%	6,909	9.9%	10,064	14.4%
Mississippi	542	1.4%	1,610	4.0%	10,981	27.4%	16,132	39.6%
Missouri	3,788	5.0%	7,078	9.3%	9,984	13.2%	15,053	19.4%
Montana	125	1.0%	304	2.4%	1,745	14.2%	2,693	21.4%
Nebraska	3,291	12.5%	7,995	30.3%	4,999	19.5%	10,414	39.4%
Nevada	1,745	4.8%	4,038	11.0%	2,879	8.0%	5,410	14.8%
New Hampshire	791	6.1%	1,088	8.1%	1,345	10.4%	1,821	13.4%
New Jersey	25,157	23.4%	37,006	34.9%	30,869	28.5%	43,853	41.3%
New Mexico	1,319	4.7%	9,530	34.0%	4,260	15.2%	13,848	49.4%
New York*	15,704	6.8%	113,093	50.1%	34,486	14.9%	136,314	60.4%
North Carolina	3,449	2.8%	30,511	24.3%	10,445	8.5%	41,230	32.8%
North Dakota	282	3.0%	432	4.5%	1,374	14.5%	2,002	20.4%
Ohio	6,045	4.5%	12,438	8.8%	19,573	14.5%	31,143	22.0%
Oklahoma	827	1.5%	40,823	76.4%	8,175	15.5%	47,841	89.4%
Oregon	4,406	9.5%	6,771	14.5%	6,908	14.9%	10,915	23.2%
Pennsylvania*†	13,735	9.6%	25,515	17.7%	24,388	16.4%	41,803	29.1%
Rhode Island*	622	5.7%	1,054	9.6%	1,398	12.8%	2,441	22.5%
South Carolina*	4,742	8.0%	24,242	40.5%	10,678	18.0%	29,699	49.5%
South Dakota	463	3.9%	674	5.7%	2,053	17.2%	2,746	23.0%
Tennessee	2,042	2.5%	19,624	24.2%	8,144	10.5%	28,651	35.4%
Texas	27,430	7.0%	203,588	52.0%	56,394	14.4%	239,835	61.3%
Utah	2,140	4.2%	2,850	5.4%	4,054	7.9%	6,560	12.4%
Vermont*	1,681	28.0%	5,592	90.6%	2,122	35.4%	6,123	99.5%
Virginia*	3,288	3.2%	21,499	21.3%	8,117	8.0%	29,196	28.9%
Washington	4,437	5.0%	10,662	11.9%	8,414	9.4%	17,648	19.8%
West Virginia	2,306	11.3%	14,149	69.2%	4,159	20.4%	19,348	94.4%
Wisconsin†	2,867	4.1%	46,619	66.2%	9,284	13.4%	52,418	74.4%
Wyoming	0	0.0%	0	0.0%	644	8.3%	870	10.9%
National	**294,829.42**	**7.4%**	**1,297,688**	**32.4%**	**573,428**	**14.5%**	**1,658,374**	**41.5%**

* These states serve special education children in their state pre-K programs but were not able to provide an unduplicated count for at least one of their programs. Estimations were used based on the average percent of special education students in state pre-K and enrollment numbers for each program.

† These states serve special education children in their state-funded Head Start pre-K programs but were not able to provide an unduplicated count for the Head Start program. Estimations were used based on the percent of children with IEPs as reported by the PIR.

††Total can overstate public enrollment as some or all Head Start children may also be served in a state's pre-K.

For details about how these figures were calculated, see the Methodology section and the Roadmap to the State Profile Pages.

TABLE 5: 2013-2014 STATE PRE-K QUALITY STANDARDS

STATE/ PROGRAM	Comprehensive early learning standards	Teacher has BA	Specialized training in pre-K	Assistant teacher has CDA or equiv.	At least 15 hrs/yr in-service	Class size 20 or lower	Staff-child ratio 1:10 or better	Vision, hearing, health, and one support service	At least one meal	Site visits	Quality Standards Checklist Sum 2013-2014
Alabama	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	10
Alaska	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	10
Arizona	✔				✔	✔	✔			✔	5
Arkansas	✔		✔	✔	✔	✔	✔	✔	✔	✔	9
California	✔		✔		✔		✔				4
Colorado	✔		✔		✔	✔	✔			✔	6
Connecticut	✔		✔			✔	✔	✔		✔	6
Delaware	✔		✔		✔	✔	✔	✔	✔	✔	8
District of Columbia	✔	✔	✔		✔	✔	✔	✔	✔		8
Florida	✔					✔				✔	3
Georgia	✔	✔	✔	✔	✔			✔	✔	✔	8
Illinois	✔	✔	✔		✔	✔	✔	✔		✔	8
Iowa Shared Visions	✔		✔			✔	✔	✔	✔		6
Iowa SVPP	✔	✔	✔			✔	✔	✔		✔	7
Kansas At-Risk	✔	✔		✔	✔	✔	✔				6
Kansas Pilot Pre-K	✔	✔		✔	✔	✔	✔				6
Kentucky	✔	✔	✔		✔	✔	✔	✔	✔	✔	9
LA 8(g)	✔	✔	✔		✔	✔	✔		✔		7
LA 4	✔	✔	✔		✔	✔	✔	✔	✔		8
LA NSECD	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	10
Maine	✔	✔	✔	✔	✔						5
Maryland	✔	✔	✔		✔		✔	✔	✔	✔	8
Massachusetts	✔				✔	✔	✔	✔		✔	6
Michigan	✔	✔	✔	✔		✔	✔	✔		✔	8
Minnesota	✔		✔	✔	✔	✔	✔	✔	✔	✔	9
Missouri	✔	✔	✔	✔		✔	✔	✔			7
Nebraska	✔	✔	✔	✔		✔	✔				6
Nevada	✔	✔	✔		✔	✔	✔			✔	7
New Jersey Abbott	✔	✔	✔		✔	✔	✔	✔	✔	✔	9
New Jersey ECPA	✔	✔	✔		✔	✔	✔	✔		✔	8
New Jersey ELLI	✔	✔	✔		✔	✔	✔	✔		✔	8
New Mexico	✔		✔		✔	✔	✔	✔	✔	✔	8
New York	✔	✔	✔		✔	✔	✔	✔			7
North Carolina	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	10
Ohio ECE	✔		✔					✔		✔	4
Oklahoma	✔	✔	✔			✔	✔	✔	✔	✔	8
Oregon	✔		✔	✔	✔	✔	✔	✔	✔	✔	9
Pennsylvania EABG	✔		✔		✔	✔	✔				5
Pennsylvania HSSAP	✔		✔	✔	✔	✔	✔	✔	✔	✔	9
Pennsylvania K4	✔	✔			✔						3
PA Pre-K Counts	✔	✔	✔		✔	✔	✔			✔	7
Rhode Island	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	10
South Carolina 4K	✔		✔		✔	✔	✔				5
South Carolina CDEPP	✔		✔		✔	✔	✔	✔	✔		7
Tennessee	✔	✔	✔		✔	✔	✔	✔	✔	✔	9
Texas	✔				✔						2
Vermont Act 62	✔				✔	✔	✔				4
Vermont EEI	✔		✔			✔	✔				4
Virginia	✔		✔		✔	✔	✔	✔			6
Washington	✔		✔	✔	✔	✔	✔	✔	✔	✔	9
West Virginia	✔	✔	✔		✔	✔	✔	✔	✔	✔	9
WI 4K	✔	✔	✔		✔					✔	5
WI HdSt	✔		✔	✔	✔	✔	✔	✔	✔		8
TOTAL	**53**	**30**	**45**	**18**	**43**	**45**	**46**	**35**	**25**	**33**	

TABLE 6: PRE-K RESOURCES PER CHILD ENROLLED BY STATE

STATE	Resources rank based on state spending	State $ per child enrolled in pre-K	Change in state per-child spending from 2012-2013 to 2013-2014 Adjusted dollars	Total state preschool spending in 2013-2014	Change in total state spending from 2012-2013 to 2013-2014 Adjusted dollars
District of Columbia	1	$15,372	$545	$191,016,442	$14,288,908
New Jersey*	2	$12,157	-$26	$629,798,393	-$363,572
Connecticut	3	$8,906	-$995	$82,742,716	-$11,189,457
Oregon	4	$8,471	-$99	$61,069,891	-$498,503
Rhode Island	5	$8,335	-$1,029	$1,950,475	$602,026
Minnesota	6	$8,074	$411	$14,048,309	$155,758
Delaware	7	$7,295	$437	$6,149,300	$368,129
Washington	8	$6,658	-$76	$58,198,086	$1,695,783
Alaska	9	$6,137	-$1,176	$1,786,000	-$737,295
Pennsylvania*	10	$5,788	$56	$145,553,522	-$1,331,925
West Virginia	11	$5,766	-$182	$97,069,726	$3,257,477
Michigan	12	$5,704	$1,211	$174,275,000	$63,981,782
Arkansas	13	$5,544	-$22	$111,000,000	-$1,034,291
North Carolina	14	$5,172	$166	$137,663,376	-$10,380,890
Tennessee	15	$4,611	-$43	$85,807,267	-$799,547
Louisiana*	16	$4,565	-$98	$90,248,459	-$2,410,954
Maryland	17	$4,500	$73	$132,889,099	$2,694,216
California*	18	$4,298	-$286	$568,986,908	-$24,950,304
Alabama	19	$4,288	-$656	$23,604,115	$4,339,213
Vermont*	20	$4,273	$460	$30,999,300	$8,320,083
Ohio *	21	$4,000	$37	$32,602,974	$10,009,001
New York*	22	$3,820	$177	$377,870,536	$1,384,214
Georgia	23	$3,746	$113	$305,084,448	$8,405,858
Virginia	24	$3,741	-$45	$67,424,295	$1,865,969
Massachusetts	25	$3,693	-$310	$47,978,701	-$5,401,395
Oklahoma	26	$3,671	$26	$149,859,677	$3,650,477
Wisconsin*	27	$3,577	$179	$175,264,100	$6,441,443
New Mexico*	28	$3,555	-$83	$27,280,800	$7,887,159
Texas	29	$3,479	$138	$787,147,078	$26,789,463
Kentucky	30	$3,469	-$186	$71,315,300	-$4,760,560
Illinois	31	$3,164	-$55	$238,037,465	-$5,370,795
Iowa *	32	$2,852	$153	$73,816,217	$1,918,051
Maine	33	$2,702	$385	$13,326,853	$1,537,288
Nevada	34	$2,383	-$36	$3,338,875	-$31,111
Colorado	35	$2,290	$111	$47,742,255	$5,167,319
Florida	36	$2,238	-$24	$381,108,517	-$12,888,986
Nebraska	37	$2,144	$860	$25,416,498	$12,004,510
Kansas*	38	$2,110	-$74	$17,441,983	-$1,146,658
Missouri	39	$2,009	-$77	$7,782,864	$116,596
South Carolina*	40	$1,817	$505	$49,838,273	$13,796,635
Arizona	41	$1,543	-$504	$12,306,790	-$1,028,159
Hawaii	No program	$0	$0	$0	$0
Idaho	No program	$0	$0	$0	$0
Indiana	No program	$0	$0	$0	$0
Mississippi*	No program	$0	$0	$0	$0
Montana	No program	$0	$0	$0	$0
New Hampshire	No program	$0	$0	$0	$0
North Dakota	No program	$0	$0	$0	$0
South Dakota	No program	$0	$0	$0	$0
Utah	No program	$0	$0	$0	$0
Wyoming	No program	$0	$0	$0	$0
United States		**$4,125**	**$61**	**$5,556,840,884**	**$116,352,953**

For details about how these figures were calculated, see the Methodology section and Roadmap to the State Profile Pages.

* In January, Mississippi became the first state in four years not funding pre-K statewide to create a new program. It spent $3 million to enroll 1,774 children, and met all 10 of NIEER's quality standard benchmarks. While not included in the rankings because the program did not operate for half the school year, it is a noteworthy addition.

TABLE 7: RANKINGS OF ALL REPORTED RESOURCES PER CHILD ENROLLED

Resources rank based on all reported spending	State	All reported $ per child enrolled in pre-K	Estimate of per-child spending needed to meet NIEER benchmarks†	Is the reported funding sufficient to meet NIEER benchmarks?	Additional per-child funding needed	Quality benchmark total
1	District of Columbia	$15,372	$11,214	Yes	$0	8
2	New Jersey	$12,157	$9,543	Yes	$0	8.8
3	Connecticut	$11,441	$8,763	Yes	$0	6
4	Rhode Island	$9,763	$9,015	Yes	$0	10
5	West Virginia	$8,799	$7,172	Yes	$0	9
6	Oregon	$8,471	$4,801	Yes	$0	9
7	Minnesota	$8,074	$4,561	Yes	$0	9
8	Oklahoma	$7,678	$7,041	Yes	$0	8
9	North Carolina	$7,351	$8,450	No	$1,100	10
10	Delaware	$7,295	$4,898	Yes	$0	8
11	Kentucky	$6,818	$4,302	Yes	$0	9
12	Washington	$6,658	$5,450	Yes	$0	9
13	Alabama	$6,507	$8,025	No	$1,518	10
14	Alaska	$6,137	$4,705	Yes	$0	10
15	Maine	$5,968	$4,080	Yes	$0	6
16	Tennessee	$5,895	$8,183	No	$2,289	9
17	Virginia	$5,893	$9,588	No	$3,695	6
18	Pennsylvania	$5,788	$6,249	Yes	$0	6.5
19	Michigan	$5,704	$6,568	No	$864	8
20	Wisconsin	$5,699	$4,488	Yes	$0	5.1
21	Arkansas	$5,544	$7,448	No	$1,905	9
22	California	$4,981	$6,726	No	$1,745	4
23	Louisiana	$4,667	$8,193	No	$3,527	8.0
24	Maryland	$4,500	$6,726	No	$2,226	8
25	Vermont	$4,273	$4,175	No	$98	4
26	Ohio	$4,000	$4,544	No	$544	4
27	Massachusetts	$3,958	$9,139	No	$5,182	6
28	New York	$3,820	$6,928	No	$3,108	7
29	Georgia	$3,746	$8,749	No	$5,003	8
30	Illinois	$3,674	$4,992	No	$1,317	8
31	Colorado	$3,579	$4,625	No	$1,046	6
32	New Mexico	$3,555	$4,434	No	$879	8
33	Texas	$3,533	$5,013	No	$1,479	2
34	Iowa	$3,241	$4,301	No	$1,060	6.9
35	Nevada	$3,157	$4,904	No	$1,746	7
36	Nebraska	$2,283	$4,083	No	$1,800	6
37	Florida	$2,238	$4,456	No	$2,217	3
38	Kansas	$2,110	$4,186	No	$2,076	6
39	Missouri	$2,009	$6,694	No	$4,685	7
40	South Carolina	$1,817	$5,428	No	$3,611	5.6
41	Arizona	$1,543	$4,546	No	$3,003	5
No program	Hawaii	$0	$4,641	No	$4,641	NA
No program	Idaho	$0	$3,998	No	$3,998	NA
No program	Indiana	$0	$4,206	No	$4,206	NA
No program	Mississippi	$0	$4,178	No	$4,178	NA
No program	Montana	$0	$3,890	No	$3,890	NA
No program	New Hampshire	$0	$4,547	No	$4,547	NA
No program	North Dakota	$0	$4,345	No	$4,345	NA
No program	South Dakota	$0	$3,826	No	$3,826	NA
No program	Utah	$0	$4,513	No	$4,513	NA
No program	Wyoming	$0	$4,372	No	$4,372	NA
	U.S.	**$4,679**	**$8,423**	**No**	**$3,744**	

† For each state, a school-day, program-day, or weighted estimate of per-child spending was used, based on the operating schedule of the state pre-K program and the percent of children served in each type of operating schedule. Estimates for no-program states are for part-day programs. State estimates were constructed from a national estimate adjusted for state cost of education differences. The national estimate was obtained from Gault, B., Mitchell, A., & Williams, E. (2008). *Meaningful Investments in Pre-K: Estimating the Per-Child Costs of Quality Programs.*Washington, DC: Institute for Women's Policy Research. The state cost index was obtained from: Taylor, L. (2014). *Extending the NCES CWI. The Bush School of Government and Public Service, Texas A&M University.*

* This state serves preschoolers in both school- and part-day programs and therefore a weighted estimate of per-child spending was calculated.

For details about how these figures were calculated, see the Methodology section and Roadmap to the State Profile Pages.

NIEER
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Press Release

73 Easton Avenue • New Brunswick, NJ 08901 • Phone 848.932.4350 • Fax 732.932.4360 • www.nieer.org

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CONTACT: Kirsty Clarke Brown

(732) 993-8051, kbrown@nieer.org

ALASKA PRE-K HAS HIGH QUALITY STANDARDS, UNCERTAIN FUTURE

Funding Prospects Look Bleak

Washington, D.C — State funded preschool education, hard hit by the Great Recession, has turned the corner and in many states is back on an expansion track according to the national survey of the states done annually by the nonpartisan National Institute for Early Education Research (NIEER) at Rutgers University. For the second year in a row, NIEER's data show that, nationally speaking, the states have increased funding for pre-K.

Adjusted for inflation, state funding for pre-K increased by nearly $120 million in 2013-2014 across all 50 states and Washington, DC. Enrollment growth also resumed, albeit modestly, with a total increase of 8,335 slots to reach its highest level recorded over the report's 12-year history. And program quality standards increased as an unprecedented seven states gained ground on NIEER's 10 benchmarks for quality standards.

The prospects for state funded preschool looked bright in 2009-2010 when Alaska launched its pilot program. That program met all 10 of NIEER's benchmarks for quality standards and has continued to do so since the program shifted from pilot status in 2011-2012. A scheduled endowment change and re-competition for state grants occurred in fiscal year 2013, and an increase of $800,000 in funding allowed for expansion to eight programs serving 345 children in the 2012-2013 school year.

However, this increase was removed in 2014. Although pre-K funding was slated for closure in 2014-2015, supporters were successful in obtaining grant extensions for two years. In March, the House shot down operating budget amendments that would have added funds back into the state funded pre-K program, which ranks 39th in access for 4-year-olds. "It is unfortunate that Alaska, after doing the hard work of establishing a high-quality program, appears ready to squander that effort, leaving the overwhelming majority of its youngest learners with no state-funded pre-K," said NIEER director Steve Barnett.

"Elsewhere, it is heartening to see state funded pre-K, once the fastest growing area in the entire education sector, back on the road to recovery," said Barnett, "but given that the states cut half a billion dollars in funding in 2011-2012 and a number of states have yet to address those cuts, much work remains to be done."

Joined at the press conference by U.S. Secretary of Education Arne Duncan, Barnett called on all levels of government to dedicate additional resources to preschool education in order to bridge the gap. "Unfortunately, the effects of the recession landed hardest on preschool-age children and our future prosperity depends on their future productivity," he said.

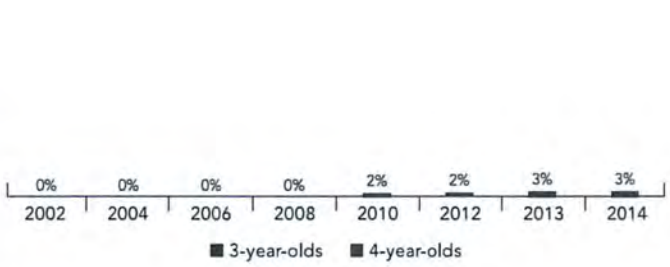
Barnett said that in addition to adequate funding, state pre-K should have adequate quality and serve all children under 200 percent of poverty. Bold leaders from both major parties are moving some cities and states dramatically ahead, but far too many states have yet to follow. As some cities move to provide preschool for all, most recently New York and Seattle, other areas of their states are left behind. At the same time, quality preschool is becoming a right for every child in some states; other states offer their children no pre-K at all.

*****

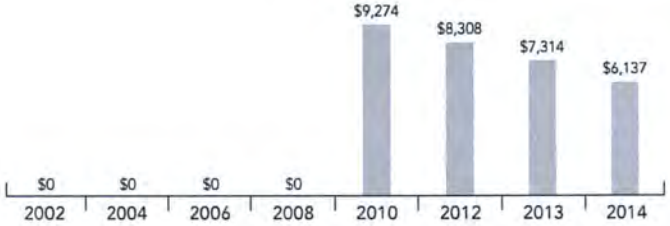
The National Institute for Early Education Research (www.nieer.org) at the Graduate School of Education, Rutgers University, New Brunswick, NJ, supports early childhood education policy and practice through independent, objective research.

Alaska

PERCENT OF STATE POPULATION ENROLLED*



STATE SPENDING PER CHILD ENROLLED*
(2014 DOLLARS)



Four-year-olds in Alaska have the Alaska Pilot-Kindergarten Project (AP3) available in six school districts through competitive grants since the 2009-2010 school year. A majority of programs operate in combined public school and Head Start programs. Grantees offer half-day programs as well as outreach to families preferring in-home care for preschoolers. Funding is granted to public schools that may in turn subcontract with faith-based settings, family child care centers, Head Start programs, and private child care centers.

The federal Head Start guidelines share similarities with Alaska's pre-K program eligibility requirements with eligibility based on family income at, or below, 100 percent of the federal poverty level. However, if space is available, programs can take a maximum of 35 percent of children from families between 100 and 130 percent FPL.

Renamed the Alaska Prekindergarten Program, the pre-K program shifted from pilot status in the 2011-2012 school year, to a scheduled endowment change and re-competition for state grants in fiscal year 2013. The state pre-K program had a total budget of $2.5 million and served children in eight districts for the 2012-2013 school year. There was an $800,000 drop in funding in 2013-2014, so fewer children were served this year. Although pre-K funding was slated for closure in 2014-2015, supporters were successful in providing grant extensions for 2 full years.

The Teaching Strategies Gold assessment was piloted by the state three times per year in two-thirds of the programs during the 2011-2012 school year. The state required its use for all grantees in the new competition. An evaluation of the AP3 program was completed in the 2010-2011 school year, determining process quality as well as program impact and child results based on pre- and post-assessments using the DIAL II, PPVT, and ECERS instruments.

Alaska has offered a supplement to federally recognized Head Start programs since the 1980s. The financial support is part of an effort to develop program quality through school readiness activities and professional improvement. The funds also offer admission to additional children and families whenever possible.

ACCESS RANKINGS	
4-YEAR-OLDS	3-YEAR-OLDS
39	None Served

RESOURCES RANKINGS	
STATE SPENDING	ALL REPORTED SPENDING
9	14

ALASKA PREKINDERGARTEN PROGRAM

ACCESS

Total state program enrollment	291
School districts that offer state program	15%
Income requirement	130% FPL[1]
Hours of operation	3 to 5 hours/day, 4 or 5 days/week[2]
Operating schedule	Academic year
Special education enrollment, ages 3 and 4	1,132
Federally funded Head Start enrollment, ages 3 and 4	2,437
State-funded Head Start enrollment, ages 3 and 4	0

STATE PRE-K AND HEAD START ENROLLMENT AS PERCENTAGE OF TOTAL POPULATION

† Some Head Start children may also be counted in state pre-K.
†† Estimates children in special education not also enrolled in state pre-K or Head Start.

QUALITY STANDARDS CHECKLIST

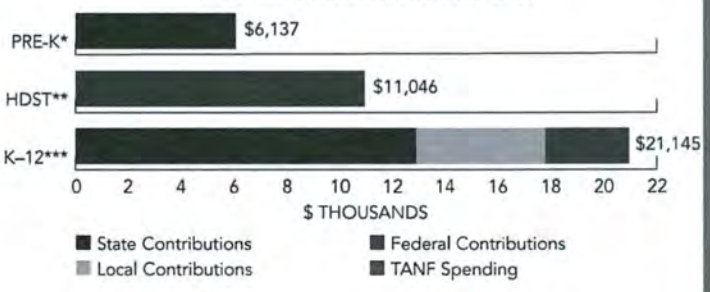
POLICY	STATE PRE-K REQUIREMENT	BENCHMARK	DOES REQUIREMENT MEET BENCHMARK?
Early learning standards	Comprehensive	Comprehensive	☑
Teacher degree	BA[3]	BA	☑
Teacher specialized training	ECE endorsement (P–3)	Specializing in pre-K	☑
Assistant teacher degree	CDA[3]	CDA or equivalent	☑
Teacher in-service	6 credit hours/5 year	At least 15 hours/year	☑
Maximum class size		20 or lower	☑
3-year-olds	NA		
4-year-olds	20		
Staff-child ratio		1:10 or better	☑
3-year-olds	NA		
4-year-olds	1:10		
Screening/referral and support services	Vision; hearing; immunizations; psychological/ behavioral; developmental; and support services[4]	Vision, hearing, health; and at least 1 support service	☑
Meals	Breakfast or lunch and one snack	At least 1/day	☑
Monitoring	Site visits and other monitoring	Site visits	☑

TOTAL BENCHMARKS MET: 10

RESOURCES

Total state pre-K spending	$1,786,000
Local match required?	No
State Head Start spending	$[5]
State spending per child enrolled	$6,137
All reported spending per child enrolled*	$6,137

SPENDING PER CHILD ENROLLED



* Pre-K programs may receive additional funds from federal or local sources that are not included in this figure.

