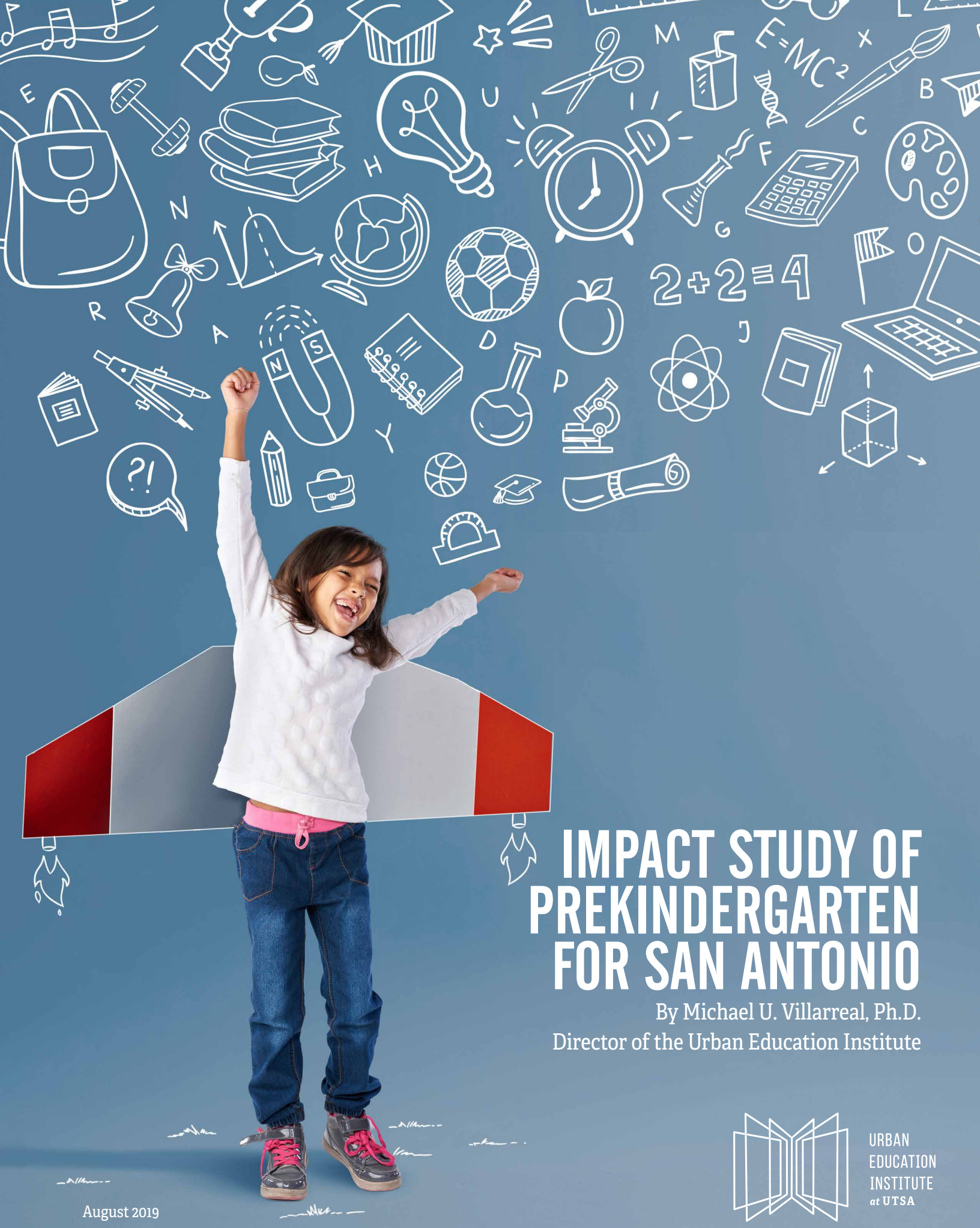

IMPACT STUDY OF PREKINDERGARTEN FOR SAN ANTONIO

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URBAN EDUCATION INSTITUTE at UTSA

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EXECUTIVE SUMMARY

In 2012, citizens of the City of San Antonio took a bold step by voting to expand access to high quality prekindergarten by dedicating a one-eighth cent sale tax to the creation of four high quality prekindergarten lab schools, a system of professional development for early education instructors, and a grant program to support high-quality prekindergarten at area school districts. This report presents the first impact study of this city initiative—Pre-K 4 SA. This study analyzed Pre-K 4 SA's effect on pre-kindergarten enrollment in Bexar County following its authorizing election and its direct effect on the early education outcomes of students who participated in its lab schools. This study also investigated if the program produced more pronounced effect sizes on particular subgroups of students. It also examined Pre-K 4 SA's impact relative to public pre-k.

Analysis conducted for this report examined students who enrolled in Pre-K 4 SA in the academic year Fall 2013/Spring 2014. We used a statistical procedure known as Inverse Propensity Score Weighting to estimate effect sizes. Our methodology allowed this study to control for selection bias and produce a base comparison group of students who on average exhibit the same student attributes as the students who participated in Pre-K 4 SA. The base comparison group enrolled in the same Bexar County elementary schools attended by Pre-K 4 SA students.

KEY FINDINGS

The study produced the following key findings:

- Pre-K 4 SA caused third-grade reading scores to rise from below the state average to above the state average. Pre-K 4 SA increased reading scores equal to 0.095 standard deviations or the equivalent of a change in percentile ranking of 3.8 percentage points.
- Pre-K 4 SA caused third-grade math scores to increase by an amount larger than its effect on reading scores. Pre-K 4 SA students scored above the state average as a group on the state's mandated third-grade math exam; while, students who did not participate in public pre-k scored below the state average. The Pre-K 4 SA effect size on math scores equaled 0.112 standard deviations or the equivalent of a change in percentile ranking of 4.5 percentage points.
- Pre-K 4 SA caused attendance to increase from kinder to third grade by 13.4 days or a relative growth rate of 2 percent.
- Pre-K 4 SA decreased the share of students assigned to special education by 3.3 percentage points or a relative decline of 28.5 percent.
- Pre-K 4 SA eliminated the need to repeat a grade between kindergarten and second grade. Without Pre-K 4 SA, 0.4 percent of students repeated at least one grade between kindergarten and second grade.
- Pre-K 4 SA and public pre-k produced no discernable effect on the probability of receiving a school disciplinary action.
- Pre-K 4 SA produced pronounced effects for two observable subgroups of students: the economically disadvantaged and the limited English proficient (LEP). Children outside of these two categories benefited from Pre-K 4 SA but across fewer observed outcomes.
- Pre-K 4 SA—like a stronger dose of nutrition—amplified the positive impact of public prekindergarten. While the average public prekindergarten program improved student outcomes for its enrolled students, Pre-K 4 SA produced larger student gains.

POLICY IMPLICATIONS

This study affirms prior studies that assessed the effectiveness of high-quality pre-kindergarten. Though this study was limited to its first cohort, Pre-K 4 SA produced positive effects on early education outcomes that carried on four years later into third-grade.

One of the areas where prekindergarten had the most pronounced impact was on the placement of children in special education for students identified as economically disadvantaged, homeless, or limited English proficient. Of this targeted population, students who participated in Pre-K 4 SA and public prekindergarten programs were 31 percent and 18 percent less likely to be placed into special education, respectively. This substantial impact both saves money for schools and avoids well documented negative impacts on children when they are unnecessarily placed into special education.