** Head Start per-child spending for the 2013-2014 year includes funding only for 3- and 4-year-olds served. Past years figured have unintentionally included funds for Early Head Start.

*** K–12 expenditures include capital spending as well as current operating expenditures.

Data are for the '13-'14 school year, unless otherwise noted.

[1] Mirroring federal Head Start guidelines, up to 35 percent of enrollment may be children whose family incomes are between 100 and 130 percent FPL after priority is given to children at or below 100 percent FPL. In addition, some communities may meet poverty of access criteria per federal Head Start regulations.

[2] All programs are part day and must operate for at least 3 hours per day, but cannot operate for more than 5 hours per day. Programs operate for 4 or 5 days per week, for a minimum of 14 hours per week, though the actual schedule is determined locally. Programs may partner with child care or other services to provide wraparound care.

[3] Teachers must be state certified with a BA in ECE or a related field or specialized training in a related field, and assistant teachers must have a current CDA,12 ECE credits, or an AA in ECE or with specialized training in early education or a related field.

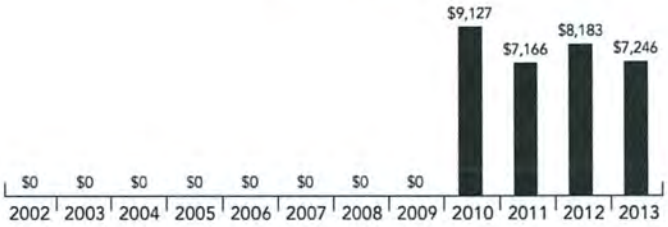
[4] All programs follow state pre-elementary statute and regulations. School districts partnering with Head Start programs must follow federal Head Start requirements. Support services include parenting support or training, health services for children, and nutrition information.

[5] Alaska's state Head Start funds are used to enhance Head Start services and improve quality. About 63 percent of the programs are jointly operated by public schools and Head Start.

Alaska

PERCENT OF STATE POPULATION ENROLLED

STATE SPENDING PER CHILD ENROLLED
(2013 DOLLARS)



Since 2009-2010, six school districts in Alaska have offered the Alaska Pilot-Kindergarten Project (AP3) for 4-year-olds. Programs were funded through competitive grants. A majority of programs operate in combined public school and Head Start programs. Grantees offer half-day programs, as well as outreach to families preferring in-home care for preschoolers. Funded public schools may subcontract with faith-based settings, family child care centers, Head Start programs, and private child care centers.

The federal Head Start guidelines are similar to Alaska's pre-K program eligibility requirements, with eligibility based on family income at or below 100 percent of the federal poverty level. If space is available, programs can take a maximum of 35 percent of children from families between 100 and 130 percent FPL.

Renamed the Alaska Pre-Kindergarten Program, the pre-K program shifted from pilot status in the 2011-2012 school year, to a scheduled endowment change and re-competition for state grants in fiscal year 2013. The state pre-K program has a total budget of $2.5 million and serves children in eight districts for the 2012-2013 school year. An increase of $800,000 allowed for expansion to eight programs serving 345 in the 2012-2013 school year, this increase was removed as of FY 14. At this time, the future of program funding beyond the end of fiscal year 2014 is undecided.

Teaching Strategies Gold assessment was piloted as an assessment by the state three times per year, in two-thirds of the programs, during the 2011-2012 school year. It will be required for all grantees in the next competition. CLASS was also piloted in some classrooms in 2012-2013, and will be used in all classrooms next year. Alaska is currently in the process of having an independent alignment of the Early Learning Guidelines and the new state standards.

An evaluation of the AP3 program was completed in the 2010-2011 school year, examining process quality as well as program impact and child results, based on pre- and post-assessments using the DIAL II, PPVT, and ECERS instruments.

Alaska has offered a supplement to federally recognized Head Start programs since the 1980s. The financial support is part of an effort to develop program quality through school readiness activities and professional improvement. The funds also allow access to additional children whenever possible.

ACCESS RANKINGS	
4-YEAR-OLDS	3-YEAR-OLDS
37	None Served

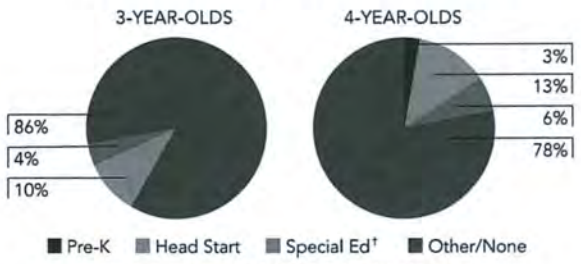
RESOURCES RANKINGS	
STATE SPENDING	ALL REPORTED SPENDING
7	10

ALASKA PILOT PREKINDERGARTEN PROGRAM

ACCESS

Total state program enrollment	345
School districts that offer state program	15%
Income requirement	130% FPL[1]
Hours of operation	3 to 4 hours/day, 5 days/week[2]
Operating schedule	Academic year
Special education enrollment, ages 3 and 4	1,207
Federally funded Head Start enrollment, ages 3 and 4	2,406
State-funded Head Start enrollment, ages 3 and 4	0

STATE PRE-K AND HEAD START ENROLLMENT AS PERCENTAGE OF TOTAL POPULATION



† This is an estimate of children in special education who are not enrolled in state-funded pre-K or Head Start.

QUALITY STANDARDS CHECKLIST

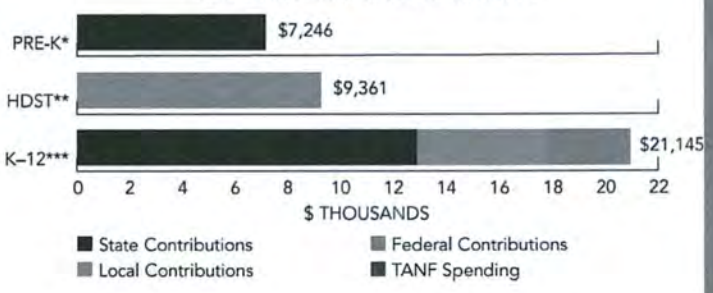
POLICY	STATE PRE-K REQUIREMENT	BENCHMARK	DOES REQUIREMENT MEET BENCHMARK?
Early learning standards	Comprehensive	Comprehensive	☑
Teacher degree	BA[3]	BA	☑
Teacher specialized training	ECE endorsement	Specializing in pre-K	☑
Assistant teacher degree	CDA[3]	CDA or equivalent	☑
Teacher in-service	6 credit hours/5 years	At least 15 hours/year	☑
Maximum class size		20 or lower	☑
3-year-olds	NA		
4-year-olds	20		
Staff-child ratio		1:10 or better	☑
3-year-olds	NA		
4-year-olds	1:10		
Screening/referral and support services	Vision, hearing, health, psychological/ behavioral, developmental;and support services[4]	Vision, hearing, health; and at least 1 support service	☑
Meals	Breakfast or lunch and one snack	At least 1/day	☑
Monitoring	Site visits and other monitoring	Site visits	☑

TOTAL BENCHMARKS MET: 10

RESOURCES

Total state pre-K spending	$2,500,000
Local match required?	No
State Head Start spending	$7,299,200[5]
State spending per child enrolled	$7,246
All reported spending per child enrolled*	$7,246

SPENDING PER CHILD ENROLLED



* Pre-K programs may receive additional funds from federal or local sources that are not included in this figure.

** Head Start per-child spending for the 2012-2013 year includes funding only for 3- and 4-year-olds served. Past years figured have unintentionally included funds for Early Head Start.

*** K–12 expenditures include capital spending as well as current operating expenditures.

Data are for the '12-'13 school year, unless otherwise noted.

[1] Mirroring federal Head Start guidelines, up to 35 percent of enrollment may be children whose family incomes are between 100 and 130 percent FPL after priority is given to children at or below 100 percent FPL. In addition, some communities may meet poverty of access criteria per federal Head Start regulations.

[2] All programs are part day and must operate for at least 3 hours per day, but cannot operate for more than 5 hours per day. Programs operate for 4 or 5 days per week, for a minimum of 14 hours per week, though the actual schedule is determined locally. Programs may partner with child care or other services to provide wrap-around care.

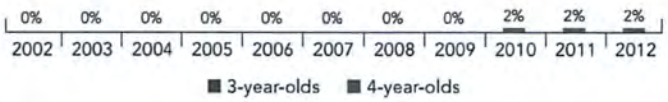
[3] Teachers must be state certified with a BA in ECE or a related field or specialized training in a related field, and assistant teachers must have a current CDA,12 ECE credits, or an AA in ECE or with specialized training in early education or a related field.

[4] All programs follow state pre-elementary statute and regulations. School districts partnering with Head Start programs must follow federal Head Start requirements. Support services include parenting support or training, health services for children, and nutrition information.

[5] Alaska's state Head Start funds are used to enhance Head Start services and improve quality. About 63 percent of the programs are jointly operated by public schools and Head Start.

Alaska

PERCENT OF STATE POPULATION ENROLLED



■ 3-year-olds ■ 4-year-olds

STATE SPENDING PER CHILD ENROLLED (2012 DOLLARS)

Since the 2009-2010 school year, the Alaska Pilot Pre-Kindergarten Project (AP3) has been available to 4-year-olds in six school districts through competitive grants. Half-day programs are provided by grantees, as well as outreach to those families choosing in-home care for preschoolers. Funding is awarded to public schools that may in turn subcontract with faith-based settings, family child care centers, Head Start programs, and private child care centers. A majority of programs operate in blended public school and Head Start programs.

Alaska's pre-K program eligibility requirements share similarities with the federal Head Start guidelines with eligibility based on family income at or below 100 percent of the federal poverty level. However, if space allows, programs can take a maximum of 35 percent of children from families between 100 and 130 percent FPL.

Renamed the Alaska Pre-Kindergarten Program, the pre-K program transitioned from pilot status in the 2011-2012 school year with a scheduled funding change and re-competition for state grants in fiscal year 2013. For the 2012-2013 school year, the state pre-K program has a total budget of $2.5 million and serves children in eight districts.

During the 2011-2012 school year, the Teaching Strategies Gold assessment was piloted by the state three times per year in two-thirds of the programs. The state plans to require its use for all grantees in the new competition. An evaluation of the AP3 program was completed in the 2010-2011 school year, measuring process quality as well as program impact and child outcomes based on pre- and post-assessments using the DIAL II, PPVT, and ECERS instruments.

Since the 1980s, Alaska has offered a supplement to federally recognized Head Start programs. The funding is part of an effort to improve program quality through school readiness activities and professional development. The funds also provide access to additional children and families whenever possible. State funding through Alaska's Head Start supplement totaled $7.2 million in the 2011-2012 school year.

ACCESS RANKINGS	
4-YEAR-OLDS	3-YEAR-OLDS
38	None Served

RESOURCES RANKINGS	
STATE SPENDING	ALL REPORTED SPENDING
4	8

ALASKA PRE-KINDERGARTEN PROGRAM

ACCESS

Total state program enrollment	211
School districts that offer state program	11%
Income requirement	100% FPL[1]
Hours of operation	3 to 5 hours/day, 4 or 5 days/week[2]
Operating schedule	Academic year
Special education enrollment	1,199
Federal Head Start enrollment, ages 3 & 4	2,459
State-funded Head Start enrollment	0

STATE PRE-K AND HEAD START ENROLLMENT AS PERCENTAGE OF TOTAL POPULATION

† This is an estimate of children in special education who are not enrolled in state-funded pre-K or Head Start.

QUALITY STANDARDS CHECKLIST

POLICY	STATE PRE-K REQUIREMENT	BENCHMARK	DOES REQUIREMENT MEET BENCHMARK?
Early learning standards	Comprehensive	Comprehensive	☑
Teacher degree	BA[3]	BA	☑
Teacher specialized training	ECE endorsement[3]	Specializing in pre-K	☑
Assistant teacher degree	AA[3]	CDA or equivalent	☑
Teacher in-service	6 credit hours/5 years	At least 15 hours/year	☑
Maximum class size		20 or lower	☑
3-year-olds	NA		
4-year-olds	20		
Staff-child ratio		1:10 or better	☑
3-year-olds	NA		
4-year-olds	1:10		
Screening/referral and support services	Vision, hearing, health, developmental; and support services[4]	Vision, hearing, health; and at least 1 support service	☑
Meals	Breakfast or lunch and one snack	At least 1/day	☑
Monitoring	Site visits and other monitoring	Site visits	☑

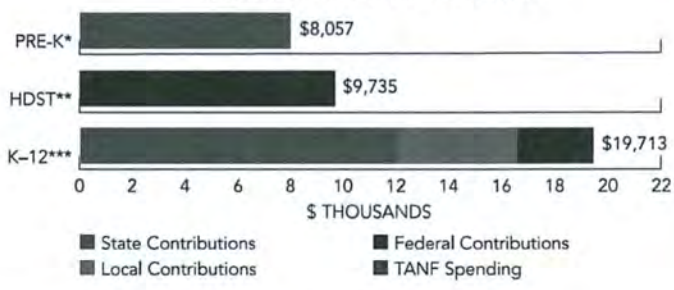
TOTAL BENCHMARKS MET

10

RESOURCES

Total state pre-K spending	$1,700,000
Local match required?	No
State Head Start spending	$7,299,200[5]
State spending per child enrolled	$8,057
All reported spending per child enrolled*	$8,057

SPENDING PER CHILD ENROLLED



* Pre-K programs may receive additional funds from federal or local sources that are not included in this figure.

** Head Start per-child spending for the 2011-2012 year includes funding only for 3- and 4-year-olds served. Past years' figures have unintentionally included funds for Early Head Start.

*** K–12 expenditures include capital spending as well as current operating expenditures.

Data are for the '11-'12 school year, unless otherwise noted.

[1] Mirroring federal Head Start guidelines, up to 35 percent of enrollment may be children whose family incomes are between 100 and 130 percent FPL after priority is given to children at or below 100 percent FPL.

[2] All programs are part day and must operate for at least 3 hours per day, but cannot operate for more than 5 hours per day. Programs operate for 4 or 5 days per week, for a minimum of 14 hours per week, though the actual schedule is determined locally.

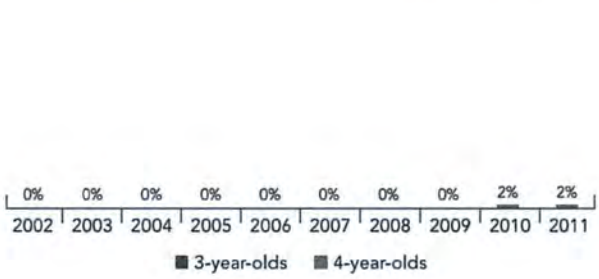
[3] Teachers must be state certified with a BA in ECE or a related field or specialized training in a related field, and assistant teachers must have an AA in ECE or a related field.

[4] All programs follow state pre-elementary statute and regulations. School districts partnering with Head Start programs must follow federal Head Start requirements. Support services include parenting support or training, health services for children, and nutrition information.

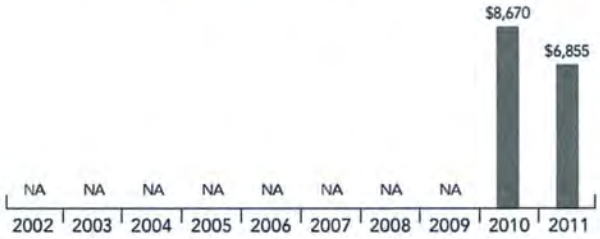
[5] Alaska's state Head Start funds are used to enhance Head Start services and improve quality.

Alaska

PERCENT OF STATE POPULATION ENROLLED



STATE SPENDING PER CHILD ENROLLED (2011 DOLLARS)



The Alaska Pilot Pre-Kindergarten Project (AP3) started in the 2009-2010 school year. The program serves 4-year-old children in six school districts through competitive grants. Grantees operate half-day preschool programs and also provide outreach to families who choose to provide in-home care for preschoolers. While funding is awarded to public schools, grantees can subcontract with Head Start, private child care, family child care, and faith-based settings. Most programs operate in blended Head Start and public school programs.

Program eligibility requirements are similar to the federal Head Start guidelines. Eligible children are from families with incomes at or below 100 percent of the federal poverty levels, though, if space allows, programs may take a maximum of 35 percent of children from families between 100 and 130 percent of the federal poverty level. The AP3 program meets all 10 of NIEER's quality standards benchmarks, which include high-quality standards for teacher credentials, staff-child ratios, and class sizes.

In the 2011-2012 school year, the pre-K program is transitioning from pilot status with a scheduled funding change and re-competition for state grants in fiscal year 2013. The state is piloting use of the Teaching Strategies Gold assessment three times per year in two-thirds of the programs in the 2011-2012 school year and plans to require its use for all grantees in the new competition.

Alaska has offered a supplement to federally recognized Head Start programs since the 1980s. The goal of this funding is to improve program quality through professional development and school readiness activities. These funds also provide access to additional children and families whenever possible. In the 2010-2011 school year, state funding through Alaska's Head Start supplement totaled $7.2 million.

ACCESS RANKINGS	
4-YEAR-OLDS	3-YEAR-OLDS
37	None Served

RESOURCES RANKINGS	
STATE SPENDING	ALL REPORTED SPENDING
5	11

ALASKA PILOT PREKINDERGARTEN PROGRAM

ACCESS

Total state program enrollment	248
School districts that offer state program	11%
Income requirement	100% FPL[1]
Hours of operation	3 to 5 hours/day, 4 or 5 days/week[2]
Operating schedule	Academic year
Special education enrollment	1,220
Federally funded Head Start enrollment	2,442
State-funded Head Start enrollment	0

STATE PRE-K AND HEAD START ENROLLMENT AS PERCENTAGE OF TOTAL POPULATION

† This is an estimate of children in special education who are not enrolled in state-funded pre-K or Head Start.

QUALITY STANDARDS CHECKLIST

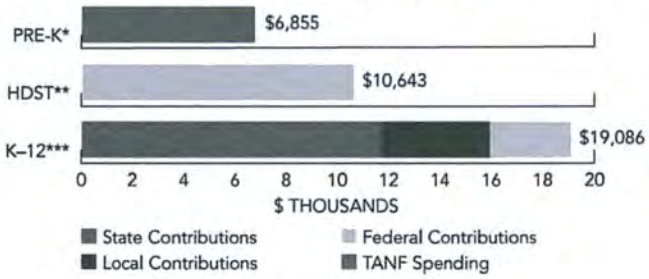
POLICY	STATE PRE-K REQUIREMENT	BENCHMARK	DOES REQUIREMENT MEET BENCHMARK?
Early learning standards	Comprehensive	Comprehensive	☑
Teacher degree	BA[3]	BA	☑
Teacher specialized training	ECE endorsement[3]	Specializing in pre-K	☑
Assistant teacher degree	AA[3]	CDA or equivalent	☑
Teacher in-service	6 credit hours/5 years	At least 15 hours/year	☑
Maximum class size		20 or lower	☑
3-year-olds	NA		
4-year-olds	20		
Staff-child ratio		1:10 or better	☑
3-year-olds	NA		
4-year-olds	1:10		
Screening/referral and support services	Vision, hearing, health, developmental; and support services[4]	Vision, hearing, health; and at least 1 support service	☑
Meals	Breakfast or lunch and one snack	At least 1/day	☑
Monitoring	Site visits and other monitoring	Site visits	☑

TOTAL BENCHMARKS MET: 10

RESOURCES

Total state pre-K spending	$1,700,000
Local match required?	No
State Head Start spending	$7,292,600[5]
State spending per child enrolled	$6,855
All reported spending per child enrolled*	$6,855

SPENDING PER CHILD ENROLLED



* Pre-K programs may receive additional funds from federal or local sources that are not included in this figure.

** Head Start per-child spending for the 2010-2011 year includes funding from the American Recovery and Reinvestment Act (ARRA).

*** K–12 expenditures include capital spending as well as current operating expenditures.

Data are for the '10-'11 school year, unless otherwise noted.

[1] Mirroring federal Head Start guidelines, up to 35 percent of enrollment may be children whose family incomes are between 100 and 130 percent FPL after priority is given to children at or below 100 percent FPL.

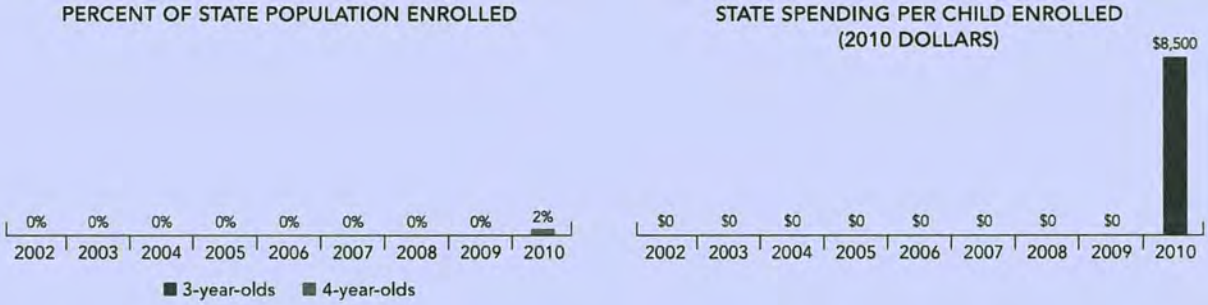
[2] All programs are part-day and must operate for at least 3 hours per day, but cannot operate for more than 5 hours per day. Programs operate for 4 or 5 days per week, for a minimum of 14 hours per week, though the actual schedule is determined locally.

[3] Teachers must be state certified with a BA in ECE or a related field or specialized training in a related field, and assistant teachers must have an AA in ECE or a related field.

[4] All programs follow state pre-elementary statutes and regulations. School districts with Head Start programs must follow federal Head Start regulations. Support services include parenting support or training, health services for children, and nutrition information.

[5] Alaska's state Head Start funds are used to enhance Head Start services and improve quality.

Alaska



Starting in the 2009-2010 school year, the state began a pilot preschool program. The Alaska Pilot Pre-Kindergarten Project (AP3) is a school-year program serving 4-year-old children through competitive grants awarded to six school districts. The grant recipients operate half-day preschool programs and provide outreach to families choosing to provide in-home care for preschoolers. Funding is awarded to public schools and then they can subcontract with Head Start, private child care, family child care, and faith-based settings to provide services. The majority of the programs operate in blended public school and Head Start programs. Eligibility requirements mirror federal Head Start guidelines. Children are eligible from families at or below 100 percent of the federal poverty level, although programs may take up to 35 percent of children from 100 to 130 percent of the federal poverty level if space is available. AP3 provides for comprehensive services with high-quality standards for teacher education, class sizes, and staff-child ratios. Using data from the 2009-2010 school year, which was the first year of operation, the program will be evaluated for both process quality and program impact/child outcomes.

Since the 1980s, Alaska has offered a supplement to any federally recognized Head Start program operating in the state. These funds are intended to improve the program's quality through school readiness activities and professional development as well as to provide access to additional children and families whenever possible. During the 2009-2010 school year, state funding through Alaska's Head Start supplement totaled more than $7.2 million and served approximately 50 children and families in Early Head Start and Head Start settings.

ACCESS RANKINGS	
4-YEAR-OLDS	3-YEAR-OLDS
38	None Served

RESOURCES RANKINGS	
STATE SPENDING	ALL REPORTED SPENDING
3	6

ALASKA PILOT PREKINDERGARTEN PROGRAM

ACCESS

Total state program enrollment	200
School districts that offer state program	11%
Income requirement	100% FPL
Hours of operation	3 to 5 hours/day, 4 or 5 days/week[1]
Operating schedule	Academic year
Special education enrollment	1,097
Federally funded Head Start enrollment	2,205
State-funded Head Start enrollment	53[2]

STATE PRE-K AND HEAD START ENROLLMENT AS PERCENTAGE OF TOTAL POPULATION

† This is an estimate of children in special education who are not enrolled in state-funded pre-K or Head Start.

QUALITY STANDARDS CHECKLIST

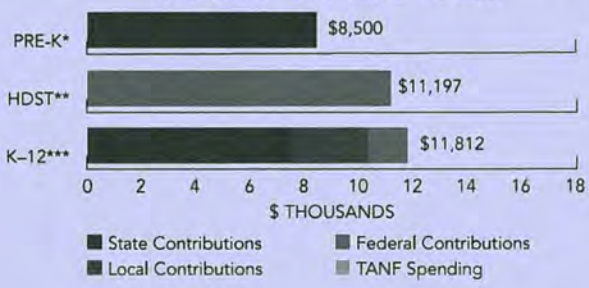
POLICY	STATE PRE-K REQUIREMENT	BENCHMARK	DOES REQUIREMENT MEET BENCHMARK?
Early learning standards	Comprehensive	Comprehensive	☑
Teacher degree	BA[3]	BA	☑
Teacher specialized training	ECE endorsement[3]	Specializing in pre-K	☑
Assistant teacher degree	AA[4]	CDA or equivalent	☑
Teacher in-service	6 credit hours/5 years	At least 15 hours/year	☑
Maximum class size		20 or lower	☑
3-year-olds	NA		
4-year-olds	20		
Staff-child ratio		1:10 or better	☑
3-year-olds	NA		
4-year-olds	1:10		
Screening/referral and support services	Vision, hearing, health, developmental; and support services[5]	Vision, hearing, health; and at least 1 support service	☑
Meals	Breakfast or lunch and one snack	At least 1/day	☑
Monitoring	Site visits and other monitoring	Site visits	☑

TOTAL BENCHMARKS MET: 10

RESOURCES

Total state pre-K spending	$1,700,000
Local match required?	No
State Head Start spending	$7,292,600
State spending per child enrolled	$8,500
All reported spending per child enrolled*	$8,500

SPENDING PER CHILD ENROLLED



* Pre-K programs may receive additional funds from federal or local sources that are not included in this figure.

** Head Start per-child spending for the 2009-2010 year includes funding from the American Recovery and Reinvestment Act (ARRA).

*** K–12 expenditures include capital spending as well as current operating expenditures.

Data are for the '09-'10 school year, unless otherwise noted.

[1] All programs are part day and must operate for at least 3 hours per day, but cannot operate for more than 5 hours per day. Programs operate for 4 or 5 days per week, for a minimum of 14 hours per week, though the actual schedule is determined locally.

[2] Alaska was not able to break its state-funded Head Start enrollment down by single year of age. As a result, this figure is an estimate based on the percentage of federal Head Start enrollees in Alaska who were 3 or 4 years old.

[3] Teachers must be state certified with a BA in ECE or a related field or specialized training in a related field.

[4] Assistant teachers must have an AA in ECE or a similar related field.

[5] All programs follow state pre-elementary statutes and regulations. School districts with Head Start programs must follow federal Head Start regulations. Support services include parenting support or training, health services for children, and nutrition information.

Economic Impact of

Early Care & Learning Services in Alaska

2011 Update

An update of a McDowell Group report prepared for the System for Early Education Development (SEED)

Alaska SEED

The trillium flower,

with its three petals, best represents the varied relationships between early childhood services and the economy. One petal represents parents and the need to focus on the social infrastructure supporting workers and their employers. Another petal represents children and the investments in human development and education, while the third petal is the regional economy that quantifies child care as an industry that produces jobs and stimulates the economy. (R. Ribeiro and M. Warner, January, 2004, "Measuring the Regional Economic Importance of Early Care and Education: The Cornell Methodology Guide")

Although education and the acquisition of skills is a lifelong process, starting early in life is crucial. Recent research has documented the high returns that early childhood programs can pay in terms of subsequent educational attainment and in lower rates of social problems, such as teenage pregnancy and welfare dependency. This research shows that by investing in early childhood education, governments—in partnership with private firms and nonprofit foundations—can reap extraordinarily high economic returns, benefits that are low-risk and long-lived.

Ben Bernanke, Chairman
of the Federal Reserve,
February 2007

The purpose of this report is to measure the economic impacts of early care and learning services on Alaska's economy, providing updated and new data where available. Economic impacts are measured in terms of:

- Employment of the early care and learning sector
- Income generated by wage-earning parents due to the availability of early care and learning services
- Spending on these services by both families and government
- Long-term economic benefit of quality early care and learning

This report also includes important results of a telephone survey conducted as part of the original study in 2006 and still considered reliable and relevant in 2010. This includes:

- Attitudes on the importance of state funding for early care and learning services
- Availability of high-quality, affordable early care and learning services

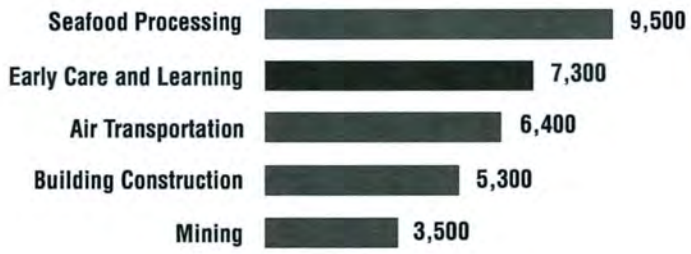
What We Know about the Early Care and Learning Workforce

Size and Distribution of Sector

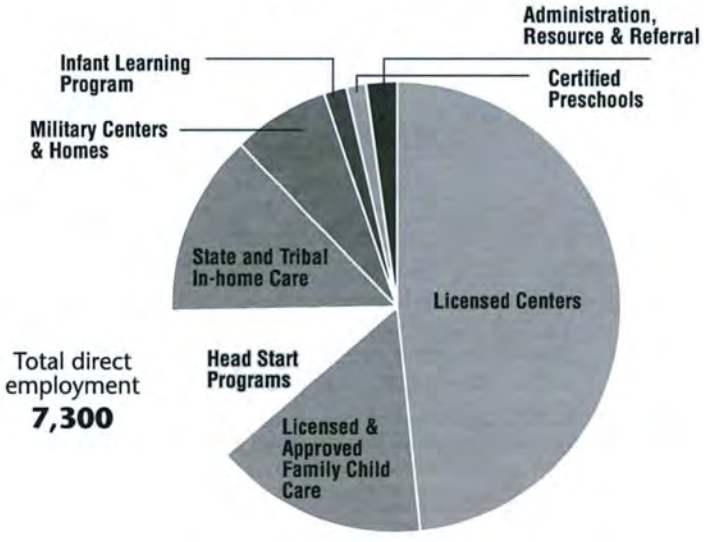
Alaska's early care and learning direct workforce currently numbers 7,300 compared to 6,500 estimated in 2005. This includes individuals working at child care centers, family child care, Head Start, private and public preschool and pre-kindergarten, infant learning programs and other early childhood settings. Counting indirect employment, the total increases to 8,400, compared to 7,400 reported for 2005.

The estimate of 7,300 workforce participants is derived from a variety of sources and is considered a conservative estimate. For instance, it does not include an unknown number of at-home providers who care for four or fewer unrelated children or at-home providers caring for any number of related children. No license is required for these categories of providers.

Number of Employees by Workforce Sector



The Early Care and Learning Sector



	2005	2009	% increase
Early Care and Learning Jobs (Direct and Indirect)	7,400	8,400	14%
Early Care and Learning Total Wages (Direct and Indirect)	$124 million	$150 million	21%

Sector Wages

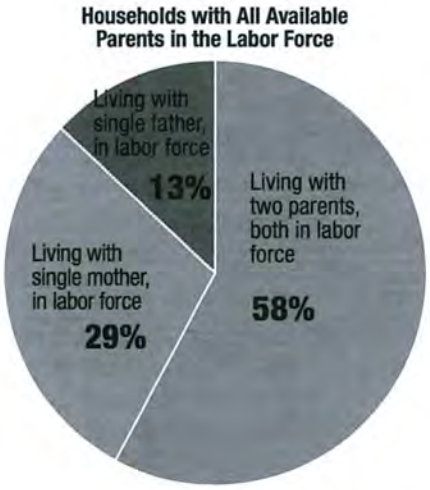
Despite the responsibility of individuals employed in the early care and learning sector, compensation is very low. Department of Labor and Economic Development (DOLWD, 2009) payroll data indicates the average monthly wage of an individual employed in this sector was $1,494. The average monthly wage overall in Alaska for this same time period was $3,886, over 2.5 times what someone employed in early care and learning earns.

To put this in further context, the average salary of a private sector child care worker or preschool teacher is less than half the average salary of a kindergarten teacher. The early care and learning field lacks a compensation structure to reward increased credentials and professional development. As a result, even when private sector child care workers and preschool teachers have the same credentials, their compensation remains low compared to pre-K and kindergarten teachers in the public school system.

Child care workers earn wages equivalent to some of the lowest-paying jobs in the economy.

What We Know about Working Families

Simply put, the availability of affordable, high-quality early care and learning services allows parents to remain in the workforce, if they need or elect to do so. In 2009, there were 69,199 children under six years of age in Alaska (DOLWD). Of these children, 62% (43,000) lived in households where all available parents were in the labor force, whether families were dual-income or single-parent.



Early care and learning services make it possible for 32,300 Alaskans to participate in the labor force (one adult for each household with children under six years of age where all parents are in the labor force). This accounts for 10% of the Alaska resident workforce. Assuming these working parents also account for 10% of all Alaska resident wages, their total annual wages are just over $1.1 billion. This indicates an average of $35,300 per family in additional Alaska annual income.

	2005	2009	% increase
Alaskans in workforce due to availability of child care	29,400	32,300	10%
Contribution to household income	$850 million	$1.1 billion	29%

What this Means for Alaska

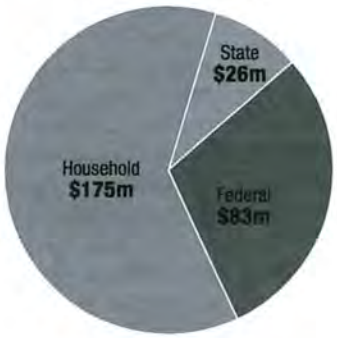
Mounting evidence shows that the availability of quality early care and learning is critical to building and maintaining a viable state economy. The economic impact of the early care and learning sector includes jobs for thousands of Alaskans, millions of dollars in spending by household and governments, and indirect contributions.

- **7,300 directly employed** in early care and learning workforce
- **$150 million** generated in direct and indirect early care and learning **workforce payroll**
- **32,300 Alaskans in the labor force** as a result of availability of early care and learning services
- Adding **$1.1 billion to earned wages** (average of $35,300 per family based on statewide averages)

What We Know about Spending on Early Care and Learning Services by Families and Government

There are two sources of spending on early care and learning services — the money individual families pay for these services and the money spent by federal and state government. Households in Alaska spend an estimated $175 million annually on early care and learning services for children under six years of age. Government spends $109 million with $83 million of that contribution coming from federal funding and $26 million from state funding.

Child Care Funding



According to the 2010 report, "Parents and the High Cost of Child Care" released by the National Association of Child Care Resource and Referral Agencies (NACCRRA), since 2000, the cost of child care has increased twice as fast as the median income of families. The updated 2010 report provides interesting data about the cost of child care services by state. The report also compares child care costs with the cost of attending state higher education institutions.

Cost of Care in Alaska

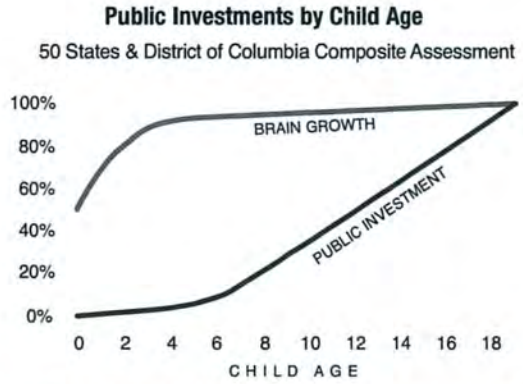
Average annual cost for infant 2009	Average annual cost for 4-year-old in 2009	Average tuition and fees at state university
$8,904	$8,268	$4,920

What We Know about Long-term Economic Benefits of Quality Early Care and Learning

Economists from various academic, business and government organizations have applied new economic models to early care and education and generated dollar figures for what investments in early childhood services can yield for the economy in the short- and long-term. There are now several long-term studies that have followed graduates of early learning programs through adulthood and documented significant savings in the area of remedial education, school drop-outs, welfare, and crime. The studies conclude that improvements to social and emotional well-being yield greater returns than a focus exclusively on cognitive gains. (Dana E. Friedman, Ed.D. for the Early Childhood Funders' Collaborative, "The New Economics of Preschool, 2004.")

Benefits of high quality early care and learning opportunities include:

- Increased earning capacity due to higher educational attainment
- Increased tax revenues as a result of higher paying jobs
- Reduced criminal justice system costs
- Reduced welfare costs
- Reduced spending for remedial services in schools



While 85% of the brain's core structure (size, growth, and much of its hard wiring) is developed by age four, less than 4% of public investments in education and development are made by that time. The implication is the earlier the investment on early education, the higher the return on investment will be.

Source: "Early Learning Left Out: Building an Early Learning Childhood System to Secure America's Future," Voices for America's Children, June 2010.

What Alaskans Think about State Funding for Early Care and Learning

In 2006, McDowell Group conducted a telephone survey about support of state funding for early care and learning services in Alaska. The results showed that Alaskans place a priority on funding for these services:

- 87% of households think it is important or very important for state government to provide financial support for early care and learning services.
- The number increases to 94% for households with children under six years of age.
- Urban and rural residents alike support funding for early care and learning.

What Alaskans Say about the Impact on Families

The 2006 survey indicated how the early care and learning sector directly impacts households with a child under the age of six:

- 45% found it difficult or very difficult to find acceptable child care.
- 36% reported that the quality, cost or availability of child care prevented someone in their household from seeking employment or had restricted the number of hours they could work.
- 50% reported that cost had the greatest impact on their ability to find acceptable child care.

McDowell GROUP

This report is an update of the 2006 McDowell Group, "Economic Impact of Early Education and Child Care Services in Alaska." Funding for this report was provided by:

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- Alaska Association for the Education of Young Children
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- Head Start Collaboration Office, Dept. of Education and Early Development
- King Career Center, Early Childhood Education
- Municipality of Anchorage, Child and Adult Care Licensing
- Prentice Consulting

In Conclusion

There are many reasons to invest in early care and learning programs for young children. The focus of this report is on the short and long term economic benefits of doing so. Nobel Laureate James Heckman states:

> *Early environments play a large role in shaping later outcomes. Skill begets skill and learning begets more learning.* ***Early advantages cumulate; so do early disadvantages.*** *Later remediation of early deficits is costly, and often prohibitively so, though later investments are also necessary since investments across time are complementary. Evidence on the technology of skill formation shows the importance of early investment. At current levels of public support,* ***America under-invests in the early years of its disadvantaged children. Redirecting additional funds toward the early years, before the start of traditional schooling, is a sound investment in the productivity and safety of our society.***
>
> *"The Productivity Argument for Investing in Young Children," 2006*

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Impacts of a Prekindergarten Program on Children's Mathematics, Language, Literacy, Executive Function, and Emotional Skills

Christina Weiland and Hirokazu Yoshikawa
Harvard Graduate School of Education

Publicly funded prekindergarten programs have achieved small-to-large impacts on children's cognitive outcomes. The current study examined the impact of a prekindergarten program that implemented a coaching system and consistent literacy, language, and mathematics curricula on these and other nontargeted, essential components of school readiness, such as executive functioning. Participants included 2,018 four and five-year-old children. Findings indicated that the program had moderate-to-large impacts on children's language, literacy, numeracy and mathematics skills, and small impacts on children's executive functioning and a measure of emotion recognition. Some impacts were considerably larger for some subgroups. For urban public school districts, results inform important programmatic decisions. For policy makers, results confirm that prekindergarten programs can improve educationally vital outcomes for children in meaningful, important ways.

High-quality early childhood education equips children with the cognitive skills required for success in elementary school and beyond. Studies show that intensive preschool interventions can be highly cost effective and have positive impacts into adulthood (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002; Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010; Reynolds, Temple, White, Ou, & Robertson, 2011). From a developmental science perspective, this makes much sense; children's cognitive skills are malleable at a young age, and thus supporting their early development builds a strong foundation for later educational and intellectual success. Children with higher levels of early vocabulary, reading, mathematics, and executive functioning consistently have greater levels of academic success in elementary and middle school (Duncan et al., 2007; McClelland, Acock, & Morrison, 2006; National Early Literacy Panel, 2008). While the evidence is more mixed for emotional outcomes, both developmental theory and some empirical evidence suggest similar links to later academic outcomes for that domain (Entwisle, Alexander, & Olson, 2005; Pianta & Stuhlman, 2004).

Such findings have helped motivate the recent expansion of state- and locally funded prekindergarten programs in the United States. As of 2010, 40 states had implemented prekindergarten programs, enrolling 27% of the nation's 4-year-olds (Barnett et al., 2010). Evaluations of these programs with the strongest research design to date (regression discontinuity) have confirmed that children enrolled in these programs have higher language, literacy, and mathematics outcomes, on average, at scale (Gormley, Gayer, Phillips, & Dawson, 2005; Gormley, Phillips, & Gayer, 2008; Hustedt, Barnett, Jung, & Goetze, 2009; Hustedt, Barnett, Jung, & Thomas, 2007; Wong, Cook, Barnett, & Jung, 2008). Findings on impacts of public prekindergarten on children's socioemotional skills come from two quasi-experimental (and nonregression discontinuity) studies and findings were mixed (Gormley, Phillips, Newmark, Perper, & Adelstein, 2011; Magnuson, Ruhm, & Waldfogel, 2007).

While overall these results are encouraging, research suggests that many preschool programs struggle to attain good instructional quality (Burchinal, Kainz, & Cai, 2011; Peisner-Feinberg & Burchinal, 1997). Accordingly, there have been many efforts to increase preschool quality, including interventions

This study is funded by the Institute of Education Sciences. Thanks to the Boston Public Schools; Jason Sachs; the BPS Department of Early Childhood; participating coaches, principals, teachers, and children; John Willett; Richard Murnane; Nonie Lesaux; John Papay; and members of the Harvard RD Methodology in Prekindergarten Studies Working Group (particularly Howard Bloom, Jens Ludwig, Doug Miller, Guido Imbens, and Thomas Lemieux). Special thanks to our research assistants Kjersti Ulvestad, Carla Schultz, Julia Hayden, Michael Hurwitz, Hadas Eidelman, Kam Sripada, Ellen Fink, Julia Foodman, Deni Peri, Caitlin Over, and John Goodson.

Correspondence concerning this article should be addressed to Christina Weiland, Harvard Graduate School of Education, 14 Appian Way, Room 704, Cambridge, MA 02139. Electronic mail may be sent to Christina_weiland@mail.harvard.edu.

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that use curricula, teacher professional development, or both as quality supports. Many such interventions have shown efficacy when implemented on a small scale or in research demonstration trials. When such interventions are taken to scale, it is widely recognized that achieving positive impacts is more challenging. The intervention's creators, for example, cannot be as heavily involved, and maintaining quality of implementation is more difficult (Shadish, Cook, & Campbell, 2002).

This study, which used data on approximately 2,000 students enrolled in the Boston Public Schools (BPS) public prekindergarten program, represents an intersection of the literature on the effects of public prekindergarten programs and the literature on quality-support interventions in preschool. Regarding the former, as in the strongest of the prekindergarten studies, we used a quasi-experimental regression-discontinuity (RD) design, with the birthday cutoff for entry into the program providing exogenous treatment eligibility, to estimate the effects of public prekindergarten on children's developmental outcomes. Relevant to the quality-support literature, the BPS program combined two features that are prominent in the literature on preschool quality improvement: research-based (mathematics, language, and literacy) curricula, paired with a coaching system for preschool teachers. Curricula were chosen by the district and implemented at scale without involvement of the curriculum developers. The coaching system was developed by the district. Conditions accordingly represent those more typically encountered in public school districts than in research demonstration trials. Although we were not able to identify causally which of these inputs—curricula, coaching, or simply attending prekindergarten—constituted the most "active" ingredients in the intervention, we are nonetheless able to provide domain-specific and policy-relevant information regarding the pedagogical conditions under which impacts were achieved.

Within this context, we examined impacts of the BPS program on children's language, literacy, mathematics, and emotional development, domains that were directly targeted by the district-chosen curricula. One of our mathematics assessments is new to the literature and addresses some of the content limitations of more commonly used preschool mathematics assessments. We also present impacts on executive function (EF) skills, a developmentally important component of school readiness (Blair & Razza, 2007). EF was not directly targeted by the intervention, but theory and empirical work suggest that there may be spillover effects of cognitively focused curricula on this domain. In addition, we collected detailed data on the care type experienced by control-group children. Thus, we were able to specify what the program is being compared to, which is crucial given that the counterfactual for early childhood program attendance has changed substantially since landmark studies of preschool implemented in the 1960s and 1970s (Campbell et al., 2002; Schweinhart, Barnett, & Belfield, 2005). We also tested for statistically significant differences in impacts by gender, free or reduced lunch status, and race or ethnicity. The previous literature suggests that the effects of preschool may differ by these demographic characteristics. Finally, we present evidence that our results are robust to a set of threats to internal validity. Many of these sensitivity analyses—such as robustness of estimates to attrition from and late entry into the prekindergarten program, different start rules by age on certain measures, differences in reactivity to the testing situation in the treatment and control groups, and use of extant data to aid in the interpretation of produced estimates, as only children who took up an offered seat were tested—are new to the RD prekindergarten literature. Carefully examining these threats is important for advancing research methodology in future evaluations.

Short-Term Effects of Prekindergarten

Many previous studies have summarized the literature on the effects of preschool programs on children's developmental outcomes in great detail (Barnett, 1995; Currie, 2001; Gormley et al., 2005; Wong et al., 2008; Yoshikawa, 1995). In brief, prekindergarten appears to have positive, small-to-large effects on children's cognitive development and small effects on children's prosocial and problem behaviors, although the direction of the latter differs by study.

Focusing specifically on the public prekindergarten studies that share this study's research design (RD), researchers have found statistically significant positive impacts on children's mathematics scores in five of seven examined contexts (one city and six states; effect size range = 0.16–0.50) and on children's receptive vocabulary scores in four of eight examined contexts (one city and seven states; effect size range = 0.17–0.36). On assessments not shared across this body of studies, there was evidence of moderate-to-large effects on children's early literacy skills in six of eight examined contexts (Gormley et al., 2005; Gormley et al., 2008; Hustedt et al.,

2007; Hustedt et al., 2009; Wong et al., 2008). In addition, in studies of the Tulsa program (the only program in this body of literature to date for which subgroup impacts have been reported), Hispanic children and children raised in poverty, who generally have poorer outcomes than their White and higher income peers, appeared to enjoy greater benefits from enrollment in prekindergarten (Gormley et al., 2005, 2008).

Socioemotional and executive functioning outcomes have not been examined to date in the set of RD studies of the immediate impacts of prekindergarten. However, a recent study that used propensity score methodology found that public prekindergarten produced small reductions in children's timidity and increases in attentiveness (Gormley et al., 2011). A quasi-experimental study found that public prekindergarten increased children's aggression and decreased their self control (Magnuson et al., 2007). However, there were no statistically significant socioemotional effects for children who attended prekindergarten and kindergarten in the same public school.

Curricula and Coaching in Prekindergarten Settings

Curricula. Theory suggests that implementing explicit, intentional curricula in preschool programs may be effective for several reasons. Such curricula may ensure a continuing emphasis on the skills necessary for children's early school success, may help keep children engaged and challenged in the classroom, and may also help maintain classroom quality (Klein & Knitzer, 2006). Empirical evidence supports the effectiveness of some language, literacy, mathematics, EF, and socioemotional curricula on directly targeted child developmental domains (Barnett et al., 2008; Bierman et al., 2008; Clements, Sarama, Spitler, Lange, & Wolfe, 2011; Domitrovich, Cortes, & Greenberg, 2007; Fischel et al., 2007). Effective curricula in prekindergarten may also improve children's outcomes in nontargeted domains. For example, a reading and behavior management curriculum improved children's EF skills (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008), and a mathematics-focused curriculum improved children's oral language and literacy skills (Sarama, Lange, Clements, & Wolfe, in press).