Attendance is directly linked to school funding as well as student success. The study estimates San Antonio public schools received approximately $17.4 million more in funding due to increased attendance of students who enrolled in Pre-K 4 SA ($3.9 million) and the increased public pre-k population that followed the Pre-K 4 SA election ($13.5 million).

Finally, Pre-K 4 SA provides early evidence that high quality pre-kindergarten can be taken to scale and delivered through a public system. The effectiveness of public prekindergarten has been questioned because the well-publicized high-quality pre-kindergarten experiments—Perry Pre-School and Abecedarian Project—where small private programs that only treated approximately 50 students. Moreover, a recent random control trial study of Tennessee's voluntary public prekindergarten programs produced disappointing results (Lipsey, Farran, and Durkin, 2018).

INTRODUCTION

Citizens of San Antonio have long seen increased educational attainment as a solution to its poverty. Since the 1990's, they have used their City government as a vehicle for investing in programs that provide college scholarships, after school education, and workforce training. In 2012, citizens of the City of San Antonio took a bold step by voting to expand access to high quality prekindergarten by dedicating a one-eighth cent sale tax to the creation of four high quality prekindergarten lab schools, a system of professional development for early education instructors, and a grant program to support high-quality prekindergarten at area school districts. This report represents the first analysis of the impact this initiative produced on its intended outcomes.

This study should be considered an early analysis of Pre-K 4 SA impacts because it only includes students who participated in the first year of its operations. Previous research has found that the effects produced in the first year of a new program are not necessarily representative of a program's impact after it has had time to mature and strengthen (Weiss and Weiss, 1998). Consequently, the positive results this report has found are likely to improve with later Pre-K 4 SA cohorts.

A primary goal of Pre-K 4 SA was to improve access to quality public pre-kindergarten programs in the greater San Antonio community through expanded professional development and grants to school districts. As of the writing of this report, these components of Pre-K 4 SA could not be evaluated because they were not rolled out until 2016. Public pre-k students who benefited from these services had yet to reach third-grade, the first year when academic student outcomes become available.

Future research will investigate the long-term effects of Pre-K 4 SA as

participating students age. The research team of this report has created data sharing agreements and a research design that allows researchers to follow Pre-K 4 SA students into adulthood and estimate the programs impact on their educational, social, and workforce outcomes.

In summary, this study investigated four primary research questions:

1. Did Pre-K 4 SA increase public prekindergarten enrollment in the greater San Antonio community?
2. Did Pre-K 4 SA improve early-education outcomes for the students it served in its lab schools?
3. Did some subgroups of students receive a greater benefit from Pre-K 4 SA than others?
4. How did effects on early-education outcomes produced by Pre-K 4 SA compare to effects produced by public prekindergarten?

Answering these questions will inform the local policy debate over the merits of the public investment in Pre-K 4 SA. This report and the planned future studies will also answer questions that are being debated at the national level.

We know from existing research that high-quality pre-kindergarten increases the cognitive and non-cognitive abilities of participating students, resulting in positive educational, social, health, and economic benefits to students. We also know that the largest impacts occur later in the child's life and that benefits accrue to their communities.

The annual rate of return on investments in high-quality early education realized by society range from 7 to 18 percent. (Campbell, Ramey, Pungello, Sparling, and Miller-Johnson, 2002; Heckman, Moon, Pinto, Savelyev, and Yavitz, 2009). What we don't know, and what Pre-K 4 SA is poised to answer, is whether high-quality pre-kindergarten can be delivered through our public school system and at a citywide scale.

This report lays the groundwork for closing these gaps in our knowledge about high-quality public pre-kindergarten. What follows is a description of the Pre-K 4 SA program as it was evaluated and a description of the Pre-K 4 SA students included in this evaluation.

The remainder of this report is dedicated to answering our four research questions, each question is answered in a dedicated section. The report concludes with thethe Appendix, which presents the research design and data used to answer the research questions and the results of robustness checks of its methodology.

PRE-K 4 SA

Before Pre-K 4 SA was legally chartered by the City of San Antonio as a municipal corporation, its backers created the Pre-K 4 SA campaign to raise public awareness about the importance of early education and win a city election to create and support the municipal corporation of Pre-K 4 SA. This city election occurred during the academic year of Fall 2012/Spring 2013.

After winning the election, the Pre-K 4 SA campaign passed the role of serving as public champion for early education to the Pre-K 4 SA municipal corporation. In estimating Pre-K 4 SA's impact on demand for prekindergarten (Research Question 1), this evaluation recognizes the significant campaign activities that brought about the creation of Pre-K 4 SA, the municipal corporation.

The Pre-K 4 SA campaign raised over $1 million to purchase digital, print, tv, and radio media. It organized paid and volunteer campaign workers to knock on doors and explain to voters the benefits of quality early education and Pre-K 4 SA. Backers participated in hundreds of townhall meetings and public speeches and generated significant earned media coverage.

This study of Pre-K 4 SA's direct impact on student outcomes (Research Questions 2 to 4) is limited to the first cohort of students who enrolled in Pre-K 4 SA in the fall of 2013 and spring of 2014. During this period, Pre-K 4 SA employed 44 Master-level early education instructors and 83 support staff (including Assistant Teacher I Part-Time, Assistant Teacher I Full-Time, and Assistant Teacher II) to educate approximately 739 prekindergarten students. Services were provided at their lab schools on Medical Drive on the northside of San Antonio and on South New Braunfels on the southside of San Antonio.

Pre-K 4 SA described its curriculum as interactive and integrated, and set within a positive environment. Participating children experienced a school day that began at 8 am with a nutritious breakfast that engaged students to learn about table manners, develop social skills, and exercise verbal communication skills. Throughout the day children participated in group and individual activities that supported their learning through play and cut across subjects of math, reading, art, and science. Students received a nutritious lunch and snack and rest time. Students ended their school day at 3 pm with the option of an extended day program for children of working parents or attending school. The extended day program provided "more active learning in the classroom, time in the outdoor learning environment, and quality interactions that build language, academic, and social skills."

Pre-K 4 SA's professional development services and grant program were not fully implemented until 2016, outside of this report's study period.

PRE-K 4 SA STUDENTS

This study examined students who enrolled in Pre-K 4 SA during the academic year of Fall 2013/Spring 2014, attended a minimum of 90 percent of the school year, and who completed their state-mandated third grade reading and math exams in Bexar County. This pool of students amounted to 433 students. Of these students, 81 percent were Hispanic; 8 percent were White; 7 percent were Black; and 3 percent were Asian as shown in Figure 1.

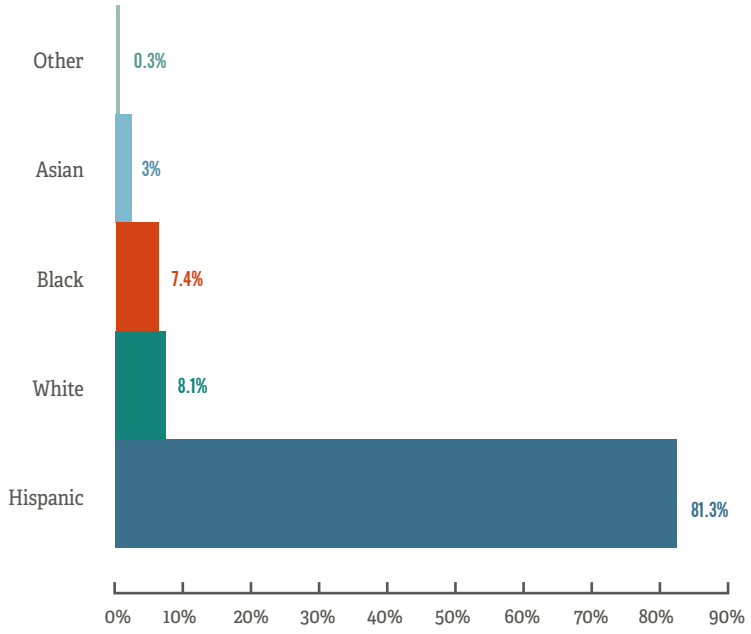


Figure 1
Distribution of study sample of Pre-K 4 SA students by ethnicity and race

Nearly two out of three Pre-K 4 SA students were identified as economically disadvantaged as shown in Figure 2. The share of Pre-K 4 SA students identified as female equaled 46 percent. The share identified as limited English proficient, immigrant, and homeless in prekindergarten equaled 10 percent, less than one percent, and less than one percent, respectively.

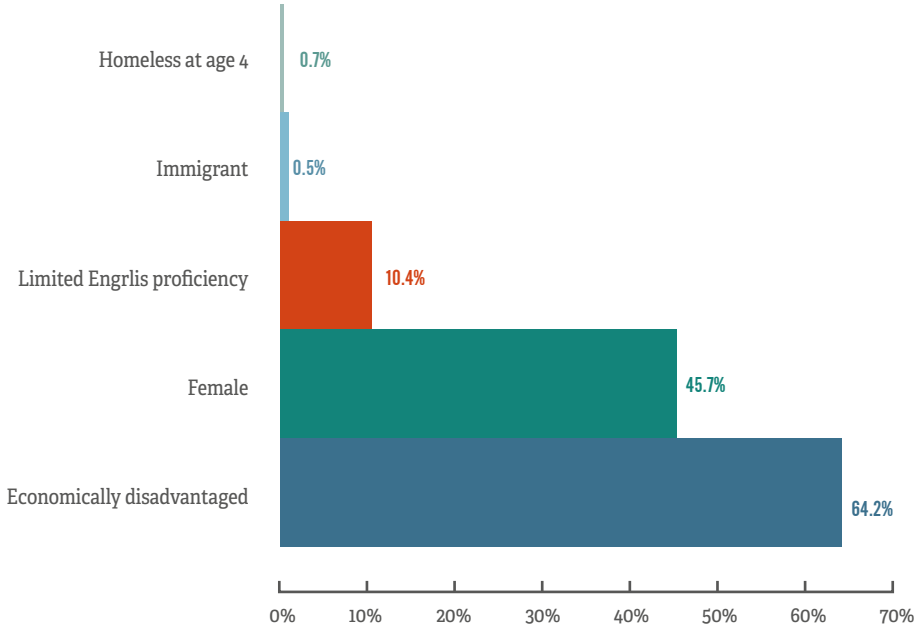


Figure 2.
Distribution of study sample of Pre-K 4 SA students by certain student attributes.

Note: Categories are not meant to add to 100 percent.

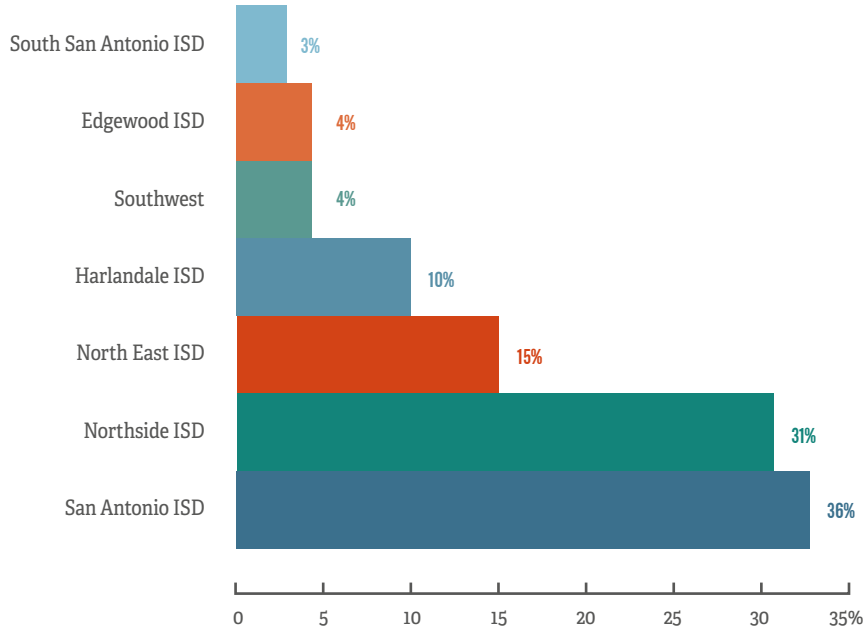
Pre-K 4 SA students included in this study had above average third-grade reading scores and average third-grade math scores as summarized in Table 1. They were present for 680 out of 720 school days from Kinder to third grade on average. Eight percent of Pre-K 4 SA students were classified into special education programs. No Pre-K 4 SA students repeated a grade between kindergarten and second grade. And, 11 percent of Pre-K 4 SA students received at least one disciplinary mark in their school record.

	OBS	MEAN	SD	MIN	MAX
Female	433	0.46	0.50	0.0	1.0
Hispanic	433	0.81	0.39	0.0	1.0
White	433	0.08	0.27	0.0	1.0
Black	433	0.07	0.26	0.0	1.0
Asian	433	0.03	0.17	0.0	1.0
Other	433	0.00	0.05	0.0	1.0
Limited English proficiency	433	0.10	0.31	0.0	1.0
Economycally disadvantaged	433	0.64	0.48	0.0	1.0
Immigrant	433	0.00	0.07	0.0	1.0
Homeless at age 4	433	0.01	0.08	0.0	1.0
Prek attendance rate	433	98.02	1.18	94.3	100.0
Third grade math score, standardized	428	0.01	0.76	-5.6	2.4
Third grade reading score, standardized	428	0.00	0.79	-5.6	2.2
Days present. kinder to third grade	433	680.58	27.75	430.5	715.0
Special education, kinder tothird grade	433	0.08	0.28	0.0	1.0
Repeated a grade. kinder to third grade	433	0.00	0.00	0.0	0.0
Disciplinary act received, kinder to thir grade	433	0.11	0.31	0.0	1.0

Table 1
Description of Students Attributes of Pre-k 4 SA students and their Student Outcomes

The top sending school district to Pre-K 4 SA was San Antonio ISD (33 percent), followed by Northside ISD (31 percent) as shown in Figure 3. Students from North East ISD (15 percent) and Harlandale ISD (10 percent) represented the next largest sources of Pre-K 4 SA students. Together these four school districts represent the home school districts of nearly 9 out of 10 Pre-K 4 SA students.