Similarly, EF may be impacted by exposing children to prekindergarten curricula that have an explicit cognitive focus. There are hypothesized to be three distinct but related components of EF—working memory, inhibitory control, and attention shifting (Blair & Razza, 2007). Each is associated with language and math skills among preschool-aged children (Blair & Razza, 2007; Bull & Scerif, 2001; Diamond, Carlson, & Beck, 2005; Gathercole & Pickering, 2000). From a Vygotskian perspective, improved language may support children's EF skills by enhancing children's outer and then inner speech, which in turn may then improve EFs as children become better able to plan and monitor their behavior (Vygotsky, 1978). Furthermore, early mathematics, language, and literacy tasks all make demands on children's working memory, cognitive flexibility, and inhibitory control (Welsh, Nix, Blair, Bierman, & Nelson, 2010). There is uncertainty about the causal direction of the relation between EF and these cognitive skills, but it is plausible that implementing effective cognitively focused curricula in preschool could improve EF.

Coaching. Coaching is an ongoing professional development model in which an expert (the coach) models instruction, observes teachers' practice, and provides teachers with constructive feedback on their pedagogy (Neuman & Cunningham, 2009). Coaching may or may not involve supporting teachers' implementation of specific curricula (Aikens & Akers, 2011). Coaching can produce gains in preschool classroom quality, teacher instructional practices, and children's cognitive and behavioral development (Aikens & Akers, 2011; Bierman et al., 2008; Neuman & Cunningham, 2009; Raver et al., 2009). Thirteen of 14 studies have found that coaching improves preschool teachers' curriculum implementation (see Aikens & Akers, 2011). Monthly coaching was also part of the professional development model in a randomized controlled trial of Building Blocks, the mathematics curriculum implemented in the current study (Clements & Sarama, 2008). These researchers found large gains in children's mathematics skills at the end of prekindergarten, as well as high levels of curricular fidelity and higher quality mathematics instruction in treatment classrooms.

Subgroup Effects

Do the effects of preschool education differ by sociodemographic factors, such as socioeconomic status, race or ethnicity, or child gender? Large-scale preschool education in the United States emerged from the desire to reduce gaps between the academic performance of children from poor versus better-off homes (Zigler & Styfco, 2010). Nearly all of the literature evaluating the impacts of preschool education on children is based on low-income populations (the median percentage of

families in poverty in rigorous preschool evaluations identified in a recent meta-analysis was 91%; Leak et al., 2012). There are some hints in the studies conducted on national data sets that the effects of preschool and center-based care on cognitive outcomes are stronger for lower income families (Brooks-Gunn, Gross, Kraemer, Spiker, & Shapiro, 1992; Currie, 2001). In recent years, there has also been strong interest in whether preschool education might reduce related gaps in cognitive performance by race or ethnicity (Magnuson & Waldfogel, 2005). The national Head Start Impact Study found significantly stronger positive effects of the program on a range of Latino children's developmental outcomes, compared to those of other racial or ethnic groups, in its follow-up to first grade (U.S. Department of Health & Human Services, 2010). The Tulsa prekindergarten study found particularly strong cognitive effects among Latino children (Gormley et al., 2005). Gender has also been of interest as a moderator of preschool impacts. A recent study pooling the Perry, Abecedarian, and Early Training Project data found stronger benefits for girls than boys (Anderson, 2008). However, a meta-analytic study covering a broader range of preschool evaluations did not find this pattern (Kelchen et al., 2012).

In our sample, a substantial proportion of families were not low income, due to the public prekindergarten system not being means tested. We therefore have an opportunity in this study to examine whether the effects of public prekindergarten differ by family socioeconomic background, as well as by race or ethnicity and gender.

In the current study, we address two research questions:

1 What is the impact of the prekindergarten program on children's early mathematics, language, literacy, EF, and emotional development?
2 Do some child subgroups (as defined by family income, race or ethnicity, or child gender) benefit statistically significantly more from the prekindergarten program than others?

Method

Intervention

Setting. In 2008–2009, the BPS 4-year-old prekindergarten program served approximately 2,045 children in 69 elementary schools. Any child within the city of Boston who turned 4 by September 1 could apply for the program; unlike many public prekindergarten programs in other districts and states (Barnett et al., 2010), children's access was not limited by their family income or other restrictions. There is no perfect metric to determine how many of the city's 4-year-olds are enrolled in the BPS prekindergarten program. One metric relies on the U.S. Census's 2010 estimate of the percentage of children under age 5 in Boston (U.S. Census Bureau, 2012). Based on those numbers, about 34% of the city's 4-year-olds were enrolled in the BPS prekindergarten program in 2008–2009. A second estimate is based on the number of children who ultimately enroll in BPS kindergarten. In 2009–2010, among children enrolled in kindergarten, 43% of those children had attended prekindergarten in BPS in the previous year (excluding those in special education-only classrooms, as these children would have been served by the district even in the absence of the prekindergarten program due to federal requirements).

Treatment condition. Children who attended the program in the treatment year (2008–2009) received a year of free full-day prekindergarten in an urban public school setting. The evaluation year was the 2nd year of full implementation of the literacy and language curriculum Opening the World of Learning (OWL; Schickedanz & Dickinson, 2005) and the mathematics curriculum Building Blocks (Clements & Sarama, 2007a). The theory of change in BPS was that implementing explicit, intentional, and uniform curricula across classrooms with professional development supports would improve and maintain the quality of support provided to teachers and optimize resource allocation (e.g., through the streamlining of teacher training; Sachs & Weiland, 2010). In a fidelity study conducted the year treatment children were enrolled in prekindergarten, coaches trained on fidelity measures for each curriculum reported that they were implemented with moderately high fidelity (Weiland, Eidelman, & Yoshikawa, 2012).

Curricula background and implementation. The OWL curriculum targets children's early language and literacy skills and includes a social-skills component embedded in each unit, in which teachers discuss socioemotional issues with children and integrate emotion-related vocabulary words. The Building Blocks curriculum targets early mathematics skills, particularly (a) number and simple arithmetic and (b) geometry, measurement, and spatial sense. Three mathematical themes—patterns, data, and sorting and sequencing—are woven into these two main areas. In addition, many activities are intentionally child directed, with children making

up their own problems or creating their own geometric designs (Clements & Sarama, 2007a). Its pedagogical approach has a heavy focus on language, as it requires children to explain their mathematical reasoning verbally. Neither curriculum targets children's EF skills directly.

OWL and Building Blocks have shown positive effects on children's outcomes in other studies (Ashe, Reed, Dickinson, Morse, & Wilson, 2009; Clements & Sarama, 2007b; Clements et al., 2011). However, the evidence base for Building Blocks is stronger than that for OWL. Children in eight programs that implemented OWL showed consistently positive effects in studies that used pre–post designs with no control group (Wilson, Morse, & Dickinson, 2009). However, a recent randomized controlled trial in Head Start centers (Dickinson, Freiberg, & Barnes, 2011; Dickinson et al., 2011) found no impacts of OWL on children's language and literacy outcomes at the end of preschool, and some negative effects at the end of kindergarten and the end of first grade. However, these latter results are somewhat difficult to interpret, as the fidelity of implementation in the treatment groups was relatively low and control classrooms had partially implemented OWL. Teachers were also on average better educated in the eight programs that showed positive effects than in the RCT (65% vs. 17% with a bachelor's degree [BA], respectively).

Teacher qualifications and professional development supports. All BPS prekindergarten teachers are subject to the same educational requirements and pay scale as K-12 teachers. All prekindergarten teachers must have at least a BA and must obtain a masters degree within 5 years. Placing BPS within the national context, in 2010, 27 of 40 states required a BA for teachers in state-funded prekindergarten programs (Barnett et al., 2010). During the treatment year, 78% of program teachers held masters degrees and 75% had at least 5 years of teaching experience. Prekindergarten teachers received a variety of supports in the year prior to our evaluation and in the evaluation year itself, including curriculum-specific training and weekly to biweekly on-site support from an experienced early childhood coach trained in both curricula. In the 1st year of implementation, teachers were offered 2 days of curricular training in Building Blocks and 5 days in OWL. During the school year, teachers were offered 4 days of training in Building Blocks and 2 days of training in OWL. In the 2nd year of implementation, all teachers new to the prekindergarten program were offered 5 days of curricular training before the start of the school year and 6 days of training during the school year. For more on teacher background characteristics, see online supporting information Appendix S4, Table S1.

Coaching sessions were tailored to address the individual needs of each teacher in implementing the curricula and managing the classroom. All early childhood coaches held masters degrees. On average, early childhood coaches had themselves taught previously in early childhood classrooms for 8.8 years (range = 2–20 years, SD = 4.9 years) and had worked as a district early childhood coach an average of 3.3 years (range = 0.5–7 years, SD = 2.2 years).

Sample

In fall 2009, children in the BPS prekindergarten program and all children who attended the program in the previous year were eligible for the study. Children in special-education-only classrooms were excluded due to concerns about the appropriateness of the assessment battery for children who were not mainstreamed. For a child to participate in the study, the principal, classroom teacher, and parent (or guardian) of the child all had to consent to participate. In fall 2009, all eligible principals and teachers were invited to participate. Of 79 elementary schools with eligible children, 12 principals declined to participate (15%). Approximately 93% of eligible teachers in participating schools agreed to participate in child-level data collection in fall 2009 (N = 250 out 270), an average of 3.7 teachers per participating school. Participating schools and teachers were representative of district schools and teachers (see online supporting information Appendix S3).

We translated parent consent forms into five languages and forwarded them to the child's home up to three times. Within participating classrooms in the 67 participating schools, 69% of 2,938 eligible children returned consent forms, for a total sample size of 2,018. This represents 54% of eligible children enrolled in the district in fall 2009. Compared to nonparticipants on 14 characteristics, study participants were more likely to live in the east attendance zone (44% vs. 35%; one of three attendance zones; $p < .001$), less likely to live in the north attendance zone (28% vs. 35%; $p < .001$), more likely to have special needs (9% vs. 6%; $p < .01$), more likely to be White (18% vs. 15%; $p < .01$), more likely to be Asian (11% vs. 9%; $p < .05$), and less likely to be Hispanic (41% vs. 46%; $p < .01$). Participating children were nested in 238 classrooms (the difference between this

figure and the 250 consented teachers is due to 7 classrooms having two teachers and 5 teachers agreeing to participate, but with very few students eligible for the study and none who ultimately returned consent forms). The number of participating children per classroom ranged from 1 to 22 (average of 8.5, $SD = 5.2$).

The final sample of 2,018 is racially, linguistically, and socioeconomically diverse. Forty-one percent of the children were Hispanic, 26% were Black, 18% were White, 11% were Asian, and 3% were of mixed, or other, race. Fifty percent of the sample spoke only English, 28% spoke Spanish, and 22% spoke a language other than English or Spanish. Sixteen languages were represented in the "other" category; within this category, the most commonly spoken languages were Vietnamese (30%), Haitian (12%), and Cape Verdean Creole (8%). Approximately 69% of sampled children were eligible for free or reduced lunch.

Child Assessment Procedures

Children were tested by study-trained child assessors. These assessors had to establish target reliability on the full battery of tests and show good rapport and child management skills in both simulated and real testing situations. All assessors were college educated and approximately one third held masters degrees. On average, the complete battery of nine tests took 45–50 min to administer. Children were tested in a single session if possible, with the session divided into smaller segments if the child showed signs of fatigue. We randomized the order of tests to limit the possibility of biasing results systematically due to child fatigue. The assessors visited classrooms in fall 2009, as close to the start of the school year as teacher and school schedules and study staffing would allow. Assessors were first allowed into schools 2 weeks after the start of school (end of September). Approximately 33% of the data were collected by the end of October, 88% collected by the end of November, and 98% collected by the end of December. Children were assessed in English.

Outcome Measures

Receptive vocabulary. Children's receptive vocabulary was measured using the Peabody Picture Vocabulary Test III (PPVT–III; Dunn & Dunn, 1997), a nationally normed measure that has been used widely in diverse samples of young children (U.S. Department of Health and Human Services, 2010). The test has excellent split-half and test–retest reliability estimates, as well as strong qualitative and quantitative validity properties (Dunn & Dunn, 1997). It requires children to choose (verbally or nonverbally) which of four pictures best represents a stimulus word. In our analysis, as in other prekindergarten RD studies (Hustedt et al., 2007; Hustedt et al., 2009; Wong et al., 2008), we used the raw score total as our outcome measure.

Prereading and reading skills. The Woodcock–Johnson Letter-Word Identification subscale (Woodcock, McGrew, & Mather, 2001) is a nationally normed, widely used measure (Gormley et al., 2005; Peisner-Feinberg et al., 2001). Children are asked to identify and pronounce isolated letters and entire words fluently. According to the developers, the estimated test–retest reliability of the Letter-Word subscale for 2- to 7-year-olds is 0.96. Consistent with other prekindergarten RD studies (Gormley et al., 2005; Gormley et al., 2008), we used the raw score total as an outcome in our analysis.

Numeracy and early math. The Woodcock–Johnson Applied Problems subscale (Woodcock et al., 2001) is a numeracy and early mathematics measure that requires children to perform relatively simple calculations to analyze and solve arithmetic problems. Its estimated test–retest reliability for 2- to 7-year-old children is 0.90 (Woodcock et al., 2001) and it has been used widely with diverse populations of young children (Gormley et al., 2005; Peisner-Feinberg et al., 2001; Wong et al., 2008). In our analysis, as in other prekindergarten RD studies (Gormley et al., 2005; Gormley et al., 2008; Hustedt et al., 2007; Hustedt et al., 2009; Wong et al., 2008), we used the raw score total as an outcome.

The Applied Problems subtest does not measure geometric and spatial capacities and researchers have raised some concerns regarding the test's comprehensiveness, appropriateness, and sensitivity in use with young children (Clements, Sarama, & Liu, 2008). Therefore, we also assessed children's mathematics skills using a subset of 19 items from the Research-Based Elementary Mathematics Assessment (REMA; Clements et al., 2008), as this measure assesses a wider range of early numeracy, geometry, and spatial skills. We used Rasch modeling and other psychometric analysis to assess the shortened REMA's psychometric properties and confirmed that it was a valid measure of children's early mathematics skills (Weiland et al., 2012). In all analyses, we used the Rasch-estimated child ability scores as the outcome.

EF skills. Our battery of tests included assessments that tapped three principal dimensions of EF:

working memory, cognitive inhibitory control, and attention shifting. Forward Digit Span and Backward Digit Span (FDS and BDS, respectively; Gathercole & Pickering, 2000; Wechsler, 1986) tapped different components of working memory. BDS measures the central executive component, while FDS measures phonological loop. In both tasks, the assessor reads aloud a string of numbers to the test child, with approximately a 1-s pause between digits. The child then either has to repeat back exactly what the assessor said (in FDS) or reverse the string of numbers (in BDS). Before items are administered, the child must pass a practice trial, demonstrating that he or she understands the directions of the task. FDS is scored from 1 to 6, while BDS is scored from 1 to 5. The score represents the child's digit span memory (i.e., a 2 represents a digit span memory of two digits).

For attention shifting, we used the Dimensional Change Card Sort (DCCS) and a subset of items from the Task Orientation Questionnaire (TOQ; Smith-Donald, Raver, Hayes, & Richardson, 2007). In the DCCS (Frye, Zelazo, & Palfai, 1995), children were shown target cards that differed along dimensions of color and shape (e.g., red and blue, rabbits and boats). Children learned to sort the cards according to one dimension (shape or color) and then were asked to sort the cards on the other dimension. After practice trials to confirm that children understood the rules, the assessor administered up to 10 trials on the DCCS. After 6 trials, if a child had missed more than 1 trial, the testing was discontinued. If the child had missed only 1 or 0 trials, the assessor continued until Trial 10. The final DCCS total score was the number of trials (out of 10) in which the child managed to shift attention from the prior criterion and sort the cards according to the new criterion correctly.

The full TOQ assesses the child's emotional state and capacity to sustain focus on a set of tasks during a testing session. After administering the child assessment battery, assessors rated each child on 13 items reflecting his or her capacity to sustain attention to the tasks, demonstrate self-regulation, and engage actively to achieve a goal. Each item was rated on a 4-point scale, with clear behavioral descriptors provided for each point on the scale. Using the full sample of children, we conducted a confirmatory factor analysis on the full set of TOQ items and confirmed the presence of three distinct constructs—positive emotion, attention shifting, and impulse control. The fit of the factor model was good (comparative fit index [CFI] = .976, root mean square error of approximation [RMSEA] = .058, standardized root mean square residual [SRMR] = .048). The four items that measured attention shifting included "Pays attention to instructions and demonstration," "Careful, interested in accuracy," "Sustains concentration—willing to try repetitive tasks," and "Cooperates, complies with tester's requests." In our analyses, we used a unit-weighted average of responses to these four items as our attention-shifting outcome.

To assess children's cognitive inhibitory control, we used Pencil Tapping (Diamond & Taylor, 1996). The child was asked to tap twice if the evaluator tapped once and tap once if the evaluator tapped twice. Assessors first administered a set of practice trials to ensure that children understood the rules of the task. Children who passed the practice were then administered 16 total trials. The task measures children's cognitive inhibitory control and, to a lesser degree, working memory and fine motor activity (Bierman, Nix, et al., 2008). Scores recorded the correct number of trials out of 16 that children achieved. Because of concern that tapping a pencil could prove difficult for preschoolers and might conflate cognitive inhibitory control with fine motor skills, we substituted larger plastic kitchen spoons for pencils in this task.

Emotional development. Our chosen emotional development outcomes are all derived from either direct testing or assessor ratings of children. Commonly used measures of children's behavior in preschool often rely on parent and teacher reports. However, parents and teachers may have different expectations of children based on whether they are entering preschool versus kindergarten, a problem discussed in Gormley et al.'s (2011) evaluation of the Tulsa prekindergarten program's impacts on children's socioemotional outcomes. Because our RD design compares preschool children with kindergarten children across an age cutoff, intervention effects on outcomes measured by parent and teacher reports could have been confounded with differences in reporters' expectations based on the child's age.

We used three measures of emotional development: the Emotion Recognition Questionnaire (ERQ; Ribordy, Camras, Stefani, & Spaccarelli, 1988), TOQ Positive Emotion, and TOQ Impulse Control (Smith-Donald et al., 2007). The ERQ assesses children's ability to identify emotions. In the ERQ, children listened to 16 stories that described characters in different situations and were shown a picture corresponding to the situation. They were then asked to identify the character's feeling by pointing to pictures of happy, mad, sad, or scared faces. The

faces shown matched the gender of the child (i.e., boys were shown boy faces and girls were shown girl faces). Children received 2 points for identifying the correct emotion, 1 point if they misidentified the emotion but identified the valence correctly, and 0 points if they identified neither emotion nor valence correctly, for a maximum score of 32. Before administering the test, the assessor first established that the child could identify the happy, mad, sad, or scared faces correctly. The ERQ has been used with children in Head Start and has demonstrated sensitivity to intervention effects (Bierman et al., 2008).

The confirmatory factor analysis described previously on the TOQ identified three items for positive emotion: "alert and interactive; is not withdrawn," "shows pleasure in accomplishment and active task mastery," and "confident"; and three items for impulse control: "can wait during and between tasks," "remains in seat appropriately during test," and "modulates and regulates arousal level in self." In our analyses, scores on our Positive Emotion and Impulse Control outcomes were unit-weighted averages of children's responses to the position emotion and impulse control factors, respectively.

Predictors

Forcing variable. Using district administrative records, we constructed a continuous predictor to measure how many days from the cutoff the child's birthdate fell, centered on September 1. This predictor was the "forcing variable" in our RD analysis—the clear cutpoint that is the exogenous determinant of children's eligibility for treatment (Lee & Lemieux, 2010). Positive integer values indicated that the child was born before September 1 and negative, after. A value of 0 indicated that the child was born on September 1.

Treatment variable. We also created a dichotomous variable that recorded whether children were in the treatment group (set equal to 1, when centered child age was 0 or greater) or the control group (set equal to 0, when centered child age was less than 0).

Covariates and Descriptive Characteristics

Administrative data. From district administrative records, we obtained information on children's race or ethnicity, home language, free and reduced lunch status, gender, and special needs status. We used a vector of dichotomous indicators to represent child race or ethnicity, each coded 1 when the child was from the particular racial or ethnic group, 0 otherwise. Racial or ethnic groups were Asian, Black, Hispanic, Other, and White. Similarly, we used a vector of dichotomous indicators to represent children's home language (English, Spanish, or Other), each coded 1 when the requisite language was the child's home language, 0 otherwise. We also constructed dichotomous indicators to represent child free and reduced lunch status, gender, and special needs status, each coded 1 if the child fell into a demographic category and 0 otherwise. These covariates have been shown to predict children's early cognitive and educational outcomes in other studies, and there is a consensus in the early childhood education literature that these should be controlled in impact analyses (Clements et al., 2011; Wong et al., 2008).

Preprogram Child-Care Types

We were also able to obtain parent-reported information on the primary type of child care that children experienced before entering the 4-year-old district prekindergarten program. When registering their children for prekindergarten, parents were asked about the child's last child-care experience, including the name of the provider, and were asked to choose one from the following care types: Head Start, private preschool, public preschool, licensed family day care, family day care, and other or none. Because parents often disagreed about program type for the same program name, we cleaned and recoded these data extensively, confirming the type for each named program so that codes are consistent across children. We verified the program type via extensive web searches and through lists of programs and types obtained from the Massachusetts Department of Early Education and Care, the Boston Early Education Quality Improvement Project, and the National Association for the Education of Young Children. Information was often unavailable regarding whether a family day-care provider was licensed and parents frequently disagreed regarding the same provider's licensing status. Thus, we collapsed licensed family day care and family day care into one category in our analysis. Other or none almost always refers to relative care, such as parental care or care by an immediate relative.

Data Analytic Strategy

Impacts: Basic framework. For the impact estimates, we capitalized on the exogenous variation in program receipt created by the use of the district's age cutoff to determine children's entry

into the program. The RD approach is useful when there is a clear cutpoint on a "forcing variable," such as child age, that is the exogenous determinant of children's eligibility for treatment. On one side of the cutoff, participants are assigned to a particular treatment, whereas on the other side of the cutoff, they are not (Imbens & Lemieux, 2008; Shadish et al., 2002; Thistlethwaite & Campbell, 1960; Trochim, 1984). In our case, children must have turned 4 years old on or before September 1, 2008 to attend the prekindergarten program (the treatment) in the 2008–2009 school year (Year 1). Any differences in average school-readiness outcomes in fall 2009 (the beginning of the 2009–2010 school year, or Year 2) between children who fell just to one side, or the other, of the cutoff, provided unbiased estimates of the causal impact of the program for children of this age. Under the standard RD design, we capitalize on the data of children remote from the birthday cutoff to estimate the treatment effect for those target children whose birthdays fell in the immediate vicinity of September 1, on one side or the other. As is common in RD studies, our results only generalize to students right at the cutoff.

Interpretation of the impact estimates. A standard application of the RD methodology, provided all assumptions are met, provides an unbiased estimate of the average effect of assignment to the treatment condition (vs. control) for participants immediately on either side of the cutoff (Bloom, 2012; Murnane & Willett, 2010). This estimate is known as the intent-to-treat (ITT) estimate as it summarizes the average difference between participants who were assigned to the treatment and control conditions, whether they end up taking up their assigned place in either the treatment or the control group. In our study, however, the only children tested are those who actually showed up in the schools at the point of testing (fall 2009). As such, the treatment estimate is not a classic ITT estimate. It also does not meet the definition of a treatment-on-the-treated (TOT) estimate, or the effect of the intervention on those who actually took up the treatment, as TOT estimates are derived from ITT estimates (Angrist & Pischke, 2008). As such, estimates produced by our study and by previous prekindergarten RD with age cutoff studies are neither pure ITT nor pure TOT estimates. Previous such studies have left this problem unresolved (Gormley et al., 2005; Wong et al., 2008).

We took several steps to address this problem (for details concerning our strategies and results, see online supporting information Appendix S1). In brief, we contend that our RD estimates are definitionally ITT estimates with potential selection bias. However, simulations and analysis using administrative data suggest that the magnitude of our estimates is closer to TOT than ITT. As such, we interpret them as representing effects for those who enrolled in the program. Later in this article, and more fully in the online supporting information Appendices S1, S2, and S4, we provide evidence that detected effects are robust to a multitude of sensitivity analyses.

Adjusting for attrition and late enrollment. To adjust for children who were missing outcome data due to attrition or late enrollment, we used propensity score weighting. Using administrative records from enrollment applications, we identified students who participated in the prekindergarten program in Year 1 but attrited from the district by time of testing (Year 2; $N = 209$). We also identified control-group children who were not included in our tested sample because they either attrited before testing ($N = 63$) or enrolled after the testing period ($N = 54$). Previous such studies have not accounted for these additional groups of children. Adjusting for them is key, given that they technically should be included in our analysis of those who took up the program. Because we had administrative data for these attriter and late-entry children, we were able to adjust for observed differences between our child assessment (impact) sample of 2,018 and the larger sample including them. Illustrating the importance of this adjustment, in Table S2 in online supporting information Appendix S4, we present descriptive statistics on the demographics of both the tested sample and the attriter and late-entry sample. As shown in the table, there are statistically significant differences between the two samples on 6 of 14 examined demographic characteristics.

To conduct the required adjustments, our propensity score model was as follows:

$$PS_{ijk} = \Pr(\text{child\_tested} = 1 | \sum X_{ijk}) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_{ijk})}} \quad (1)$$

where PS is the probability that the *i*th student, in the *j*th classroom of the *k*th school would be tested, conditional on X, a vector of student-level covariates (race or ethnicity, gender, home zone, language, and siblings). We fitted this model, obtained predicted values of these propensity that

a child would be tested, and then inverted these propensities to obtain an inverse probability weight (IPW) that we could use in our subsequent RD analysis to counteract selection into testing (Imbens & Wooldridge, 2009; Murnane & Willett, 2010). Conceptually, our IPW approach upweights children whose entry into the tested or untested condition was not predicted well by the selection model in Equation 1 and for whom we then assume that the endogenous contribution of self-selection plays less of a role in the determination of the RD estimate.

RD impact approach. We incorporated the IP weights into our RD analyses using weighted least squares regression, in the sample of tested children who did possess values on the empirical outcomes. Our impact equation was as follows:

$$\begin{aligned}\text{OUTCOME}_{ijk} = {} & \beta_0 + \beta_1 \text{TREAT}_{ijk} + \beta_2 \text{CAGE}_{ijk} \\ & + \beta_3 \text{TREAT}_{ijk} * \text{CAGE}_{ijk} + \beta_4 Y_k + \varepsilon_{ijk}\end{aligned} \quad (2)$$

where OUTCOME is a generic representation of the child-level test score, TREAT is a dichotomous indicator of treatment or control-group status, CAGE is the child's age centered on the September 1 cutoff, Y is a vector of school fixed effects, and ε is a student-level error term. We estimated robust standard errors to account for the clustering of children within classrooms. We did not include student demographics in Equation 2, as they had already been accounted for through the IPW.

Our analytical strategy and robustness checks for our RD analyses were informed by Lee and Lemieux (2010) and *What Works Clearinghouse* guidelines (Schochet et al., 2010). We first conducted a graphical analysis, displaying and smoothing the relation between the outcome child age on either side of the cutoff, by superimposing a fitted linear regression line and a smoothed, locally weighted nonparametric regression line on a scatter plot of the raw data. These empirical plots suggested the functional form of the outcome and forcing variable relation and revealed whether there was indeed a discontinuity in the average value of the outcome between the groups assigned to the treatment and control conditions, at the cutoff. Second, because specifying the correct functional form of the relation between outcome and the forcing variable is one of the chief challenges in RD analysis (Imbens & Lemieux, 2008; Ludwig & Miller, 2007), when we specified a linear relation between the two variables, we did so within a window, or bandwidth, on either side of the age cutoff, within which one might reasonably argue that the functional form of the outcome and forcing variable relation was "locally" linear. This approach is a flexible method that allows for the inclusion of covariates, and gives equal weight to all observations that fall into a local bandwidth (Imbens & Lemieux, 2008). This approach also has better boundary properties than other standard nonparametric smoothing strategies (Hahn, Todd, & Van der Klaauw, 2001). A nearly identical version of the method was used to estimate successfully the impacts of Head Start on child mortality rates and educational attainment, in another RD-designed evaluation (Ludwig & Miller, 2007).

Third, as a check on the specification of our local linear regression models, we also fitted a series of additional models in which we replaced the linear specification of the outcome and forcing variable relation with polynomial specifications and interaction terms of the necessary order between the treatment and forcing variables. We compared fit statistics across models and overspecified the models as a robustness check. Although less efficient than when models are underspecified, overspecification yields less biased estimates (Trochim, 1984) and has been used as a strategy in other early childhood RD designs (Gormley et al., 2005; Wong et al., 2008).

As a fourth step, we examined the sensitivity of our results to choice of bandwidth (Lee & Lemieux, 2010). Within selected bandwidths, we reestimated the IP weights from Equation 1, using the sample of observations corresponding to that bandwidth. To provide easy comparisons with other RD prekindergarten studies (Gormley et al., 2005; Wong et al., 2008), we adopted a bandwidth of 6 months on either side of the age cutoff and fitted our different specifications of the RD model (Equation 2) to data within this window. We also employed the cross-validation procedure of Lee and Lemieux (2010) and Imbens and Lemieux (2008) to estimate an "optimal" bandwidth, by minimizing the mean squared error of prediction at the cutoff. Within each bandwidth choice, we repeated the modeling steps outlined above and obtained additional estimates of the treatment effects.

Subgroup analysis. We extended our basic approach to estimate treatment effects for selected subgroups. The subgroups of interest included those defined by race or ethnicity (Black, Latino, White, and Asian), free and reduced lunch status, and gender. Due to the paucity of data for the Other race or ethnicity group, we did not fit models that included this subgroup. Our primary model for estimating these subgroup effects was as follows:

$$\begin{aligned}\text{OUTCOME}_{ijk} = &\beta_0 + \beta_1\text{TREAT}_{ijk} + \beta_2\text{CAGE}_{ijk} \\ &+ \beta_3\text{TREAT}_{ijk} * \text{CAGE}_{ijk} \\ &+ \beta_4\text{SUBGROUP}_{ijk} \\ &+ \beta_5\text{TREAT}_{ijk} * \text{SUBGROUP}_{ijk} \\ &+ \beta_6\text{SUBGROUP}_{ijk} * \text{CAGE}_{ijk} \\ &+ \beta_7\text{TREAT}_{ijk} * \text{SUBGROUP}_{ijk} \\ &* \text{CAGE}_{ijk} + \beta_8 Y_k + \varepsilon_{ij},\end{aligned} \quad (3)$$

where ε is a student-level error term. In this model, we represent the different sets of subgroups with a generic predictor, SUBGROUP. The predictors whose associated slope parameters represent the treatment effects for the different subgroups are as follows: (a) the dichotomous predictor SUBGROUP, indicating membership in a subgroup of interest; (b) the interaction term TREAT*SUBGROUP; (c) the interaction term SUBGROUP*CAGE; and (d) the three-way interaction term SUBGROUP*CAGE *TREAT. We also tested whether it was necessary to include higher order quadratic and cubic terms, adding in the necessary higher order terms for SUBGROUP*CAGE and TREAT*SUBGROUP*CAGE. In each analysis, we included IPW as previously explained to adjust for children who were not tested because of attrition or late enrollment. Equation 3, like Equation 2, does not include a vector of other student characteristics, as they were accounted for through the IPW. Also, for a given subgroup model, the IPW does not include the subgroup characteristic of interest. This is because including the subgroup in the weight prohibits us from including a fixed effect for the subgroup of interest (it would "double count" the subgroup effect). We reported here only those subgroup effects that are robust across bandwidth (see Figures 1 and 2). Results including all statistically significant subgroup effects across all bandwidths are available upon request.

In fitting all our regression models, we used the method of multiple imputation (with 50 imputations) to account for missing data, following Graham (2009). In Table 1, we present summary statistics on the child outcomes, including the percent missing for each outcome.

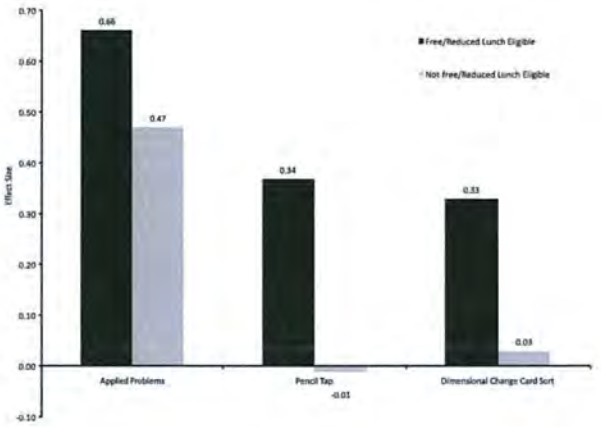

Figure 1. Estimated effect sizes of the prekindergarten program on selected outcomes, by children's free or reduced lunch status. Effect sizes were estimated from fitted regression-discontinuity models within a bandwidth of 365 days on either side of the age cutoff and with a linear relation specified between the achievement outcomes and age.

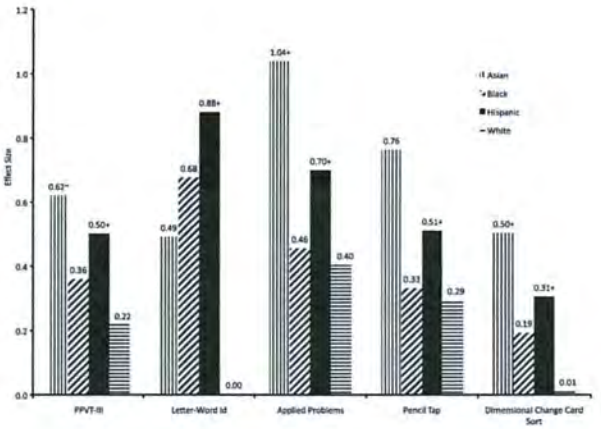

Figure 2. Estimated effect sizes of the prekindergarten program on selected outcomes, by children's race or ethnicity. + denotes that the effect for the racial or ethnic group was larger than that for White children ($p < .05$), and the effect was robust to bandwidth and functional form. ~ denotes that the effect for a racial or ethnic group was larger than that for Whites with a bandwidth of 365 days but that the effect was not robust to bandwidth and functional form. Effect sizes were estimated from fitted regression-discontinuity models within a bandwidth of 365 days on either side of the age cutoff and with a linear relation specified between the achievement outcomes and age. Subgroup effects were estimated from statistically significant interactions between race or ethnicity and treatment status ($p < .05$). Other statistical interactions between race or ethnicity, distance from the age cutoff, and treatment status were included as needed.

Results

Descriptive Statistics on Control-Group Care Types

Parents of children in the control group reported the following care types in the year in which their children were too young to enter the BPS program: Head Start (16%), public centers (12%), private centers (29%), nonrelative home-based care (10%), and relative care (33%). Two thirds of control children thus experienced some kind of nonrelative care in 2008–2009 and 57%, center care or preschool.

Main Impacts

Participation in the prekindergarten program led to statistically significant improvements in mathematics, literacy, and language skills (Table 2). Effect sizes were as follows: 0.45 for receptive vocabulary (PPVT), 0.62 for early reading (Letter–Word Identification), 0.58 for numeracy (Applied Problems), and 0.49 for numeracy and geometry (REMA Short). We also found statistically significant, positive impacts on most measures of EF and on one measure of emotional development (Tables 3 and 4). Effect sizes were 0.23 for working memory (both FDS and BDS), 0.20 for inhibitory control (Pencil Tap), 0.27 for attention shifting (DCCS), and 0.18 for emotion recognition (Emotion Recognition Questionnaire). Results for outcomes from the TOQ—attention shifting, positive emotion, and impulse control—were positive in sign but were not statistically significant. Effect sizes were very similar in models with and without the IPW correction for attrition and late entry (online supporting information Appendix S4, Table S3).

Subgroup Impacts

We also found that some subgroups of children benefited more from the program than did others. For instance, children who were eligible for free or reduced lunch benefited statistically significantly more than those who were ineligible on numeracy (Applied Problems), inhibitory control (Pencil Tap), and attention shifting (DCCS; see Figure 1). For numeracy, effect sizes for both groups were in the moderate-to-large range (0.66 and 0.47, respectively). For inhibitory control and attention shifting, the benefits of the treatment accrued nearly entirely to the children who were free or reduced lunch eligible, with a very small or zero effect at the cutoff for the children who were not free or reduced lunch eligible. For all other outcomes, impacts did not vary by free- and reduced lunch status.

In Figure 2, we display our estimates of effect size by children's race or ethnicity. Impacts were statistically significantly larger for Hispanic children than for White children on 8 of 12 assessments. These differential effects were robust to sensitivity analyses for five assessments: PPVT, Letter-Word ID, Applied Problems, Pencil Tap, and DCCS outcomes (measures across nearly the full range of domains assessed). Effects for Asian children were statistically significantly larger than those for White children on 8 of 12 assessments, but the estimated differences were robust to sensitivity analyses for only the Applied Problems and DCCS outcomes, in part due to the small size of the Asian sample. Effects for Black children were statistically significantly larger than those for White children on 3 of 12 assessments, but these differences were not robust to sensitivity analysis. All outcomes for which there were statistically significant race or ethnicity effects that were robust across bandwidth and functional form also passed general linear hypothesis (GLH) tests. That is, we found that the joint effect of the relevant subgroup characteristics multiplied by the treatment variable was not zero (e.g., F statistic $p < .10$). The exception was the

Table 1
Sample Means (Standard Deviations) for Selected Child Outcomes (N = *2,018*)

	Full sample	Born before cutoff; attended prekindergarten in 2008–2009	Born after cutoff; attended prekindergarten in 2009–2010	% missing total
PPVT–III	58.26 (21.84)	69.16 (17.65)	48.08 (20.44)	5.40
W–J Letter-Word Id	12.44 (7.18)	15.99 (7.03)	9.18 (5.59)	3.87
W–J Applied Problems	13.74 (5.30)	16.54 (4.35)	11.16 (4.75)	3.87
REMA Short Form	−0.08 (1.31)	0.62 (1.12)	−0.73 (1.13)	4.36
Pencil Tap	10.77 (6.00)	12.94 (4.56)	8.69 (6.47)	6.94
Dimension Change Card Sort	6.64 (4.26)	8.01 (3.46)	5.37 (4.54)	4.61
Backward Digit Span	1.53 (0.79)	1.78 (0.87)	1.29 (0.62)	9.56
Forward Digit Span	4.15 (1.28)	4.46 (1.18)	3.86 (1.31)	5.60
TOQ Attention	3.47 (0.66)	3.61 (0.57)	3.34 (0.71)	5.15
TOQ Positive Emotion	3.24 (0.56)	3.34 (0.52)	3.15 (0.59)	5.20
TOQ Impulse Control	3.62 (0.61)	3.70 (0.56)	3.54 (0.64)	5.05
Emotion Recognition Questionnaire	25.80 (5.08)	27.52 (3.24)	24.20 (5.90)	5.70

Note. PPVT = Peabody Picture Vocabulary Test; W–J Letter-Word Id = Woodcock–Johnson Letter-Word Identification; W–J Applied Problems = Woodcock–Johnson Applied Problems; REMA = Research-Based Early Mathematics Assessment; TOQ = Task Orientation Questionnaire.

Table 2

Estimated Treatment Impact (Standard Errors) on Language, Literacy, and Mathematics Outcomes, for Samples of Children Within Selected Bandwidths Around the Age Cutoff on the Forcing Variable

	PPVT–III		W–J Letter-Word ID		W–J Applied Problems		Research-Based Early Mathematics Assessment Short Form		
BW (in days)	**365 +**	180	**365 +**	180	**365**	180	**365**	180	111 +
Treatment	**9.00*** (1.81)**	7.85** (2.60)	**3.45*** (0.55)**	2.61** (0.78)	**2.81*** (0.46)**	2.59*** (0.62)	**0.57*** (0.12)**	0.49** (0.15)	0.37* (0.19)
Effect size	**0.44**	0.38	**0.62**	0.47	**0.59**	0.55	**0.50**	0.43	0.33
Functional form of hypothesized outcome and child-age relation	**Linear**	Linear	**Linear + int.**	Linear	**Linear**	Linear	**Linear**	Linear + int.	Linear + int.
N	**2,018**	969	**2,018**	969	**2,018**	969	**2,018**	969	627

Note. All fitted regression models include the fixed effects of schools and standard errors are corrected for the clustering of children within classrooms. For all outcomes, we fitted regression models using only samples of observations that fell within 365 and 180 days of the cutoff. We also fit models in samples of children that fell within the optimal bandwidth (BW) determined via the cross-validation procedure (+ denotes the optimal bandwidth). For outcomes where the optimal bandwidth was 365 or 180 days, we fitted two models. Within each analysis, we modeled the outcome as a linear, quadratic, and cubic function of the forcing variable, and we also fit models that included interactions between the child-age variable and the treatment indicator. Preferred models are listed in bold. Effect sizes are expressed in terms of the standard deviation of the control group. PPVT = Peabody Picture Vocabulary Test; W–J Letter-Word Id = Woodcock–Johnson Letter-Word Identification; W–J Applied Problems = Woodcock–Johnson Applied Problems. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 3

Estimated Treatment Impact (Standard Errors) on Executive Functioning Outcomes, for Samples of Children Within Selected Bandwidths Around the Age Cutoff on the Forcing Variable

	Pencil Tap			Backward Digit Span			Forward Digit Span		Dimensional Change Card Sort			TOQ Attention		
BW (in days)	**365**	180	287+	**365**	180	221+	**365**	180+	**365**	180	300+	**365**	180	147+
Treatment	**1.39***	1.33†	1.49**	**0.15***	0.16†	0.19*	**0.31****	0.46*	**1.25****	1.34*	1.21**	**0.08**	0.05	0.06
	(0.54)	(0.79)	(0.57)	**(0.07)**	(0.10)	(0.08)	**(0.12)**	(0.18)	**(0.40)**	(0.54)	(0.43)	**(0.07)**	(0.09)	(0.10)
Effect size	**0.21**	0.21	0.23	**0.24**	0.26	0.31	**0.24**	0.35	**0.28**	0.30	0.27	**0.11**	0.07	0.08
Functional form of hypothesized outcome and child-age relation	**Linear + int.**	Linear	Linear + int.	**Linear**	Linear	Linear	**Linear**	Linear	**Linear**	Linear	Linear	**Linear**	Linear	Linear
N	**2,018**	969	1,439	**2,018**	969	1,199	**2,018**	969	**2,018**	969	1,610	**2,018**	969	799

Note. All fitted regression models include the fixed effects of schools and standard errors are corrected for the clustering of children within classrooms. For all outcomes, we fitted regression models using only samples of observations that fell within 365 and 180 days of the cutoff. We also fit models in samples of children that fell within the optimal bandwidth (BW) determined via the cross-validation procedure (+ denotes the optimal bandwidth). For outcomes where the optimal bandwidth was 365 or 180 days, we fitted two models. Within each analysis, we modeled the outcome as a linear, quadratic, and cubic function of the forcing variable and we also fit models that included interactions between the child-age variable and the treatment indicator. Preferred models are listed in bold. Effect sizes are expressed in terms of the standard deviation of the control group. TOQ = Task Orientation Questionnaire.
$^{\dagger}p < .10$. $^{*}p < .05$. $^{**}p < .01$.

Table 4

Estimated Treatment Impact (Standard Errors) on Emotional Development Outcomes, for Samples of Children Within Selected Bandwidths Around the Age Cutoff on the Forcing Variable

	Emotion Recognition Questionnaire			TOQ Positive Emotion			TOQ Impulse Control		
BW (in days)	**365**	180	293+	**365**	180	332+	365	180	**129+**
Treatment	**1.12* (0.50)**	1.22† (0.70)	0.84 (0.58)	**0.02 (0.05)**	0.01 (0.07)	0.08 (0.06)	0.05 (0.11)	0.09 (0.08)	**0.13 (0.09)**
Effect size	**0.19**	0.21	0.14	**0.03**	0.02	0.01	0.07	0.14	**0.20**
Functional form of hypothesized outcome and child-age relation	**Linear**	Linear	Linear	**Linear + int.**	Linear + int.	Linear + int.	Cubic + int.	Linear	**Linear**
N	**2,018**	969	1,582	**2,018**	969	1,795	2,018	969	**724**

Note. All fitted regression models include the fixed effects of schools and standard errors are corrected for the clustering of children within classrooms. For all outcomes, we fitted regression models using only samples of observations that fell within 365 and 180 days of the cutoff. We also fit models in samples of children that fell within the optimal bandwidth (BW) determined via the cross-validation procedure (+ denotes the optimal bandwidth). For outcomes where the optimal bandwidth was to 365 or 180 days, we fitted two models. Within each analysis, we modeled the outcome as a linear, quadratic, and cubic function the forcing variable and we also fit models that included interactions between the child-age variable and the treatment indicator. Preferred models are listed in bold. Effect sizes are expressed in terms of the standard deviation of the control group. TOQ = Task Orientation Questionnaire.
†$p < .10$. *$p < .05$.

effect of Letter-Word Id for Hispanics: In a GLH test, we could not reject the null hypothesis that the joint effect of the interactions between the race or ethnicity variables and the treatment indicator was zero, $F(3) = 1.86$, $p = .14$. We found no differences in impacts of the program by gender.

Robustness Checks

We followed best practices as described in the RD literature and conducted extensive sensitivity analyses to confirm the robustness of our findings (Imbens & Lemieux, 2008; Lee & Lemieux, 2010). Threats to the internal validity of our results included: (1) treatment misallocation at the cutoff; (2) nonsmooth or discontinuous variation in observed and unobserved student characteristics around the cutoff; (3) discontinuities in the outcomes at points other than the cutoff; (4) incorrect specification of the functional form of the relation between outcome and forcing variable; (5) sensitivity of results to the choice of bandwidth around the age cutoff; (6) inflated estimates of treatment effect due to treatment-group children being more familiar with, and comfortable in, testing situations than control-group children; (7) the accumulation of Type I error as a result of multiple tests being conducted; (8) sensitivity of results to use of different start rules on the PPVT–III; and (9) sensitivity of results due to use of raw scores rather than IRT-based *W* scores on the Woodcock–Johnson Letter-Word Identification and Applied Problems subscales. Threats 1 to 5 and Threats 8 and 9 could result in either an over- or underestimation of the true impact of the treatment, whereas Threat 6 could lead to an overestimate of the true impact and Threat 7 could lead to an overstatement of the statistical significance of our findings. We examined each of these threats in turn and found no evidence that suggested any threats to the internal validity of our identifying assumptions (see online supporting information Appendix S2 for details).

Discussion

We found that a prekindergarten program that combined evidence-based curricula with trained BA- and masters-level teachers and coaching support produced positive effects on multiple domains of school readiness. We detected substantial and statistically significant effects of the prekindergarten program on educational outcomes both in domains that were targeted directly by the prekindergarten curriculum—literacy, language, mathematics, and

emotional development—and in a related but nontargeted domain (EF).

Language, literacy, and mathematics impacts were in the moderate-to-large range (effect sizes 0.45–0.62), whereas EF impacts were in the small range (0.20–0.27). From a developmental perspective, the small positive impacts on children's EF dimensions—working memory, inhibitory control, and attention shifting—are particularly interesting. Small impacts on EF are consistent with the "spillover" hypothesis described earlier in this article; that is, mathematics, language, and literacy curricula that are cognitively focused may also improve other cognitive developmental domains like EF, even without directly targeting them. For example, evidence suggests that mathematics skills such as number composition and decomposition are quite closely related to working memory (Geary, Hoard, Byrd-Craven, Nugent, & Numtee, 2007). Furthermore, preschool numeracy and geometry activities make demands on children's ability to shift attention appropriately among problem elements, and to inhibit automatic or prepotent responding to only one aspect of a given problem (Welsh et al., 2010). Language skills such as expressive and receptive vocabulary are associated with better performance on inhibitory control and attention shifting among young children (Fuhs & Day, 2011). The curricula implemented in Boston aimed to enhance these particular mathematics, language, and literacy skills and therefore may have led to simultaneous impacts on EF dimensions. The possible mathematics-EF spillover is particularly promising, given that the optimal approach for promoting EF skills in prekindergarten is unknown and given that early mathematics skills are a robust predictor of later academic achievement in both math and reading (Duncan et al., 2007).