Figure 3. Distribution of Pre-K 4 SA students of Cohort Fall 2013/ Spring 2014 by Home School District



SECTION 4. PRE-K 4 SA IMPACT ON ACCESS

Did Pre-K 4 SA increase public prekindergarten enrollment in the greater San Antonio community?

As shown in Figure 4, the evidence suggests Pre-K 4 SA caused an increase in public prekindergarten enrollment of 9.07 percentage points, or a growth relative to the expected public prekindergarten student population of Bexar County equal to 18.7 percent (9.07 percentage point increase divided by 48.55 percent).

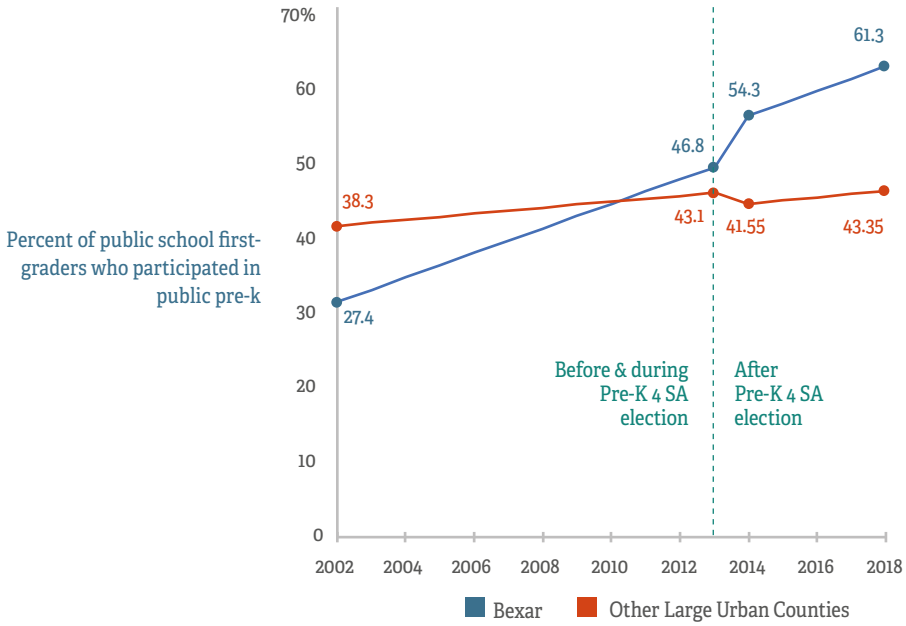


Figure 4. Best-fit trend lines of public prekindergarten enrollment as a percent of public school first-grade students in Bexar County and other large urban counties of Texas, fiscal year-ending 2002 to 2018

The expected percent of Bexar County public school first graders who participated in public prekindergarten equaled 27.4 percent in fiscal year-ending 2002, 11 percentage points below other Texas urban counties as shown in Figure 1. These estimates controlled for variances in student attributes that predict prekindergarten enrollment such as share of economically disadvantaged public school students, share of homeless students, and share of limited English proficient students.

After 2002, Bexar county public schools increased their share of first-graders who participated in public prekindergarten faster than other Texas urban counties (counties of Harris, Dallas, Tarrant, and Travis). By 2010, Bexar county public schools enrolled more first graders who participated in public prekindergarten than their counterparts in other Texas urban counties.

Following the Pre-K 4 SA election, Bexar county public schools experienced a stair-step increase in first graders who participated in prekindergarten enrollment; while their counterparts in other Texas urban counties experienced a slight decline.

The effect of Pre-K 4 SA on prekindergarten enrollment was calculated by subtracting the change in pre-k enrollment in other urban counties of Texas before and after the Pre-K 4 SA election from the change in pre-k enrollment in Bexar county during the same time period. Subtracting out the change in pre-k enrollment in other urban counties controlled for statewide trends in public pre-k enrollment that would have occurred in Bexar County outside the Pre-K 4 SA election. A more detailed discussion of this methodology can be found in Appendix 1.

PRE-K 4 SA IMPACT ON EARLY EDUCATION:

Did Pre-K 4 SA improve early-education outcomes for the students it served in its lab schools?

Pre-K 4 SA produced positive academic outcomes for the first cohort of Pre-K 4 SA students—a notable achievement since the first cohort enrolled during Pre-K 4 SA's inaugural year of operations. This section presents an analysis that contrasts student outcomes of students who participated in Pre-K 4 SA to those who did not participate in public pre-k. It also presents estimated effect sizes, standard errors, 95 percent confidence intervals, and other supporting statistics in Table 2.

This study used a quasi-experimental research design known as inverse propensity weighing to estimate program effect sizes. This research design controlled for the effects of confounding variables: gender, race and ethnicity, poverty, homelessness, and limited English proficiency.

Inverse probability weighing is often used in policy impact studies that use observation data and can be found in many peer-reviewed academic journals. A more detailed explanation of this methodology can be found in Appendix 1. (Ho et al., 2007; Morgan and Winship, 2014; Rosenbaum and Rubin, 1983)

THIRD-GRADE READING

Pre-K 4 SA caused third-grade reading scores to rise from below the state average to above the state average. As shown in Figure 5, Pre-K 4 SA increased reading scores equal to 0.095 standard deviations or the equivalent of a change in percentile ranking of 3.8 percentage points.

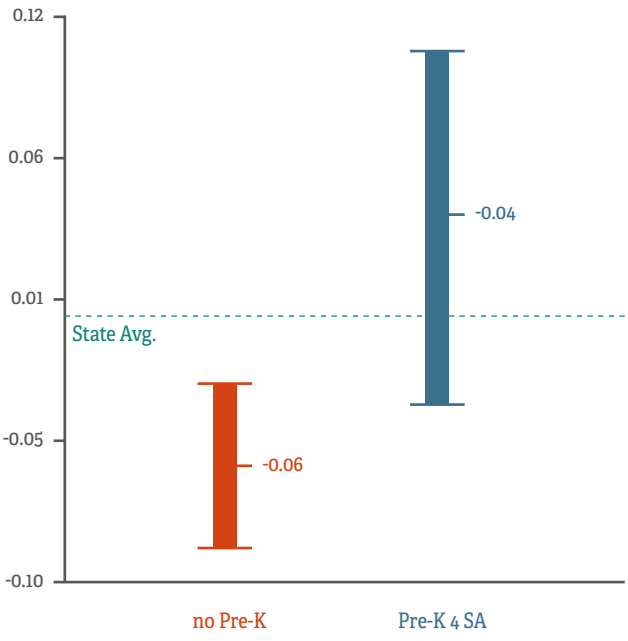


Figure 5. Third-grade reading scores standardized and with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA.

THIRD-GRADE MATH

Pre-K 4 SA caused third-grade math scores to increase by an amount larger than its effect on reading scores. As shown in Figure 6, Pre-K 4 SA students scored above the state average as a group on the state's mandated third-grade math exam; while, students who did not participate in public pre-k scored below the state average. The Pre-K 4 SA effect size on math scores equaled 0.112 standard deviations or the equivalent of a change in percentile ranking of 4.5 percentage points.