Although we cannot pinpoint specific active ingredients that led to detected effects, we believe the combination of curricula and coaching, implemented with majority masters-level teachers, likely played a major role. The OWL and Building Blocks curricula have shown promising results to date in other studies (Ashe et al., 2009; Clements & Sarama, 2007b; Clements et al., 2011) and we found that teachers implemented them moderately well. Furthermore, it is possible that implementing both a mathematics curriculum and a language and literacy curriculum created a synergistic effect, as both evidence and theory suggest that stronger literacy and language skills can support children's learning of mathematics skills, and vice versa (Duncan et al., 2007; Harrison, McLeod, Berthelsen, & Walker, 2009; Wagner, Venezky, & Street, 1999).

The mix of children from lower and higher income families in the BPS prekindergarten program may also have contributed to the detected impacts. Boston and Tulsa are the only public prekindergarten contexts examined to date in which applications were not restricted by family income requirements, and both achieved particularly strong results. Among older students, having higher achieving peers from higher income families can affect individual children's achievement, particularly for lower ability students or those from poorer backgrounds (Zimmer & Toma, 2000). The positive effects of having higher ability peers also occur among preschoolers (Henry & Rickman, 2007). Across the 40 states with prekindergarten programs, only 8 did not have requirements prioritizing lower income families (Barnett et al., 2010).

The counterfactual care options in Boston are worth considering as a potential alternative explanation of detected effects. Strong results in Boston could have been a function of lower quality alternative care in the control group. Approximately two thirds of control-group children were enrolled in nonrelative care and nearly half were enrolled in center care, proportions that roughly mirror national trends (Haskins & Barnett, 2010). Making this alternative explanation unlikely, relative to other states, child-care regulations in Massachusetts are among the most stringent in the nation (National Association of Child Care Resource & Referral Agencies, 2011).

In terms of subgroups, we found that impacts on most outcome measures were not statistically significantly different when comparing children from more affluent versus less affluent households. Likewise, focusing on results that were robust to bandwidth and functional form, effects for Hispanic and Asian children were not statistically significantly higher than those of White children for the majority of outcomes. Our findings run counter to some studies that suggest that the positive benefits of preschool accrue mostly or entirely to poorer and minority children (see Currie, 2001). As in the Tulsa prekindergarten program (Gormley et al., 2005), more affluent and White children also benefited from the BPS prekindergarten program.

Nonetheless, findings for Hispanic children versus their White peers should be highlighted, as we found the largest number of statistically significant effects for Hispanics (5 of 12 measured, encompassing all examined cognitive domains). A limitation of our study is that children were tested in English only. However, our findings align with those from the Head Start Impact Study (U.S.

Department of Health and Human Services, 2010) and from the Tulsa prekindergarten evaluation (Gormley et al., 2005), which also found larger impacts on cognitive outcomes for Hispanic children. Evidence suggests that Hispanic children may be particularly likely to benefit from high-quality, supportive instructional contexts (Han, 2008). Furthermore, the rates of growth of children from lower income Spanish-speaking homes can surpass that of native-born children in both word reading and oral language skills (Mancilla-Martinez & Lesaux, 2011). Nationally, Hispanic children are underrepresented in preschool programs and their enrollment rates in recent years have even declined (Fuller & Kim, 2011). In Boston, among Hispanic children entering regular education kindergarten in fall 2009, 39% had experienced the BPS prekindergarten in the previous year, compared to 42% of Blacks, 51% of Whites, and 58% of Asians. Policy-level efforts to increase the enrollment of Hispanic children in prekindergarten programs may be particularly beneficial from both developmental and cost–benefit perspectives.

Ultimately, our study cannot unpack the causal mechanisms behind the detected effects. Our results concern the effects of the combination of these particular prekindergarten curricula and coaching, in the context of Boston's prekindergarten teaching workforce, on children's developmental outcomes. Identifying the causal active ingredients should be a priority in future research on the impact of prekindergarten programs. Likewise, due to the RD design, our results generalize only to students at the cutoff. Future research should prioritize using other research designs, such as randomized controlled trials, to inform the degree to which impacts in our study and similar studies generalize to those farther away from the cutoff. An additional limitation of our study is that children were tested in English due to concerns about the psychometric validity of combining scores from the English and Spanish versions of the same measure (e.g., the PPVT and its Spanish-language counterpart, the Test de Vocabulario en Imagenes Peabody use different norming populations, as well as different stop rules).

Despite these limitations, our results provide further evidence on the benefits of public prekindergarten programs for children. In particular, the combination of evidence-based curricula and coaching supports implemented at scale in the context of Boston's public schooling system brought about educationally and statistically significant improvements in multiple domains of school readiness. As such, the results contribute to the literatures on preschool quality improvement as well as public prekindergarten evaluations.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Appendix S1. Interpreting the RD Estimates.

Appendix S2. Addressing Threats to Validity and Robustness Checks.

Appendix S3. Comparison of Participating and Nonparticipating Schools and Teachers.

Appendix S4. Additional Supporting Tables and Figures.

Appendix S5. References.

Summary of Great Start Readiness Program Evaluation Findings 1995-2011

- Kindergarten teachers consistently rated GSRP graduates as more ***advanced in imagination and creativity, demonstrating initiative, retaining learning, completing assignments*** and as ***having good attendance*** (Florian, et al., 1997).
- Second grade teachers rated GSRP graduates higher on being ***ready to learn, able to retain learning, maintaining good attendance and having an interest in school*** (Xiang & Schweinhart, 2002).
- A ***higher percentage of 4th grade GSRP graduates passed the MEAP*** compared to non-GSRP students (Xiang & Schweinhart, 2002).
- GSRP boys ***took more 7th grade math courses*** than non-GSRP boys (Malofeeva et al., 2007).
- GSRP ***children of color took more 8th grade math courses*** (Malofeeva et al., 2007).
- Significantly ***fewer GSRP participants were retained in grade*** than non-GSRP students between 2nd and 12th grades (36.5% versus 49.2% in 12th grade) (HighScope, 2011).
- Significantly ***fewer GSRP children of color were retained for two or more grades*** than their non-GSRP counterparts by the 12th grade (14.3% versus 28.1% in 12th grade) (HighScope, 2011).
- More GSRP students ***graduated on time from high school*** than non-GSRP participants (58.3% versus 43.0%) (HighScope, 2011).
- More ***GSRP children of color graduated on time from high school*** than non-GSRP participants (59.7% vs. 36.5%) (HighScope, 2011).

The findings provide evidence of both the short- and long-term impact of GSRP attendance on student outcomes.

*The data used for these analyses were collected from a cohort of 595 children (338 GSRP graduates and 258 non-GSRP graduates) from six districts who were followed from kindergarten through 12th grade.

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Attachment B

Michigan Great Start Readiness Program Evaluation 2012: High School Graduation and Grade Retention Findings

Lawrence J. Schweinhart, Zongping Xiang, Marijata Daniel-Echols,
Kimberly Browning, & Tomoko Wakabayashi

HighScope Educational Research Foundation
600 North River Street, Ypsilanti, MI 48198-2898
http://www.highscope.org

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Office of Great Start/Early Childhood

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About HighScope Educational Research Foundation

HighScope Educational Research Foundation is an independent, nonprofit organization with headquarters in Ypsilanti, Michigan. Founded in 1970, HighScope's mission is to lift lives through education so everyone can succeed in life and contribute to society. Its vision is widespread participatory education in which students and teachers are partners in shaping the learning experience. To this end, it engages in evaluative research, development of curriculum, training, and assessment materials, and dissemination through educational services and publishing. These activities target teachers and caregivers in early childhood programs. It also disseminates research findings to those who influence children's lives, including teachers, child-caregivers, parents, administrators, policymakers, academics, and researchers. We value your opinions and pay attention to them in our work. If you have any comments or suggestions about this or any other HighScope's research related reports, please contact:

HighScope Educational Research Foundation
Research Department
600 N. River Street
Ypsilanti, MI 48198-2898
Fax: 734-485-2000
research@highscope.org

The HighScope Educational Research Foundation website address is *http://www.highscope.org*

Table of Contents

List of Tables and Figures

Tables

Figures

Acknowledgments

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Abstract

This evaluation of the Great Start Readiness Program finds that 58 percent of GSRP participants, as compared to 43 percent of non-participants of similar background, graduated from high school on time. This difference was greater among students of color – 60 percent versus 37 percent. This difference occurred because 37 percent of GSRP participants as compared to 49 percent of non-participants repeated a grade during their schooling. In particular, 14 percent of GSRP participants of color as compared to 28 percent of non-participants of color repeated two or more grades. In addition, 35 percent of GSRP participants as compared to 28 percent of non-participants were found proficient in math and language arts on the Michigan Merit Examination at grades 11 or 12.

Introduction

This report presents the findings of the evaluation of the Great Start Readiness Program (GSRP) through high school graduation. The GSRP is the state-funded preschool program of the state of Michigan, which began in 1985. This study uses GSRP study data to investigate the relationship between state-funded preschool attendance and short- and long-term child outcomes. Data are analyzed from a sample of preschool attendees and non-attendees that spans their schooling from preschool through high school graduation and beyond.

The work presented here extends the investigation of outcomes for 595 children who were enrolled in GSRP during the 1995-96 school year. These students were tracked through high school using data provided by the Center for Educational Performance and Information (CEPI) within the Office of the State Budget and additional data provided to HighScope by the Michigan Department of Education. This report centers on the findings regarding high school graduation and grade retention.

- The principal research question is whether GSRP participation improves the high school graduation rate, on time and a year later.
- The second research question is how much the GSRP effect on grade retention influences the timing of high school graduation.

This report begins with a review of the findings of evaluations of early childhood education programs. It next looks at the methods and previous findings of this Great Start Readiness Program Evaluation. It then presents the analysis of the high school graduation, the analysis of grade retention, and the analysis of how they relate to each other, and the analysis of Michigan Merit Examination scores. It ends with summary, consideration of the study limitations, and conclusions.

A substantial body of evidence points to the fact that high-quality preschool experiences have an effect on children's short-term and long-term development (Barnett, 2011; Belsky et al., 2007; Gorey, 2001; Henry et al., 2003; Peisner-Feinberg

et al., 2001; Schweinhart, Montie, , Xiang, Barnett, Belfield, & Nores, 2005). Several evaluations have been conducted which have specifically evaluated state-funded preschool programs (Early et al., 2006; Gormley et al., 2005; Henry et al., 2003). Most find at least modest, positive program effects on children's performance, attendance, and reduced rates of grade retention. Much of the work that has examined the effect of state-funded preschool programs has focused on relatively short-term impacts. Evaluations have primarily focused on whether or not preschool graduates are ready for kindergarten or how preschool attendance affects student performance in kindergarten and first grade (Hustedt et al., 2007; Lamy et al., 2005). Few studies have looked beyond the kindergarten and first grade performance of attendees of state-funded preschool programs (Henry et al., 2003; Peisner-Feinberg et al., 2001).

The Great Start Readiness Program (GSRP), formerly the Michigan School Readiness Program (MSRP), is a state-funded preschool initiative which began as a pilot program in 1985. To qualify for the program, a child must be four years of age and have at least two of the following risk factors: low birth weight, developmentally immature, physical and/or sexual abuse and neglect, nutritionally deficient, long-term or chronic illness, diagnosed handicapping condition (mainstreamed), lack of stable support system of residence, destructive or violent temperament, substance abuse or addiction, language deficiency or immaturity, non-English or limited English speaking household, family history of low school achievement or dropout, family history of delinquency, family history of diagnosed family problems, low parent/sibling educational attainment or illiteracy, single parent, unemployed parent/parents, low family income, family density, parental/sibling loss by death or parental loss by divorce, teenage parent, chronically ill parent/sibling (physical, mental or emotional), incarcerated parent, housing in rural or segregated area, and other (can only apply to 10 percent of the enrolled children). (Eligibility criteria for GSRP have since been pared to eight risk factors.)

Since 1995 the HighScope Educational Research Foundation has served as independent evaluator for the GSRP. Evaluators have followed a cohort of program and comparison children who entered kindergarten during the 1996-97 school year at six evaluation sites across the state. This cohort consisted of 338 GSRP children and 257 other children of the same age who did not have a preschool program experience and came from families whose parents' self-reported income was low enough to have qualified them for GSRP.

Evaluation Method

Data were analyzed with Bernoulli hierarchical generalized linear modeling to investigate the differences between GSRP participants and non-participants, controlling for student and school characteristics. We examined how students who attended GSRP compared to students who did not attend GSRP on two primary outcomes of interest, grade retention and high school graduation. These analyses controlled for student-level demographic and socioeconomic variables including

age, gender, ethnicity, special need status in early grades, mother's level of education at school entry, free lunch status and the frequency of school transfers since middle school (6^{th} – 12^{th} grades).

The evaluation of the 1995-1996 GSRP cohort started with 338 children who attended a GSRP program during the 1995-1996 school year in six selected sites across the state of Michigan. It also included an additional 258 children at these sites who did not attend a GSRP program (no GSRP), but were like their counterparts in age and socioeconomic status. The no-GSRP students in this cohort entered kindergarten in 1996, the same year as the GSRP children, but they did not have a preschool program experience. They came from families whose parents' self-reported income was low enough to have qualified them for the GSRP, that is under 200 percent of the federal poverty level – $30,300 for a 4-person family in 1996 (Assistant Secretary for Planning and Evaluation, 2012). The state's median income at that time was $51,342 (State median income estimates, FY 1997). The KidsCount Data Center estimates that 45 percent of Michigan's children live below 200 percent of the poverty level (KidsCount Data Center, 2011). Examination of the 25 risk factors indicated that the GSRP group was representative of the GSRP students across the state (Xiang & Schweinhart, 2002).

As shown in Table 1, no significant differences were detected between the GSRP participants and non-participants in age, gender, fathers present at home, persons in the household, mother's highest year of education, or household annual income; the GSRP group fathers had .41 more years of education than the no-GSRP group fathers (Xiang & Schweinhart, 2002).

Table 1
Characteristics of Children and Their Families, by GSRP Status

Characteristic	GSRP (n = 239-336)	No GSRP (n = 183-255)
Average age at kindergarten entry	5.30	5.29
Females	51.4%	51.0%
Fathers present at home	61.5%	60.6%
Average number of persons in the household	4.53	4.69
Average of mother's highest year of education	12.14	11.95
Average of father's highest year of education	12.11*	11.70
Average annual income of households	$17,882	$18,022

*:p<.05

Previously Reported Findings

Previous reports of the findings of the evaluation of this cohort have appeared through kindergarten (Florian, Schweinhart, & Epstein, 1997), second grade (Xiang, Schweinhart, Hohmann, Smith, & Storer, 2000), fourth grade (Xiang & Schweinhart, 2002), and middle school (Malofeeva, Daniel-Echols, & Xiang, 2007).

In kindergarten, teachers and trained observers rated the development of the GSRP group significantly better than the no-GSRP group (Florian et al., 1997). Teachers rated them significantly better on *initiative, learning retention, completion of assignments,* and *creativity in using materials.* Trained observers rated them significantly better on *shows initiative, has a good attendance record, interested in school work, gets along with other children, gets along with teachers and other adults, takes responsibility for dealing with own errors or problems, retains learning well, is cooperative, completes assignments, imaginative and creative in using materials*, and *ready to learn and participate in school.* These findings were later confirmed using additional background information on the children.

In grade 2, teachers ranked the GSRP group significantly higher than the no-GSRP group on the School Readiness Rating Scales (SRRS) of *ready to learn, retaining learning, good attendance,* and *interest in school work.* In addition, the GSRP group had a significantly lower grade retention rate than the no-GSRP group (8% vs. 15%; Xiang et. al, 2000).

Kindergarten through grade 3 teachers ranked the GSRP group significantly higher than the no-GSRP group on the SRRS scales of *retains learning, ready to learn and participate, shows initiative, good attendance,* and *shows interest in school work.* Grade 4 teachers rated the GSRP group significantly higher than the no-GSRP group on *literacy skills, thinking skills,* and *makes good progress to next grade* (Xiang & Schweinhart, 2002).

In grade 4, students who had attended GSRP had a significantly higher percentage of satisfactory scores on the Michigan Educational Assessment Program (MEAP), the state-wide test assessing student academic performance, than students who had not attended GSRP. Larger percentages of the GSRP group demonstrated proficiency on the MEAP in both math (55% vs. 47%) and reading (43% vs. 35%). Again, a smaller percentage of the GSRP group than the no-GSRP group had ever repeated a grade (14% vs. 22%). Parents of GSRP students were significantly more involved in school activities and communication with teachers during the first 3 years of school than comparable parents whose children did not participate. Parent involvement, as in previous years, was positively correlated to children's social relations scores across years, and with their 4th grade academic performance.

To examine whether the positive effects of GSRP were sustained in the middle school years, five outcomes were examined when the 1996-1997 kindergarten cohort were in grades 6-8. The outcomes examined were: Michigan Educational Assessment Program (MEAP) state-wide assessment results in 7th grade; grade retention in grades 6-8; school attendance in grades 6-8; math and science course enrollment in grades 7 and 8; and receipt of Title I and special education services at the end of grades 6-8. While no group differences were found in the MEAP scores, school attendance, or Title I/special education services, and mixed results were found for math and science course enrollment, a significant association persisted for grade retention. GSRP participants were less likely to be retained in grades 6-8. The

effect on grade retention was more complex in grades 7 and 8, when an interaction effect was found between GSRP participation and race. While fewer GSRP participants of color were retained in grade, this effect was not found for white GSRP participants. Similarly, an interaction was found between GSRP participation and gender, and GSRP boys were significantly less likely to be retained than non-GSRP boys. No similar effect was found for girls.

For Title I/special education services, GSRP participants were found to have relatively higher rates of special education services in grades 7 and 8, as one might expect given their larger number of risk factors. However, since information on risk factors for no-GSRP comparison students was not collected at the beginning of the study, the implication of this result remains unclear (Malofeeva et al., 2007).

High School Graduation

Two indicators were used to represent high school graduation: (1) "Graduation on time" with a diploma before or at the end of 13 years of schooling (K-12); and, (2) "Graduation on time or a year later" which included graduation with a diploma by the end of 14 years (the last year data were available for the analysis). For both measures, participants who obtained a GED by the end of 13 or 14 years of schooling were coded as not graduated.

Method

The analysis included 503 GSRP participants out of the original 595. The overall retention rate was 85 percent, with little difference between the GSRP and no-GSRP groups (86% vs. 83%) and little variation across the six study sites (78% - 91%). The data used in the analysis came from the Michigan Student Data System, which tracks Michigan public school students 3 times a year on such measures as their enrollment, grade level, and graduation status. For the 92 participants who were not included in the graduation analysis, 37 had not had any record in the database since the system's inception. The remaining 55 were not included because of the unavailability of their schooling status, potentially due to a transfer out of the system (e.g., transferring to an out-of–state school, private or home school) or because they disappeared from the system (e.g., no record was found for a school period or following a transfer to another within-state school).

Analysis of the remaining 503 participants did not reveal significant differences between the GSRP and no-GSRP groups in their student-level demographic and socioeconomic variables including age, gender, ethnicity, special need status in early grades, mother's level of education at school entry, free lunch status and the frequency of school transfers since middle school (6^{th} – 12^{th} grades). The 55 students who were not included in the analysis due to transfer or disappearance from the system were found to be significantly lower in family income at school entry ($p < .05$) and tended to be more likely to be held back in grade ($p = .12$) compared to the 503 participants.

The Bernoulli hierarchical generalized linear model (HGLM) was used to examine whether high school graduation was related to students' GSRP participation, controlling for seven covariates (age, gender, race, special education status in earlier grades, level of mother education at school entry, free lunch status grade 6-12, and frequency of school transfers grade 6-12). The analysis also adjusted for school district differences.

Findings

Table 2 shows that significantly more of the GSRP group than the no-GSRP group **graduated from high school on time** (57% vs. 43%, $p < .01$) – a difference of 14 percentage points. This difference was smaller for white students – only 9 percentage points and not statistically significant (56% vs. 47%). But it was larger and clearly significant for non-white students—22 percentage points. (59% vs. 37%, $p < .01$).

Table 2
High School Graduation on Time, by GSRP Status and Race

	GSRP	No GSRP
All	57.3%**	42.5%
Non-white	58.8%**	36.5%
White	56.3%	46.5%

**: $p < .01$; *: $p < .05$; GSRP percents are adjusted for the effects of 7 covariates.

Table 3 shows that GSRP and no-GSRP groups did not differ significantly in their **high school graduation rates on time or a year later** (64% vs. 60%), nor did GSRP and no-GSRP boys differ in this variable (51% vs. 59%). However, significantly more GSRP than no-GSRP girls graduated on time or a year later (75% vs. 62%, $p < .05$) – a 13.5 percentage-point difference.

Table 3
High School Graduation on Time or a Year Later, by GSRP Status and Gender

Gender	GSRP	No GSRP
All	64.1%	60.3%
Male	50.5%	58.7%
Female	75.3%*	61.8%

*: $p < .05$; GSRP percents are adjusted for the effects of 7 covariates.

The finding of a GSRP effect on high school graduation on time but not on high school graduation on time or a year later points strongly to grade retention as the mediator between GSRP and high school graduation. The correlation between grade retention and on-time high school graduation was -.731 (Spearman's *rho*, $n = 503$, $p < .001$). Table 4 shows that, combining GSRP participants and non-participants, 80 percent of the non-retained students, but only 6 percent of the retained students, graduated from high school on time. A year later, 3 percent more of the non-retained students and 28 percent more of the retained students graduated, so that 83 percent of the non-retained students and 34 percent of the retained students graduated from high school by then. (The high school graduation rate for students retained two or three years was only 6 percent at that point.) Despite some catching up a year later, grade retention led to almost twice as many high school dropouts as high school graduations.

Table 4
High School Graduation Timing by Grade Retention Status

Grade Retention Status	Graduation on Time ($n = 250$)	Graduation a Year Later ($n = 65$)	Not Graduated Yet ($n = 178$)
Never retained ($n = 297$)	80.1%	2.7%	17.2%
Ever retained ($n = 206$)	5.8%	27.7%	66.5%
Retained 1 year ($n = 126$)	7.5%	41.3%	49.2%
Retained 2 or 3 years ($n = 80$)	0.0%	6.3%	93.8%

The path from GSRP to not repeating a grade to on-time high school graduation is also evident in the amount that grade retention adds to the prediction of on-time high school graduation status by GSRP status and the seven background covariates used in these analyses (age, gender, race, special education by grade 4, mother's education, family income eligibility for the free lunch program, and number of school transfers in grades 6-12), using logistic regression analysis. Its contribution was quite strong (*beta* = -4.09, $p < .001$). Using the Cox and Snell R^2, the variance accounted for was .202 without grade retention and .494 with it – an increase of .292.

Grade Retention

Grade retention has been implemented as a strategic intervention in public schools for decades, despite the limited availability of data to support the efficacy of the practice. While its prevalence has fluctuated over time, the last two decades have seen increased numbers of students retained seemingly due to two intricately related trends: (1) increased efforts to end the practice of social promotion (the practice of promoting students with their class whether or not they have obtained the performance goals/skills required for the next grade); and (2) the push for

educational accountability tied to the advent of the No Child Left Behind law in 2001.

Meta-analyses and reviews of retention research have largely concluded that grade retention provides few benefits for students. Jimerson (2001) reviewed 19 studies comparing academic achievement (i.e., reading, math and language) and socio-emotional adjustment between retained and matched comparison students and found negative effects of grade retention across all areas of achievement and socio-emotional adjustment. Jimerson, Anderson and Whipple (2002) reviewed 17 studies which examined using grade retention as a potential predictor of dropping out. They consistently found that despite varying limitations (such as the decade during which the studies were undertaken, location, ethnicities and differing researchers and designs) retention in grade was highly associated with dropping out of high school. In an extensive review of 91 studies published since 1980, Xia and Kirby (2009) found that, in general, grade retention does not appear to benefit students academically and that retained students are at a significant risk for dropping out of school.

Despite the consistent theme regarding the negative impacts of grade retention, the use of retention is still quite commonplace. In 2007 national statistics indicate that approximately 10 percent of all students from kindergarten through 8th grade had been retained at least once with the largest percentage of the retentions having occurred in kindergarten or 1st grade (34%). More males than females (12% vs. 8%), more Blacks than Whites or Hispanics (16% vs. 8% and 10.9%), and in regions of the U.S., more children were retained in grade in the south (13%) than in the northeast (11%), midwest (8%) or west (6%). The percentage of K-8-retained students from poor families (23%) outpaced near-poor (11%) and non-poor (5%). Mothers with the lowest educational attainment had the highest percentage of children retained (20%) (U.S. Department of Education, 2009).

Grade retention is identified as whether or not a student spent another year in a grade of school. It accumulates from kindergarten through the end of high school. For consistency, we use this term for high school students who do not accumulate enough credit hours in a year to move on to the next grade. Once a student was counted as being retained in a grade, he or she was counted as retained through the rest of schooling, regardless of actual grade or whether their record was available in the later years. If no available record indicated any grade retention, a student was defined as not retained each year through the end of high school even for the years with no available records for any reason, such as moving out of state, dropping out of school, transferring to un-graded programs or non-public schools, or simply disappearing from the system.

The rationale for calculating grade retention this way is that it corrected for under-estimation of the grade retention rate based only on students with available records. Preliminary analyses indicated that students whose records were not available were significantly more likely to be held back than students whose records were available

(57% ever retained rate for the 80 students with no available records for the last year of high school compared to 40% for the 478 students with available records, $p < .01$). To use a grade retention rate that did not account for the impact of students without records would have biased the estimate of the magnitude of grade retention especially for the last two years of high school. Despite this correction, underestimation was still possible. But our estimates also included a small amount of overestimation by including a few students who later caught up with their age-mates. Table 4 shows that 7 percent of those retained in grade graduated from high school on time.

An additional indicator for grade retention was generated for those students who were retained for two or more grades. Multiple grade retention began to appear in middle school and grew considerably in high school (n = 89, 16% of 558, by 12th grade). While students retained two or more grade levels were obviously a portion of the group of ever retained students, their tendency to end up with even lower educational achievement warranted a separate analysis to determine how GSRP participation affected them.

Once a student was identified as being retained for more than one grade level, the student remained multiply retained through end of high school regardless of the actual grade placement listed or whether the student's record was available in the later years. If no available record indicated any grade retention, a student was defined as not retained each year through end of high school even for the years with no available records for any reason.

Method

The sample for the grade retention analyses included all the 558 participants (318 GSRP students and 240 no-GSRP students) who had at least one year's record available from the Michigan Single Record Student Database since its inception. The database was created when the participants were in 6th grade. The 558 participants accounted for 94 percent of the original sample (n=595) for the first GSRP evaluation longitudinal study with little differences between the GSRP and no-GSRP groups (94% vs. 93%), as well as the six original sites where the sample was selected (92% – 96%). Since the attrition was low and the data for the 37 missing students was limited, no comparative analysis was conducted between the missing study participants and included study participants in demographic and socioeconomic background. With available grade level data for the 25 out of the 37 missing students however no difference was found in grade retention by the 4th grade between the missing 25 and the 558 included participants (16% vs. 17%).

The Bernoulli hierarchical generalized linear model (HGLM) was used to examine whether retention status was related to students' participation in the GSRP. To adjust for group differences in child demographic and socioeconomic backgrounds, seven covariates (age, gender, race, special education status in earlier grades, level of mother education at school entry, free lunch status grade 6-12, and school

transfers in grades 6-12) were included at Level 1 of the model while estimating group difference in retention status. To account for the influence of school districts on grade retention policies as well as demographic differences in the populations served, random effects of school districts were estimated at Level 2 of the model so that the effect of school districts could be adjusted for.

A 2-level HGLM was conducted of ever retained in grade for each year from 1st through 12th grade. Because the percentage of multiple retentions (two or more grade levels) in the middle school years was very low (1%-2%) this analysis was conducted for each year from 9th through 12th grade. In addition to the expected transfers from middle schools to high schools, a large percentage of students transferred between schools in middle and high school years (at least once for 39% of the study participants in middle school and for 43% of the study participants in high school), so analyses were conducted by year to provide a rigorous control for school district effects.

Findings

Table 5 shows the effect of GSRP participation on grade retention status by grade 12. Without GSRP participation, 49 percent of this at-risk group repeated at least one grade by grade 12. While this sample of students was selected to be from families of lower income than others, it is nonetheless striking that virtually half of them repeated a grade. Grade retention is clearly a widely prevalent strategy for combating school failure in Michigan. In comparison, only 37 percent of the GSRP participants repeated at least one grade – a reduction of 12 percentage points or about one fourth as many. In the no-GSRP group, almost half as many students repeated two grades as repeated one grade, and almost half as many students repeated three grades as repeated two grades. GSRP participation reduced grade retention in all three categories, particularly those repeating three or more grades.

Table 5
Grade Retention by Grade 12, by GSRP Status

Grade Retention Status	GSRP (n = 318)	No GSRP (n = 240)
Never retained in grade (n = 323)	63.2%**	50.8%
Repeated at least one grade	36.8%	49.2%
Repeated one grade (n = 149)	24.2%	30.0%
Repeated two grades (n = 63)	9.7%	13.3%
Repeated three grades (n = 23)	2.8%	5.8%

**: $p < .01$; GSRP percents are not adjusted for the effects of 7 covariates.

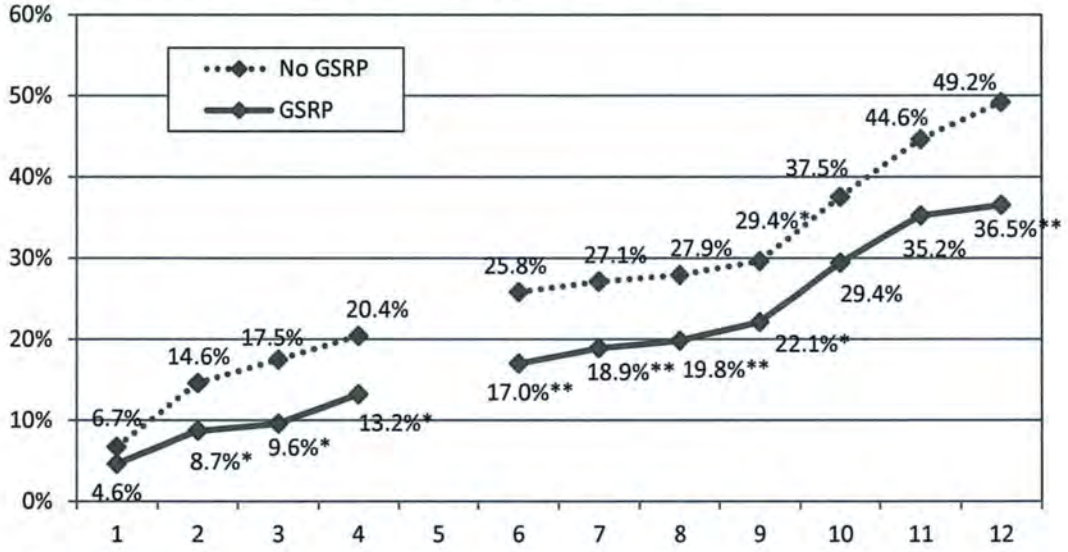
As Table 5 shows, 37 percent of GSRP participants were retained by grade 12, compared to 49 percent of the no-GSRP group, a statistically significant, 12 percentage-point difference. These percentages were virtually unaffected when adjusted for the effects of the seven covariates used in these analyses.

The Michigan School Data System provides a count of Michigan students reported in the same grade for two consecutive school years for every grade from kindergarten through grade 12 from 2003 through 2010. To equate this count to the cumulative grade retention rates reported herein, we subtracted from it an estimate of multiple grade retentions two-thirds as great as that in the study sample (because the state's children are not all disadvantaged). By this method, the cumulative grade retention rate by grade 12 for all the students in the state averaged 35 percent over the years. The no-GSRP group's 49 percent cumulative grade retention rate was 14 percentage points higher, presumably because the no-GSRP group was limited to lower-income children. The GSRP group's 37 percent cumulative grade retention rate was very close to the state's 35 percent rate. In other words, the GSRP experience erased most of the grade retention difference due to the GSRP group's disadvantages.

Michigan public schools spend $11,987 for every grade a student repeats (Spencer, 2011), while the state spends $3,400 for a student to participate in the one-school-year GSRP, 28 percent as much. Michigan had 100,000 four-year-olds in 2010 (U.S. Census Bureau, 2012), and 45 percent of them, that is, 45,000, lived below 200 percent of the poverty line (KidsCount Data Center, 2011). Without GSRP, an estimated 22,140 of these children would be retained at some time in their schooling. If GSRP served all eligible children, 16,425 of them would be retained, a reduction of 5,715 students retained in grade. In fact, GSRP has funding to serve 30,668 children in 2011-2012, equivalent to 68 percent of those under 200 percent of poverty, at a cost to the state of $103,375,000. If GSRP were funded to serve all children under 200 percent of poverty at $157,500,000, the undiscounted savings from grade retention alone would be $68,505,705, which would amount to 43.5 percent of the cost of GSRP. This simple calculation does not quantify additional savings from reducing school failure and delayed high school graduation, as well as their lifetime effects on earnings and employment and crime reduction. This return could be increased by better targeting of children and better funding per child leading to higher-quality programming.

As Figure 1 shows, GSRP participants started to be significantly less likely to be held back than the no-GSRP group by grade 2 (9% vs. 15%, $p < .05$). The differences between the two groups remained statistically significant through the 12th grade with GSRP participants being lower by 7-9 percentage points from 3rd through 11th grade, as graphically shown in Figure 1.

Figure 1. Grade Retention, by GSRP Status and Grade



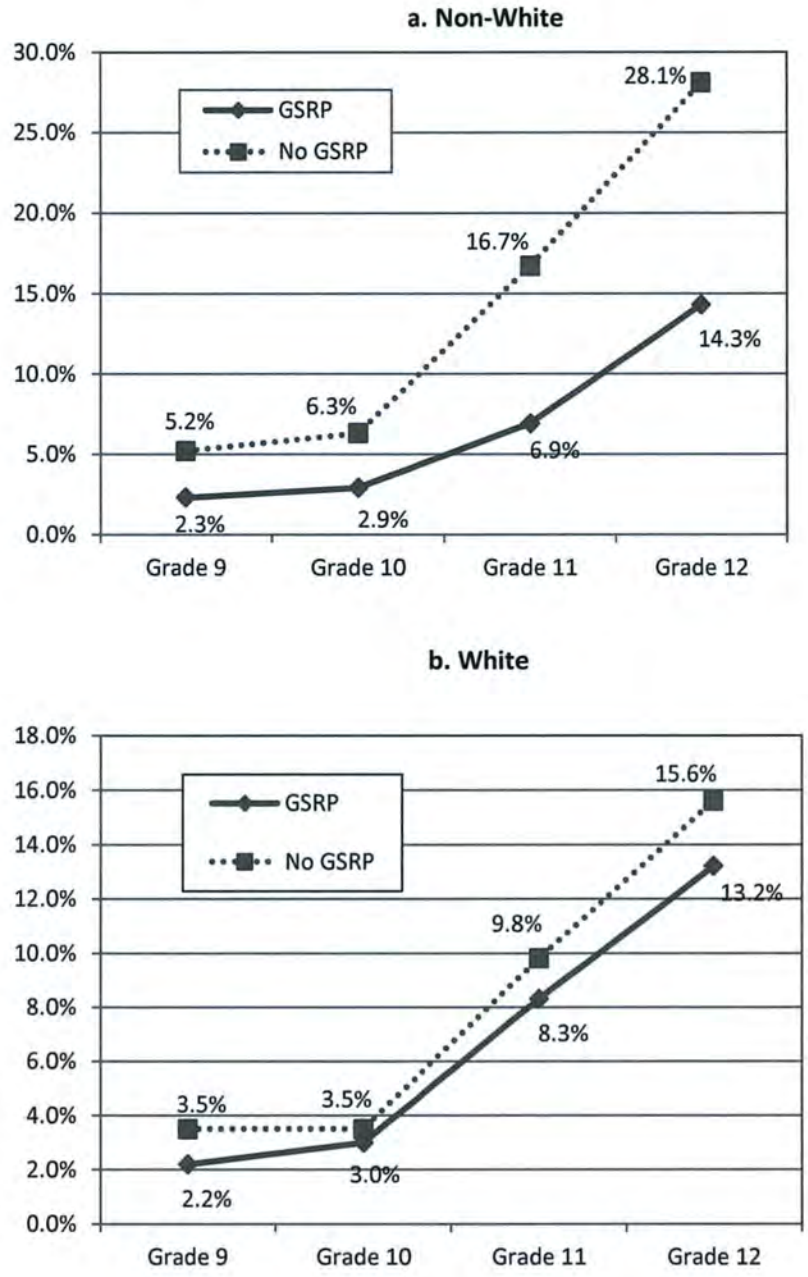
*:$p<.05$; **:$p<.01$

Multiple Grade Retention

The GSRP effects on multiple grade retention by grade 12 differed by race, so Figure 3 presents these effects by race. Only 14 percent of the GSRP participants of color repeated more than one grade, as compared to 28 percent of the non-participants of color. Only 13 percent of the white GSRP participants repeated more than one grade, as compared to 16 percent of the white non-participants. In other words, almost one third of children of color repeated more than one grade, double the rates of GSRP participants of color and white children, whether or not they attended GSRP.

Figure 2 presents the differences in multiple grade retention by high school grade level. Multiple grade retentions rose sharply in grades 11 and 12, doubling or tripling from grade 10 to grade 11 and then almost doubling again from grade 11 to grade 12. The increases are sharp for all four groups, but markedly less for GSRP participants of color than for non-participants of color. So the GSRP effect on the multiple grade retention of children of color becomes most pronounced toward the end of K-12 schooling, as far away from the prekindergarten years as it could be.

Figure 2. Multiple Grade Retention, by Race, GSRP Status, and Grade



Who Repeats a Grade?

The Great Start Readiness Program had effects on children's teacher-rated readiness for school at entry, their grade retention throughout their schooling, and their on-time high school graduation status. Grade retention status is clearly a principal mediator of program effects to the longer term in general and to on-time high school graduation status in particular. That raises the question of what grade retention status means and why it is influenced by GSRP participation.

Table 6 compares the kindergarten teacher ratings of children in this study sample who were retained by grade 4 to those of children in this study sample who were not retained by grade 4. The comparisons favored the non-retained group on all items. Items are listed in the order of the size of the difference between the two groups, so that the first items are the one most strongly associated with grade retention. Grade-level performance or better on literacy and math skills heads the list and is followed by eight items that load on a good student factor that clearly differentiates the groups (Xiang & Schweinhart, 2002). The weakest three items load on a social relationships factor that does not differentiate the groups. We conclude that teachers retain students whom they do not consider good students and do not retain students whom they do consider good students. Teachers' grade retention decisions are decisions about student scholarliness.

Table 6
Kindergarten Teacher Ratings of Children Retained or Not by Grade 4

Characteristic [a]	Not Retained (n = 387)	Retained (n = 71)	Difference
Literacy skills at or above grade level	74.4%	22.4%	52.0%***
Math skills at or above grade level	80.2%	32.8%	47.4%***
Good student factor [b]			***
Retains learning frequently	61.0%	15.7%	45.3%***
Completes assignments frequently	79.5%	39.4%	40.1%***
Shows initiative frequently	54.0%	17.6%	36.4%***
Interest in school work frequently	71.1%	31.4%	39.7%***
Ready to learn and participate frequently	71.0%	35.2%	35.8%***
Imaginative and creative frequently	51.7%	24.6%	27.1%***
Good attendance frequently	79.8%	57.7%	22.1%***
Takes responsibility for own errors frequently	51.9%	31.0%	20.9%***
Social factor [c]			--
Gets along with other children frequently	80.3%	60.6%	19.7%**
Gets along with teachers frequently	89.6%	74.6%	15.0%**
Cooperates frequently	78.8%	67.1%	11.7%*

*:$p < .05$; ** $p < .01$; *** $p < .001$.
[a] Percents of children rated to show characteristic frequently rather than sometimes or infrequently.
[b] This factor consists of the teacher-rated items that follow it (Xiang & Schweinhart, 2002).
[c] This factor consists of the teacher-rated items that follow it (Xiang & Schweinhart, 2002).

Do School Districts Differ in Grade Retention and On-Time Graduation?

Tables 7 and 8 show how GSRP participants and non-participants at the six sites differed in their rates of grade retention and on-time high school graduation. Despite variation among the sites, GSRP participants performed as well as the non-participants at all the sites on both grade retention and high school graduation on time and did better at all but one of them. The GSRP participation effect was strongest for the Detroit and Muskegon public schools, which also had the highest percentages of non-white participants (39% of the study participants in Detroit and 25% in Muskegon). However, Kalamazoo, which had the third largest number of non-white participants (16%), had no GSRP effect on grade retention or on-time high school graduation. This could be simply due to chance variation or perhaps programs in the Kalamazoo Public Schools, such as the Kalamazoo Promise of free college tuition for all students, attenuated the GSRP effect on grade retention.

Table 7
High School Graduation On Time, by GSRP Status by Site

Site	GSRP	No GSRP	Number of Cases
C.O.O.R Intermediate School District	63.2%	41.5%	79
Detroit Public Schools	59.5%	29.8%	89
St. Clair County	56.0%	55.0%	90
Kalamazoo Public Schools	50.0%	50.0%	70
Muskegon Public Schools	53.5%	38.7%	102
Wyoming Public Schools	50.0%	44.8%	73

Table 8
Grade Retention, by GSRP Status by Site

Site	GSRP	No GSRP	Number of Cases
C.O.O.R Intermediate School District	34.9%	39.0%	84
Detroit Public Schools	44.9%	65.4%	101
St. Clair County	29.3%	37.2%	101
Kalamazoo Public Schools	42.0%	42.4%	83
Muskegon Public Schools	44.4%	64.7%	106
Wyoming Public Schools	21.7%	43.2%	83

Michigan Merit Examination Performance

As part of the Michigan Educational Assessment Program, students are supposed to take the Michigan Merit Examination at grades 11 or 12. It consists of examinations in writing, jobs skills, mathematics, science and social studies. Our analysis looked at

students who scored proficient, partially proficient, or not proficient or who did not take the mathematics and English language arts (reading and mathematics) tests. Students who did not take the tests were the least successful in school: of the 137 students who did not take the MME, 10 percent never repeated a grade, 37 percent repeated one grade, and 53 percent repeated two grades. Table 9 shows that significantly larger percentages of the GSRP group than the no-GSRP group took the exams and scored more proficiently on them. This pattern was statistically significant for both tests together and for mathematics, but not for English Language Arts.

These findings may be compared to the statewide public results for the Michigan Merit Examination in spring 2010 by removing those in the study groups who did not take the test and recalculating the percentages at various levels. In mathematics, 50 percent of the state's students scored proficient, as compared to 37 percent of the GSRP group and 34 percent of the no-GSRP group. In reading and mathematics, 55 percent of the state's students scored proficient, as compared to 39 percent of the GSRP group and 40 percent of the no-GSRP group. Both GSRP and no-GSRP groups scored lower than all the state's students who took the test, reflecting their relative disadvantages.

Table 9
Michigan Merit Examination Proficiency at Grades 11/12, by GSRP Status

Proficiency Level	GSRP (n = 289)	No GSRP (n = 214)	Statistically Significant at p<.05?[a]
Mathematics			
Proficient	26.6%	22.0%	Yes
Partially proficient	11.8%	8.9%	
Not proficient	34.3%	34.6%	
Did not take the test	27.3%	34.6%	
English Language Arts (reading and writing)			
Proficient	28.4%	26.2%	
Partially proficient	30.4%	28.5%	
Not proficient	15.2%	10.3%	
Did not take the test	26.0%	35.0%	
Combined			
Proficient on both	20.4%	18.7%	Yes
Partially proficient on both	17.6%	12.1%	
Not proficient on either or both	36.3%	34.6%	
Took neither test	25.6%	34.6%	

[a] Tested by ordinal regression analysis adjusted for the effects of 7 covariates.

Summary, Limitations, and Conclusions

This evaluation examined how participation in the Great Start Readiness Program was related to performance later in school. This report looked at GSRP effects on high school graduation on time and a year later, grade retention, multiple grade retention, and Michigan Merit Examination proficiency. It identifies the following statistically significant program effects.

- More GSRP participants graduated from high school on time than did non-participants – 57 percent versus 43 percent.
- More GSRP children of color graduated on time from high school than did non-participants – 59 percent versus 37 percent.
- By grade 12, fewer GSRP participants were retained in grade than non-GSRP students – 37 percent compared to 49 percent. The percent of all the state's students ever retained in grade is 35 percent.
- 43.5 percent of the cost of the Great Start Readiness Program was recouped from savings due to the reduction in grade retentions.
- By grade 12, fewer GSRP children of color were retained for two or more grades than their non-GSRP counterparts – 14 percent versus 28 percent.
- At grades 11 or 12, GSRP participants had a higher level of proficiency than non-participants on the Michigan Merit Examination in mathematics (27% vs. 22%) and in math and language arts combined (35% vs. 28%).

These findings come from sites that represent the diverse regions of the state. However, the participating sites volunteered to participate and are not a statistically representative sample of the districts of the state.

Children participating in the study were in the same age cohort, and most of them came from low-income families. But they were selected to participate in the GSRP or not to participate by different procedures. At the time, the GSRP had 25 selection criteria of which a student had to meet two. Most were low-income but not all. But most important is the fact that GSRP group parents enrolled their children in the GSRP while no-GSRP group parents did not, showing that they were likely more motivated regarding the early childhood education of their children.

For more than 12 years, from kindergarten to 12th grade, various aspects of the GSRP program have been evaluated by comparing a group of 1995-1996 GSRP participants to a group of matched no-GSRP group of students. The results of the current study provide strong evidence of a significant relationship between GSRP attendance and participants' lower grade retention rates and high school graduation.

Grade retention is first an indicator of school failure and second an effort to address it. Grade retention reduced the percentage of these students who graduated from high school on time from 81 percent to 7 percent, and it is surprising that these 7 percent of students managed to graduate anyway. Grade retention reduces the

economic efficiency of the school system, adding the cost of a year of school per student for each year of grade retention per student.

The educational debate usually pits grade retention against social promotion, that is, promoting a student who does not meet academic standards anyway, to allow the student to remain with his or her age-mates. But this report suggests another debate that pits grade retention against the Great Start Readiness Program. For both approaches, the cost is for a year of education per student, although the state reimburses less per student for GSRP than it does for other grades. But the relative benefits of the two approaches decisively favor GSRP over grade retention. GSRP prepares children for school success and avoids school failure. Grade retention is a reaction to school failure that further stigmatizes the student and seldom actually remediates this failure. GSRP leads more at-risk children to graduate from high school on time, with their age-mates. Grade retention almost guarantees that the student will not graduate from high school on time alongside age-mates. It is reasonable to assume that students who graduate from high school on time will have better employment and earnings throughout their lifetimes.

The fact that almost half of the comparison students without GSRP repeated one or more grades means that grade retention is thriving in Michigan's educational policy. Unlike GSRP, it does not require legislative recognition, authorization, and appropriation of funding. Were it so, grade retention would surely not be such a widespread policy, since labeling of school failure is its clearest result. The wiser choice for school leaders in Michigan might well be to hold back the money they spend on grade retention and invest it in GSRP instead.

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Effects of a Prekindergarten Educational Intervention on Adult Health: 37-Year Follow-Up Results of a Randomized Controlled Trial

Peter Muennig, MD, MPH, Lawrence Schweinhart, PhD, Jeanne Montie, PhD, and Matthew Neidell, PhD

Objectives. We used 37 years of follow-up data from a randomized controlled trial to explore the linkage between an early educational intervention and adult health.

Methods. We analyzed data from the High/Scope Perry Preschool Program (PPP), an early school-based intervention in which 123 children were randomized to a prekindergarten education group or a control group. In addition to exploring the effects of the program on health behavioral risk factors and health outcomes, we examined the extent to which educational attainment, income, family environment, and health insurance access mediated the relationship between randomization to PPP and behavioral and health outcomes.

Results. The PPP led to improvements in educational attainment, health insurance, income, and family environment Improvements in these domains, in turn, lead to improvements in an array of behavioral risk factors and health (P=.01). However, despite these reductions in behavioral risk factors, participants did not exhibit any overall improvement in physical health outcomes by the age of 40 years.