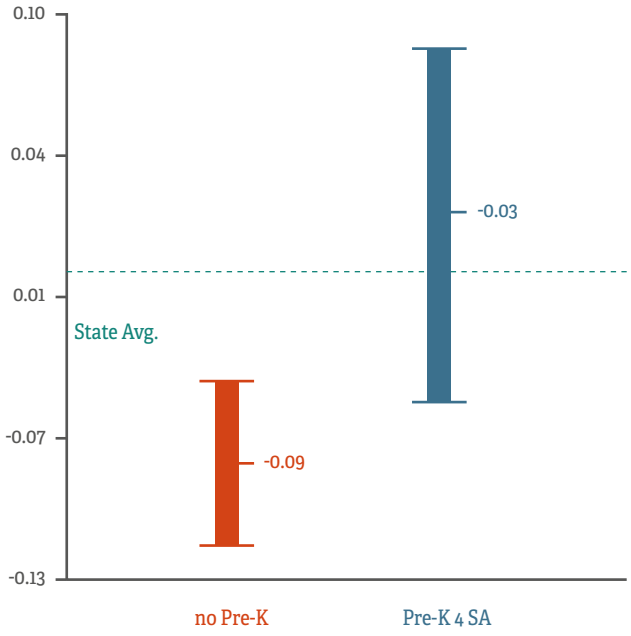


Figure 6. Third-grade math scores standardized and with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA.

SCHOOL ATTENDANCE

Pre-K 4 SA caused attendance to increase from kinder to third grade by 13.4 days or a relative growth rate of 2 percent. As shown in Figure 7, Pre-K 4 SA students attended school an average of 681 days from kinder through third grade; while, students who did not participate in public pre-k attended school an average of 668 days.

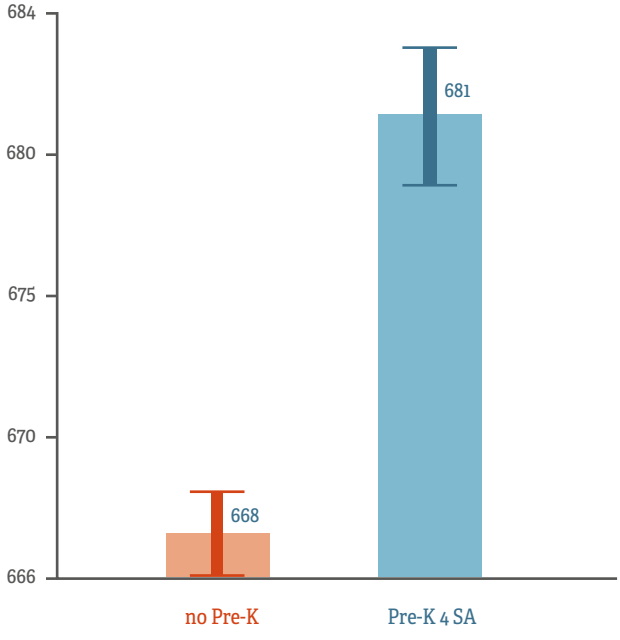


Figure 7. Days present in kinder to third-grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA.

SPECIAL EDUCATION

Pre-K 4 SA caused assignment to special education in kindergarten to third grade to decline. As shown in Figure 8, Pre-K 4 SA students had a likelihood of being assigned to special education equal to 8.2 percent; while students who did not participate in public pre-k had a likelihood of being assigned to special education equal to 11.5 percent. Pre-K 4 SA decreased the share of students assigned to special education by 3.3 percentage points or a relative decline of 28.5 percent. This means students who participated in Pre-K 4 SA were about 29 percent less likely to be placed into special education than their counterparts who did not participate in public pre-k.

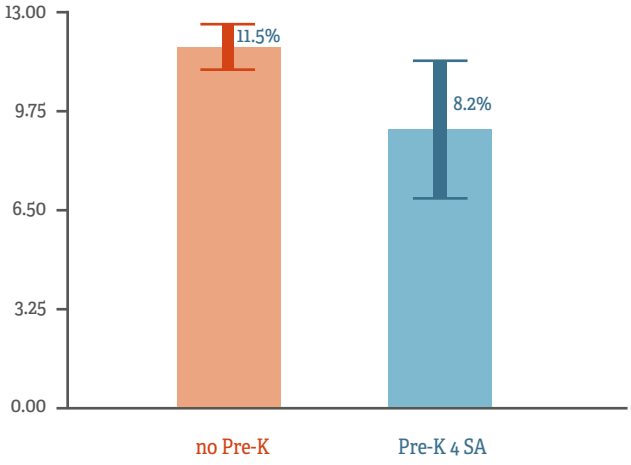


Figure 8. Probability of being assigned to a special education program in kinder through third grade with 95 percent confidence intervals of students who experienced no public pre-k & Pre-K 4 SA.

GRADE REPETITION

Pre-K 4 SA eliminated the need to repeat a grade between kindergarten and second grade. Without Pre-K 4 SA, 0.4 percent of students repeated at least one grade between kindergarten and second grade as shown in Figure 9

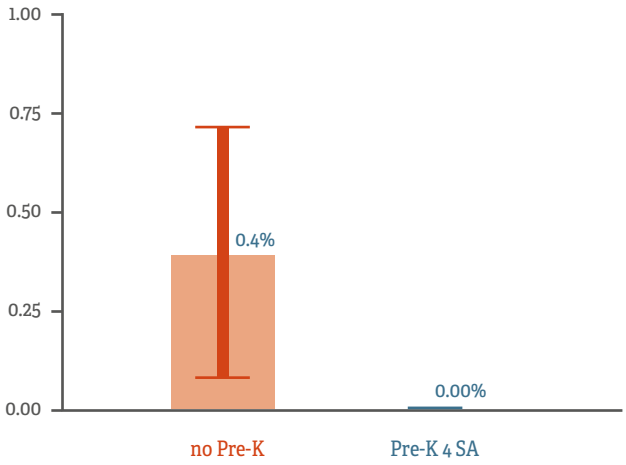


Figure 9. Probability of repeating a grade in kinder through second grade with 95 percent confidence intervals of students who experienced no public pre-k & Pre-K 4 SA.

DISCIPLINARY ACTION

Pre-K 4 SA produced no discernable effect on the probability of receiving a disciplinary action from their kindergarten to their third-grade schools.

OUTCOMES	COEFF.	SE	P-VALUE	95 percent Confidence Intervals LOWER	UPPER	OBS
Third-grade math score, standardized	0.095	0.039	0.015	0.019	0.171	11,688
Third-grade reading score, standardized	0.112	0.042	0.007	0.030	0.193	11,689
Days present, kinder to third grade	13.371	1.384	0.000	10.658	16.084	11,906
Claddified in special education, kinder to third grade	-0.033	0.015	0.025	-0.062	-0.004	11,906
Repeated grade, kinder to second grade	-0.004	0.002	0.023	-0.007	-0.001	11,906
Received disciplinary action, kinder to third grade	0.022	0.015	0.147	-0.008	0.052	11,906

Table 2. Pre-K 4 SA's Average Treatment on the Treated Effect Sizes

PRE-K 4 SA HETEROGENEOUS EFFECTS

Did some subgroups of students receive a greater benefit from Pre-K 4 SA than others?

Pre-K 4 SA produced pronounced effects for two observable subgroups of students: the economically disadvantaged and the limited English proficient (LEP). Children outside of these two categories benefited from Pre-K 4 SA but across fewer observed outcomes. The following two subsections present the findings for both sets of students.