Conclusions. Early education reduces health behavioral risk factors by enhancing educational attainment, health insurance coverage, income, and family environments. Further follow-up will be needed to determine the long-term health effects of PPP: (*Am J Public Health.* 2009;99:1431–1437. doi:10.2105/AJPH.2008.148353)

Prekindergarten programs provide a secure environment in which children are cognitively enriched, typically via a curriculum that enhances math and linguistic skills. The prekindergarten years (approximately 3 to 4 years of age) are thought to be a critical window for children's intellectual and socioemotional development.[1–4] Prekindergarten programs may be especially important for children with parents with a limited amount of education, who may not be able to provide as rich a learning environment as that available to children whose parents are better educated.[3]

Prekindergarten programs targeting children from low-income households have been shown to produce lifelong improvements in schooling, income, family stability, and job quality.[5–16] These intertwined improvements in social circumstances may in turn improve health through reductions in behavioral risk factors, enhanced job safety, better health insurance coverage, safer neighborhoods of residence, better access to healthy foods, and lower levels of psychological stress.[7,9,16–20]

Nonetheless, the long-term causal linkage between education and health and the pathways through which education affects health have not previously been established in a randomized controlled trial. We investigated whether the High/Scope Perry Preschool Program (PPP) randomized controlled trial improved adult health outcomes and health behavioral risk factors and explored how these outcomes were mediated.

METHODS

In PPP, which was initiated in 1962, 123 preschool-aged (3 or 4 years) African American children were randomized to receive no intervention or to receive a 2-year program of 2.5 hours of interactive academic instruction daily coupled with 1.5-hour weekly home visits.[21] All teachers had a master's degree and had completed training in child development. Children were recruited from low-income, predominantly African American neighborhoods in Ypsilanti, Michigan.

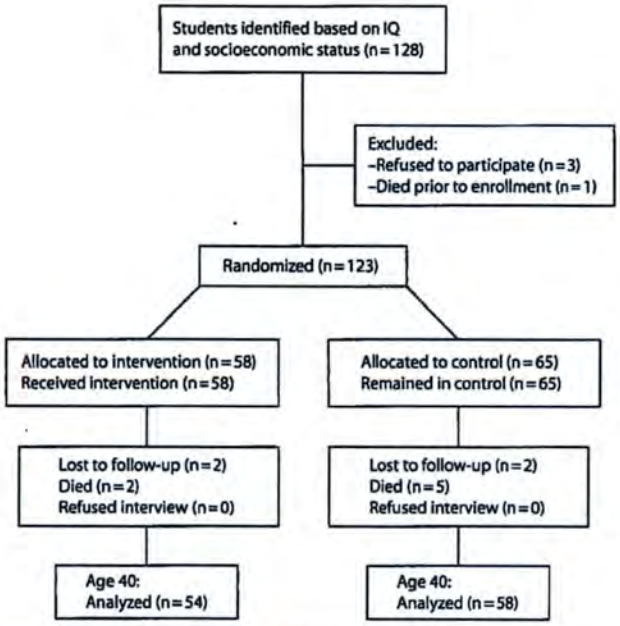
Randomization

Children eligible for PPP were identified via census data, referrals from neighborhood groups, and door-to-door canvassing. To be included, children were required to be of low socioeconomic status (based on an index score, described by Schweinhart et al.,[21] derived from parental income, education, and occupation) and to have an IQ test score (Stanford-Binet) between 70 and 85; children with any diagnosed physical handicap were excluded.

As a result of the small sample size, students were matched according to IQ, socioeconomic status, and gender before group randomization. One student in each pair was then randomized to the PPP condition or the control condition via a coin toss. Siblings were automatically entered into the same group to ensure that the intervention effect was isolated within families.

It was not possible to blind researchers or participants during the process of allocating participants to the experimental or control group. However, researchers were blinded to the collection of all follow-up data. Fifty-eight students were randomized to the intervention group, and 65 were randomized to the control group (Figure 1).[21] After the study began, 8 children with working mothers were removed from the experimental group and replaced with 8 children with nonworking mothers from the control group. This was done because children with working mothers were unable to participate in the PPP home visit component.

Children were initially followed between the ages of 3 and 4 years and then



Note. Eight students were swapped between the experimental and control groups.

FIGURE 1—Randomization flow diagram of participants in the High/Scope Perry Preschool Program.

continuously followed through the age of 40 years. Of the 123 original respondents, 4 could not be located for the age 40 survey (2 in the intervention group and 2 in the control group) and 7 had died (2 in the PPP intervention group and 5 in the control group). Face-to-face interviews conducted when the participants were aged 27 and 40 years were used to collect data on a range of health outcomes and behavioral risk factors. However, because new questions were added at the age 40 interview, data on some outcomes were not available for both interviews (unless otherwise indicated, the outcomes described here represent those assessed when participants were aged 40 years).

Statistical Analyses

Because 8 students with working mothers were exchanged between groups, children in the PPP and control groups differed according to maternal employment status. Thus, to reduce the bias caused by between-group differences in our variables of interest, we controlled for all predetermined covariates: participant gender and IQ; indicators for father's presence in the home and type of employment (skilled or semiskilled); mother's educational level, age, and employment status; and participant age at the midlife interview (given that age is an important determinant of health). We calculated *P* values for mean differences in outcome variables both before and after control for these covariates. Participants with missing data on any of the covariates were dropped from all analyses.

To overcome concerns associated with the small sample size, we examined the impact of PPP on broadly defined health categories (behavioral risk factors and health outcomes) by combining estimated effects from single response models. Behavioral risk factors were included as a primary outcome of interest because they are well-established determinants of long-term health. We examined health outcomes because we wanted to determine the extent to which we could make conclusions regarding the long-term effects of PPP on health (i.e., through the age of 40 years). We selected dependent variables according to whether they fit into the behavioral risk factor category or the health outcomes category.

We explored the impact of PPP on subcategories within these broader categories of behavioral risk factors and health outcomes as well. For the health outcomes category, these subcategories included measures of overall health status, medical conditions, and hospitalizations (tertiary care use). Overall health status was assessed as a combination of 3 binary variables: excellent or very good self-rated health, stopping work as a result of poor health, and death. Medical conditions included binary indicators of self-reported conditions (participants were asked whether they had been medically diagnosed with arthritis, asthma, diabetes, or high blood pressure and whether they had subjective joint pain) and indicator variables for obesity (body mass index $\geq 30\ kg/m^2$) and overweight (body mass index $= 25–29\ kg/m^2$), both based on self-reported height and weight. The tertiary care use subcategory comprised binary indicators for hospitalization in the preceding 12 months at age 40 years, and use of urgent care services in the preceding 12 months at age 40 years. Self-reported joint pain was the only condition for which a medical diagnosis was not required. Thus, we conducted analyses that both included and did not include this variable.

In terms of behavioral risk factor subcategories, we examined use of preventive medical care, traffic safety practices, and drug use. Use of preventive medical care services was assessed by binary indicators for a routine physician visit in the preceding 12 months at age 27 years, a routine physician visit in the preceding 12 months at age 40 years, a routine dental visit in the preceding 12 months, and a routine eye doctor visit in the preceding 12 months. Traffic safety practices were measured as binary indicators for seat belt use at age 27 years (typical or higher levels of use, compared with sometimes or no use), seat belt use at age 40 years, traffic tickets in the preceding 15 years (excluding parking tickets) at age 27 years, and traffic tickets in the preceding 15 years at age 40 years. Finally, binary indicators for current tobacco use (vs no history of use), daily alcohol use (≤ 2 drinks vs >2 drinks per day), and illicit use of prescription sedatives, marijuana, cocaine, and heroin in the past 15 years at age 40 were employed to assess drug use.

To compute effects for the categories (e.g., behavioral risk factors) and subcategories (e.g., drug use) just described, we averaged estimates obtained from single equation linear regression models. Estimates were obtained via the following equation:

$$(1)\quad Y_{1c}=PPP\times\beta_{1c}+\boldsymbol{X}\times\alpha_{1c}+\varepsilon_{1c}$$

$$Y_{2c}=PPP\times\beta_{2c}+\boldsymbol{X}\times\alpha_{2c}+\varepsilon_{2c}\ldots$$

$$Y_{Kc}=PPP\times\beta_{Kc}+\boldsymbol{X}\times\alpha_{Kc}+\varepsilon_{Kc},$$

where Y is a single response in category c, with a total of K responses in that category; PPP is a treatment indicator; and $\boldsymbol{X}$ is a vector of covariates. The treatment effect for outcome category c is

$$(2)\qquad \beta_c=(1/K)\times\sum\nolimits_k\beta_{kc}.$$

We computed estimates for each of the health categories and subcategories just defined. To allow us to summarize across single responses within a given category, we coded all single responses in the same direction so that a positive β_c value reflected a beneficial impact of PPP.

This testing approach enabled us to detect whether effects were generally beneficial (or detrimental) over a single health category with multiple endpoints.[22,23] This approach is superior to an F test of the joint significance of multiple endpoints, which is nondirectional and has less power. To compute the variance of β_c, we estimated equation 1 simultaneously (via seemingly unrelated regression) to obtain the covariance matrix of the single estimates and thus compute the standard error of the average impact.[23] This strategy provided information on whether differences between groupings were statistically significant but did not lend itself to meaningful summary measures. In addition, we examined whether there were meaningful differences between results derived from linear and logistic models and found none.

Finally, as mentioned, 8 children with working mothers were transferred between groups. Thus, we estimated models with and without conditioning on maternal employment, allowing us to determine with certainty whether this breach of the randomization protocol affected our overall findings with respect to behavioral and health outcomes.

Mediating Variables

PPP has been shown to enhance lifetime educational attainment, income, the probability of having health insurance coverage, and the family environments of adults who underwent the intervention as children.[21] Given their potential role as mediators, we explored the extent to which these 4 factors influenced the health-producing effects of PPP. We did so by separately including these factors in equation 1 and recomputing β_c for each category (after dropping missing values for mediators). The resulting percentage change in β_c provided an estimate of the extent to which each factor mediated the relationship between early education and adult health.

The educational attainment factor included dummy variables for participants who had earned a general equivalency diploma, high school graduates, and those who had completed some college by the age of 40 years. The family environment factor included dummy variables for marital status and number of children. The income factor included dummy variables for monthly and annual earning quartiles. Finally, the health insurance factor included dummy variables for private or public insurance coverage and whether the participant lacked health insurance coverage at any point during the preceding 15 years during the age 40 follow-up. We did not include death as an outcome variable because mediator variables were not available for this category.

RESULTS

Data on the basic demographic characteristics of the intervention and control groups are shown in Table 1. Participants in the control group were significantly more likely than participants in the intervention group to come from families with working mothers (as opposed to mothers who were unemployed or on welfare). There was a trend among intervention group participants toward having fathers who were working in a semiskilled or skilled occupation on program entry ($P=.08$). Otherwise, no statistically significant differences in the sociodemographic characteristics of participants randomly assigned to the intervention and control groups were noted. The differences that arose were the result of 8 children with working mothers being replaced in the intervention group after randomization by 8 children with nonworking mothers.

Analyses Adjusted for Covariates

Table 2 presents mean values for the various health outcome and health behavior measures. After control for random differences in group allocation, participants randomized to PPP scored significantly higher than did control group participants on the composite measure of health status ($P<.05$). This difference was driven by the intervention group's lower mortality rates and by the tendency for that group's members to be less likely to stop working as a result of poor health. Seven

TABLE 1—Selected Sociodemographic Characteristics, Overall and by Study Group: High/Scope Perry Preschool Program, Ypsilanti, MI, 1962–2000

	Overall, Mean	Treatment Group, Mean	Control Group, Mean	*P*
Age at midlife interview, y	40.8	40.8	40.8	.80
Program entry characteristics				
Mother's age, y	29.1	29.6	28.7	.45
Proportion male	0.4	0.4	0.4	.73
IQ score	79.0	79.6	78.5	.38
Proportion with father at home	0.5	0.6	0.5	.63
Mother's education, y	9.4	9.5	9.4	.84
Proportion with working mother	0.2	0.1	0.3	.002
Proportion with father in skilled occupation[a]	0.1	0.1	0.0	.08

Note. Data were derived from Schweinhart et al.[21]

[a]The proportion of participants whose father held a skilled or semiskilled job at the time of assignment to the Perry Preschool Program or to the control group.

TABLE 2—Coefficients for Health Outcomes and Preventive Health Behaviors by Category and Subcategory: High/Scope Perry Preschool Program, Ypsilanti, MI, 1962–2000

	Treatment Group, Mean[a]	Control Group, Mean[a]	Difference	*P*	Adjusted Difference[b]	Adjusted *P*	No. of Observations[c]
Health outcomes							
Overall health status							
Self-reported health[d]	0.39	0.41	−0.03	.79	−0.09	.39	112
Stopped working	0.43	0.55	−0.13	.19	−0.19	.07	112
Deceased	0.03	0.08	−0.04	.31	−0.08	.06	123
Category difference	...	...	−0.06	.19	−0.12	.01	...
Health conditions							
Arthritis	0.19	0.13	0.06	.39	0.03	.72	110
Joint pain	0.56	0.30	0.25	.01	0.20	.05	110
Asthma	0.13	0.11	0.02	.69	0.05	.50	111
Diabetes	0.08	0.04	0.04	.37	0.04	.41	109
Hypertension	0.35	0.25	0.10	.25	0.15	.12	110
Obesity	0.27	0.27	0.00	.98	−0.01	.94	103
Overweight	0.73	0.69	0.04	.67	0.11	.30	103
Category difference	...	...	0.07	.05	0.08	.04	...
Tertiary care use							
Hospitalizations[e]	0.26	0.44	−0.18	.42	−0.23	.36	111
Urgent care use	0.22	0.21	0.01	.88	0.04	.65	111
Category difference	...	...	−0.08	.49	−0.10	.47	...
Health outcome mean	0.30	0.29	0.01	.71	0.00	.96	...
Health behaviors							
Preventive medical care							
No physician visit at age 27 y	0.26	0.22	0.04	.64	0.02	.87	115
No physician visit at age 40 y	0.17	0.11	0.06	.35	0.07	.32	111
No dental visit	0.24	0.37	−0.13	.15	−0.12	.22	111
No eye doctor visit	0.51	0.63	−0.12	.20	−0.17	.10	110
Category difference	...	...	−0.04	.48	−0.05	.36	...
Traffic safety							
No seat belt use at age 27 y	0.43	0.66	−0.23	.01	−0.25	.02	115
No seat belt use at age 40 y	0.11	0.14	−0.03	.62	−0.03	.68	110
Traffic tickets at age 27 y	0.33	0.37	−0.04	.66	−0.13	.19	115
Traffic tickets at age 40 y	0.52	0.68	−0.16	.09	−0.15	.14	110
Category difference	...	...	−0.12	.00	−0.14	.00	...
Drug use							
Tobacco use	0.42	0.55	−0.14	.15	−0.14	.18	111
Alcohol use	0.75	0.88	−0.12	.10	−0.13	.10	110
Sedative use	0.23	0.32	−0.09	.30	−0.10	.30	110
Marijuana use	0.45	0.54	−0.09	.35	−0.10	.32	110
Cocaine use	0.23	0.29	−0.06	.48	−0.06	.51	109
LSD use	0.04	0.07	−0.03	.46	−0.04	.41	110
Heroin use	0.00	0.09	−0.09	.03	−0.07	.08	110
Category difference	...	...	−0.05	.18	−0.05	.19	...
Health behavior mean	0.31	0.39	−0.07	.02	−0.08	.01	...

Note. Discrepancies in values are due to rounding. Ellipses indicate that no data were available. Seemingly unrelated regression was used to calculate the category difference of all preceding variables within a category.

[a]Proportion of participants self-reporting the outcome of interest.

[b]Adjusted for age at midlife interview; gender; IQ at program entry; mother's education, age, and employment status at program entry; father's presence in home at program entry; and an indicator for father's occupation (skilled or semiskilled) at program entry.

[c]Range = 103–123, depending on whether dependent variable data are missing.

[d]Participants reporting good, fair, or poor health.

[e]In the past year at age 40 years.

deaths were recorded in the sample as a whole. In the PPP group 1 participant died of HIV/AIDS and 1 died of cancer, and in the control group 1 participant died of cancer and 4 were the victims of suspected murders (data not shown).

Participants in the intervention group were significantly more likely than were control group participants to have a medical condition ($P<.05$). However, when subjective joint pain (not medically diagnosed) was removed from the analyses, there was no statistically significant difference for the medical conditions category as a whole ($P=.12$). There were few between-group differences in tertiary care use.

Participants in the PPP group were significantly less likely than those in the control group to engage in risky health behaviors ($P<.01$; Table 2). For example, they scored higher on traffic safety practices ($P<.001$), primarily because of their greater use of seat belts at the age of 27 years ($P<.05$). Although PPP group participants reported fewer physician visits but more dental and eye care visits, rates of preventive medical care use were not significantly different between the 2 groups. Rates of smoking and use of sedatives, marijuana, LSD, cocaine, and heroin were lower among participants in the PPP condition, but alcohol use rates were higher. When these differences were analyzed separately, none were statistically significant.

Mediators

Overall, participants randomized to the PPP condition completed more education and had better family environments, higher incomes, and better quality health insurance coverage than participants in the control group. Table 3 shows the extent to which each of these factors mediated changes in health outcomes and health risk behaviors among participants in the PPP group. Because overall results for the health outcomes category were not significant, we discuss mediators only with respect to behavioral risk factors.

None of the potential mediators we studied clearly emerged as a consistent explanatory variable in regard to traffic safety or drug use. However, educational attainment ($B=0.02$, or 63% of the total) and health insurance coverage ($B=0.03$, or 46% of the total) explained nearly all of the variation in use of preventive care services (percentages do not sum to 100% because of imprecision in the analysis). The mediators in combination explained roughly half of the observed variation in overall preventive health behaviors.

Robustness Tests

When analyses were limited to participants for whom data on all measures were available, the results were not substantively different from the results of the earlier analyses (and this was true of the data presented in both Table 2 and Table 3). In analyses conditioned on maternal employment, differences in overall health outcomes between the PPP and control groups remained nonsignificant ($P=.84$). Differences in health status measures remained significant ($P=.01$), but there were no differences in medical conditions between groups ($P=.08$), even when subjective joint pain was included. Overall differences in health behaviors between the groups remained significant ($P=.01$), led by improved traffic safety practices ($P=.005$) and reduced drug use ($P=.09$) in the PPP group.

TABLE 3—Mediation Coefficients for Education, Family Environment, Income, Health Insurance, and All Factors Combined: High/Scope Perry Preschool Program, Ypsilanti, MI, 1962-2000

	Baseline	Education	Family Environment	Income	Insurance	All
Health outcomes						
Overall	0.02	0.03	0.02	0.01	0.02	0.02
Health status	-0.14	-0.10	-0.15	-0.16	-0.14	-0.13
Medical conditions	0.09	0.10	0.08	0.08	0.07	0.08
Tertiary care use	-0.06	-0.07	-0.04	-0.05	-0.02	-0.04
Health behaviors						
Overall	-0.08	-0.06	-0.08	-0.06	-0.07	-0.04
Traffic safety	-0.13	-0.12	-0.13	-0.12	-0.12	-0.12
Preventative care	-0.06	-0.02	-0.05	-0.04	-0.03	0.01
Drug use	-0.07	-0.05	-0.06	-0.03	-0.05	-0.03

Note. Coefficients were adjusted for age at midlife interview; gender; IQ at program entry; mother's education, age, and employment status at program entry; father's presence in home at program entry; and an indicator for father's occupation (skilled or semiskilled) at program entry.

DISCUSSION

Participants initially randomized to the PPP intervention were more likely than those randomized to the control group to complete more schooling, to have a stable family environment, to be insured, and to have higher earnings.[21] We hypothesized that these social benefits would translate into improvements in health-promoting behaviors, which should in turn translate into lower rates of such health conditions as diabetes, hypertension, obesity, and arthritis. This reduced frequency of health conditions should then translate into improved overall health status and reduced mortality. As the participants age, we would expect such differences to become more pronounced.

We found that the effects of PPP on educational attainment, stable family environments, health insurance coverage, and earnings had indeed led to improvements in participants' health behaviors by the time they reached 40 years of age. For instance, our results showed that use of preventive health care services was almost entirely driven by the effects of PPP on health insurance coverage and educational attainment. The effects of the other mediators explained about half of the variation in behavioral risk factors. No other clear predictive patterns emerged.

Although 40 years of age is early for health outcomes to materialize, we nonetheless found statistically significant improvements in the health status of experimental group participants. However, the observed differences in rates of self-reported medical conditions were in the opposite direction of that expected; participants in the PPP group, despite their better risk profile and health status, reported

more medical conditions than did participants in the control group. Although these differences were not significant in all of our analyses, they negated any benefits of PPP on overall health outcomes.

The higher prevalence of medical conditions among participants in the PPP group was not explained by between-group differences in health insurance coverage. Although participants randomized to the PPP condition were more likely than those in the control condition to have employer-sponsored coverage (65% vs 45%) and were less likely to depend on prison-based health care (6% vs 14%) or Medicaid or Medicare (9% vs 17%) coverage, adjusting for coverage did not substantively alter our findings.

Limitations

Four important limitations of our design should be noted. First, our approach of calculating averages within broader categories of outcomes resulted in all outcomes within a group being of equal weight, and some outcomes may be more important than others (e.g., mortality is more important than days of work missed as a result of illness as a measure of overall health status). Likewise, categories take on differing levels of importance; self-reported conditions, for instance, are less important than overall measures of health status. We are unaware of an objective measure for appropriately weighting these outcomes.

Second, because PPP's effects on future educational attainment were powerful, participants assigned to the intervention group may have interpreted the meaning of complex survey questions differently than those assigned to the control group. However, questions were formulated by survey professionals and administered by a highly trained interviewer. Thus, rather than eliminating questions that may have been difficult to interpret (e.g., prevalence of medical conditions), we decided to include all questions so that we could increase the statistical power of our study. Inclusion of medical examination data as well as biomarkers of health (e.g., serum cholesterol and C-reactive protein samples) in future surveys of the PPP participants would allow better determination of the health of that group.[24]

Third, our results may not generalize well to higher income, nonminority populations, given evidence suggesting that educational interventions have more of an impact on disadvantaged populations than on more advantaged groups.[25] Finally, statistically significant between-group variance in maternal employment occurred despite randomization. For this reason, we controlled for random variation in familial sociodemographic characteristics. When the analyses were conditioned on maternal employment, the results were similar or slightly enhanced, suggesting that our findings were not confounded.

Conclusions

With the exception of the higher prevalence of self-reported conditions among the members of the PPP group, our findings are consistent with those of nonrandomized studies in which high levels of educational attainment have been shown to directly improve health status.[7,9,16,26] Other studies have demonstrated that increases in educational attainment lead to higher incomes, increases in rates of health insurance coverage, and reductions in divorce rates.[11–14,27–29]

Some have questioned whether education leads to reductions in behavioral risk factors, arguing that most people are aware that risky behaviors are bad for their health[30] and that higher educational attainment as well as better health can be attributed to studies' omission of confounding factors (e.g., higher genetic potential or more forward-looking behaviors).[31,32] Our findings suggest that such theories are incorrect.

PPP was a high-quality early childhood intervention targeted toward disadvantaged children with an IQ ranging from 70 to 85. The structural problems faced by these children were stark, probably explaining their low IQ scores.[33] Despite these structural problems, PPP produced dramatic reductions in crime and poverty rates.[5,21] Crime is a public health problem for which we did not account in our study. Criminal activity involves risk-taking behaviors that can be life threatening, imprisonment has been linked to shortened life expectancy,[34] and crime leads to psychological trauma, injury, or death among the perpetrator's victims. All of these factors suggest that PPP's health benefits extend beyond the outcomes measured here.

Given that behavioral risk factors are strong determinants of health in later life, it is likely that the large reductions in such risk factors observed here will ultimately translate into improved health outcomes in this cohort. Our findings therefore suggest that prekindergarten programs hold promise as public health interventions. However, the members of the PPP cohort have not yet reached the age at which heart disease, cancer, and stroke begin to shape morbidity and mortality, so more time will be needed for definitive results on physical health outcomes arising from this novel educational intervention. ■

About the Authors

Peter Muennig and Matthew Neidell are with the Department of Health Policy and Management, Mailman School of Public Health, Columbia University, New York, NY. Larry Schweinhart and Jeanne Montie are with the High/Scope Educational Research Foundation, Ypsilanti, MI.

Correspondence should be sent to Peter Muennig, MD, MPH, Mailman School of Public Health, Columbia University, 600 W 168th St, 6th Floor, New York, NY 10032 (e-mail: pm124@columbia.edu). Reprints can be ordered at http://www.ajph.org by clicking on the "Reprints/Eprints" link.

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Contributors

P. Muennig originated the study and led the development of the article. L. Schweinhart and J. Montie provided data and helped to develop the article. M. Neidell conceptualized the study design, conducted the statistical analyses, and contributed to the development of the article.

Human Participant Protection

No protocol approval was needed for this study.

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