In Figures 10 through 19, the subsections contrast student outcomes between students who did not participate in public pre-k and those who participated in Pre-K 4 SA for each set of subgroups. In Tables 4 and 5, the subsections summarize estimated effect sizes, their 95 percent confidence intervals, and other supporting statistics.

ECONOMICALLY DISADVANTAGED

Students identified as economically disadvantaged made up approximately two of every three Pre-K 4 SA students. They included a larger share of students who were identified as Hispanic and Black as compared to the non-economically disadvantaged Pre-K 4 SA students.

Third-grade Reading. As shown in Figure 10, Pre-K 4 SA produced larger benefits for students identified as economically disadvantaged then those identified as not being economically disadvantaged. Pre-K 4 SA increased third-grade readings scores of economically disadvantaged students by 0.16 standard deviations or the equivalent of a change in percentile ranking of 6.4 percentage points; while the non-economically disadvantaged did not experience a statistically significant change in their reading scores.

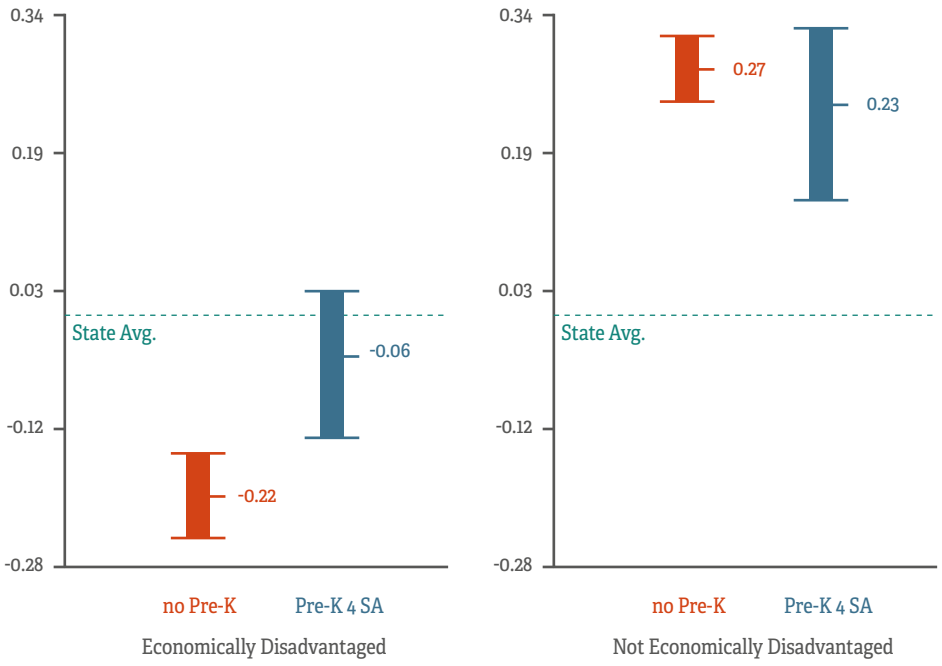


Figure 10. Third-grade reading scores standardized and with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as economically disadvantaged.

Third-grade Math. As shown in Figure 11, Pre-K 4 SA increased third-grade math scores of economically disadvantaged students by 0.14 standard deviations or the equivalent of a change in percentile ranking of 4.9 percentage points; while the non-economically disadvantaged did not experience a statistically significant change in their math scores.

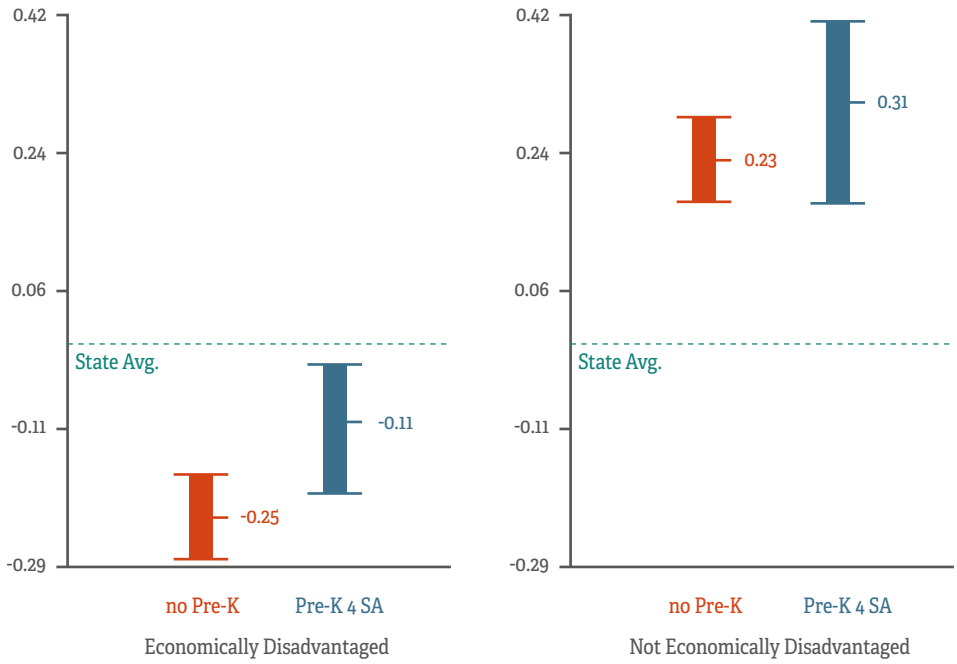


Figure 11. Third-grade math scores standardized and of with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as economically disadvantaged.

School Attendance. As shown in Figure 12, Pre-K 4 SA increased school attendance of economically disadvantaged students by 18.3 days or a relative growth rate of 2.8 percent; while school attendance of students not identified as economically disadvantaged increased by 5.6 days or a relative growth rate of 1 percent.

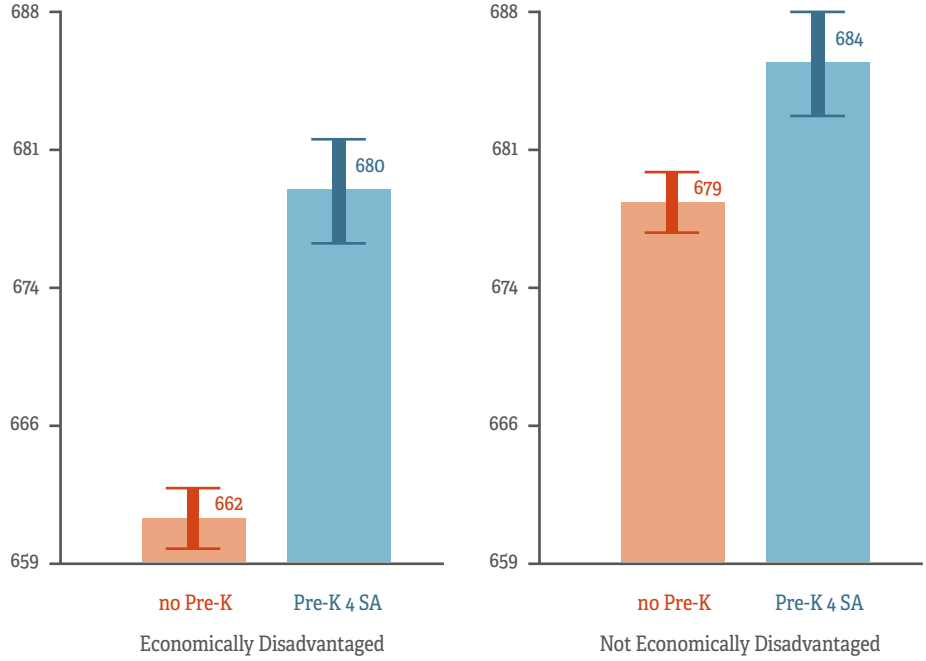


Figure 12. Days present in kinder to third-grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as economically disadvantaged.

Special Education. Pre-K 4 SA students—both those identified as economically disadvantaged and those not economically disadvantaged—were assigned to special education programs at rates lower than their counterparts who did not enroll public pre-k as shown in Figure 13. However, Pre-K 4 SA did not produced a different sized impact for the economically disadvantaged than the non-economically disadvantaged by a statistically significant level.

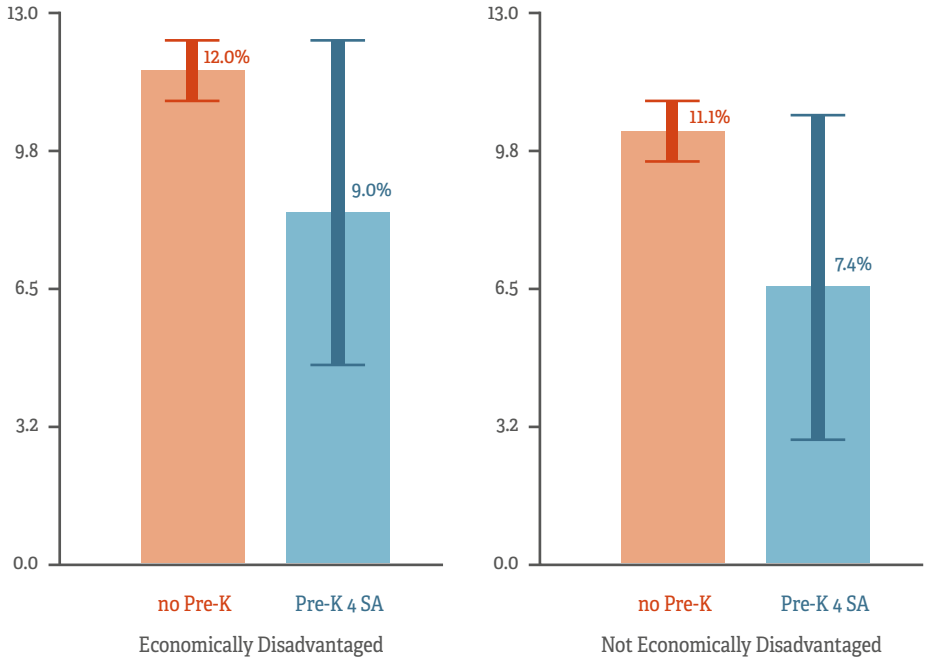


Figure 13. Probability of being assigned to a special education program in kinder through third grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as economically disadvantaged.

Special Education. Grade Repetition. Students repeated a grade between kinder and third at an exceptionally low rate—less than half a percent overall. Pre-K 4 SA, however, eliminated the likelihood of grade repetition for economically disadvantaged students as shown in Figure 14. The effect size on grade repetition for economically disadvantaged students equaled negative 0.5 percentage points; while its effect on students not economically disadvantaged decreased but not by a statistically significant level.

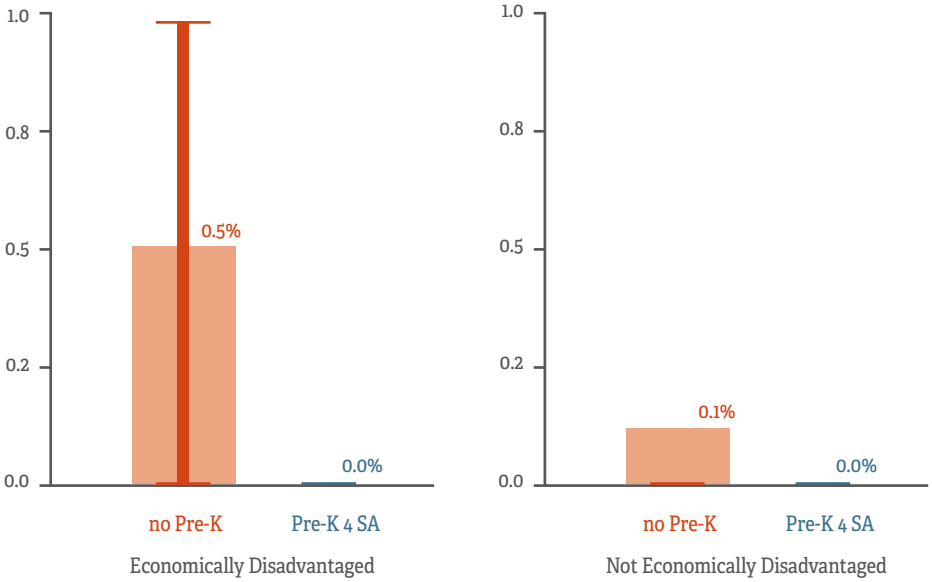


Figure 14. Probability of repeating a grade in kinder through second grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as economically disadvantaged.

Disciplinary Action. Pre-K 4 SA did not produce heterogeneous effects on disciplinary action by economically disadvantaged status.

ECONOMICALLY DISADVANTAGED	COEFF.	SE	P-VALUE	95 percent Confidence Intervals LOWER	UPPER	OBS
Third-grade math score, standardized	0.16	0.05	0.00	0.06	0.26	7,588
Third-grade reading score, standardized	0.14	0.05	0.01	0.03	0.24	7,591
Days present, kinder to third grade	18.27	1.79	0.00	14.77	21.77	7,733
Classified in special education, kinder to third grade	-0.03	0.02	0.013	-0.07	-0.01	7,733
Repeated grade, kinder to second grade	-0.005	0.00	0.03	-0.01	-0.00	7,733
Received disciplinary action, kinder to third grade	0.01	0.02	0.71	-0.03	0.04	7,733

NOT ECONOMICALLY DISADVANTAGED	COEFF.	SE	P-VALUE	LOWER	UPPER	OBS
Third-grade math score, standardized	-0.03	0.06	0.55	0.14	0.07	4,073
Third-grade reading score, standardized	0.08	0.06	0.22	0.05	0.20	4,071
Days present, kinder to third grade	5.56	1.83	0.00	1.97	9.15	4,144
Classified in special education, kinder to third grade	-0.04	0.02	0.09	-0.09	-0.01	4,144
Repeated grade, kinder to second grade	-0.001	0.00	0.16	-0.00	-0.00	4,144
Received disciplinary action, kinder to third grade	0.05	0.03	0.06	-0.00	0.011	4,144

Table 3. Pre-K 4 SA's Average Treatment on the Treated Effect Sizes by Economically Disadvantaged Status

LIMITED ENGLISH PROFICIENT (LEP)

Pre-K 4 SA produced larger benefits for students identified as LEP then those identified as not being LEP. LEP students made up approximately one of every ten Pre-K 4 SA students. They included a larger share of Hispanic students than their counterparts who were identified as not being LEP.

Third-grade Reading. Pre-K 4 SA increased third-grade readings scores of LEP students by 0.27 standard deviations or the equivalent of a change in percentile ranking of 10.9 percentage points; while their non-LEP counterparts did experience an increase in reading scores but not at statistically significant level as shown in Figure 15.

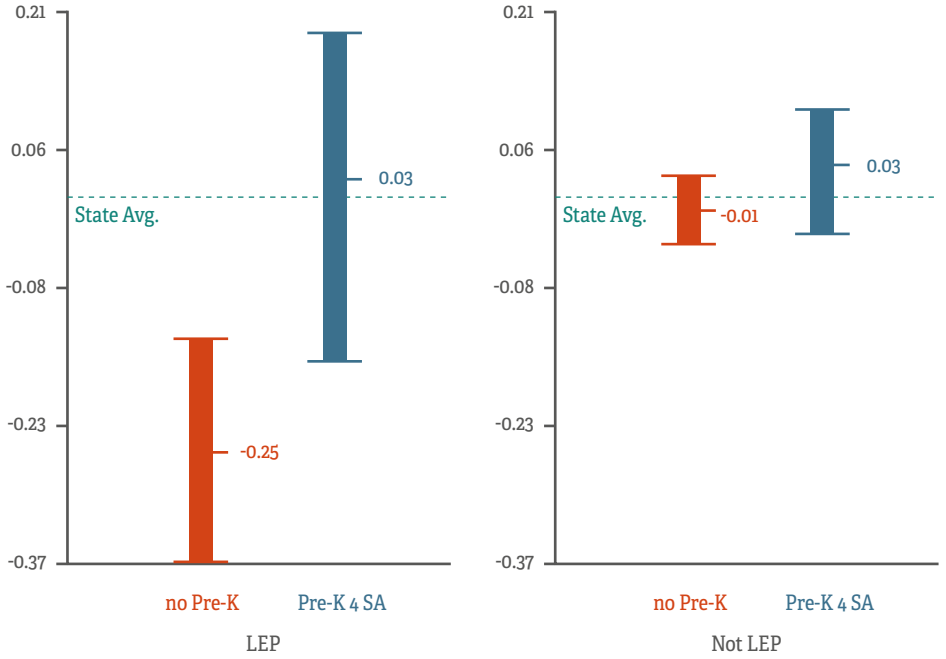


Figure 15. Third-grade reading scores standardized and with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as limited English proficient (LEP).

Third-grade Math. Pre-K 4 SA increased third-grade math scores of students identified as LEP by 0.29 standard deviations or the equivalent of a change in percentile ranking of 10.2 percentage points; while their counterparts identified as not being LEP again experienced an increase but by a smaller amount and not at a statistically significant level as shown in Figure 16.

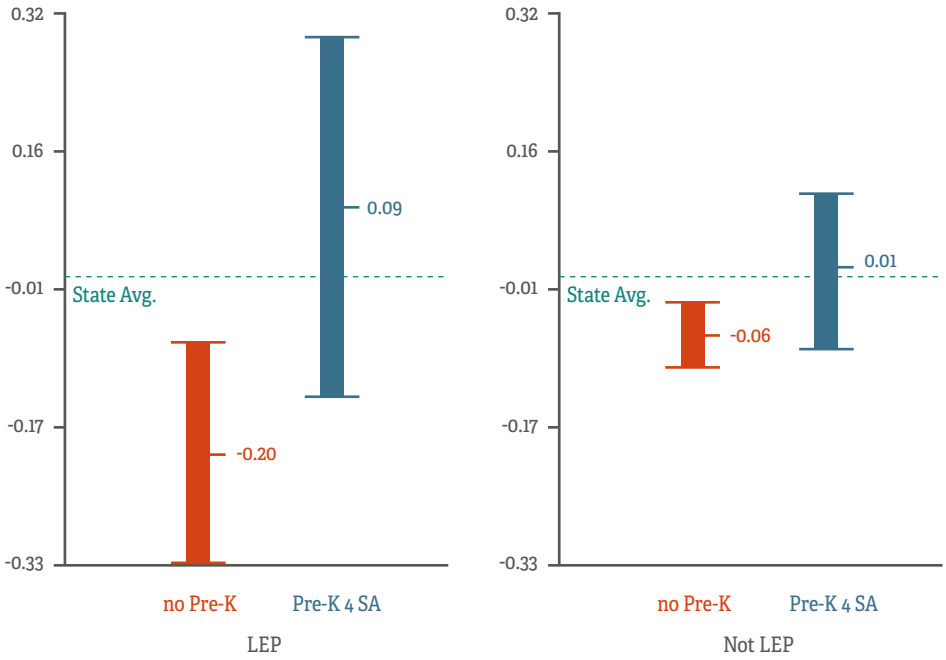


Figure 16. Third-grade math scores standardized and of with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as limited English proficient (LEP).

School Attendance. Pre-K 4 SA increased school attendance of LEP students by 21 days or a relative growth rate of 3.2 percent; while school attendance of students not identified as LEP increased by 12 days or a relative growth rate of 1.8 percent as shown in Figure 17.

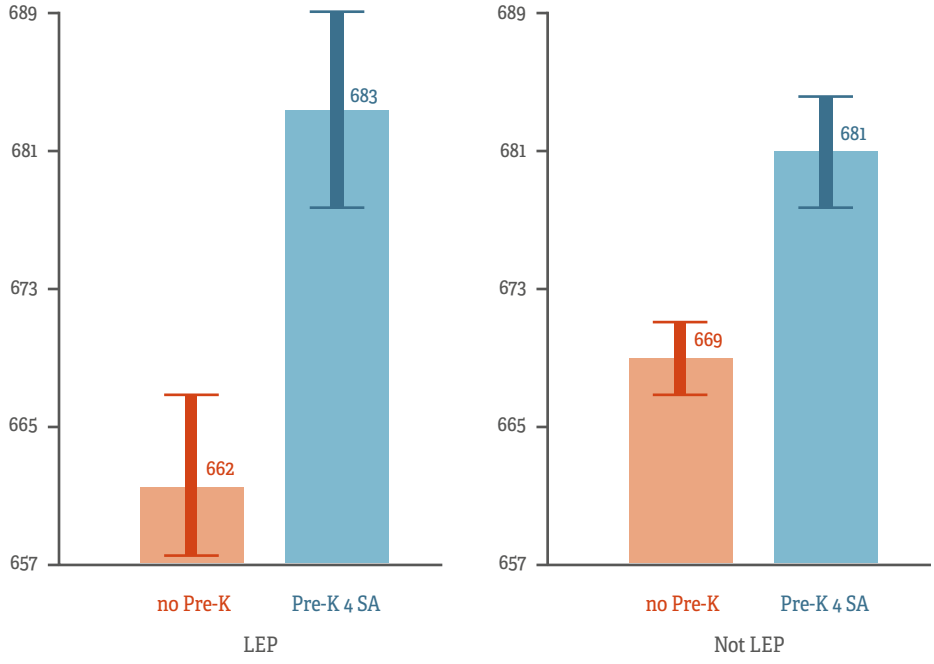


Figure 17. Days present in kinder to third-grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as limited English proficient (LEP).

Special Education. Pre-K 4 SA decreased the rate of assignment to special education for LEP and non-LEP students. Pre-K 4 SA's impact, however, was not statistically different across the two types of students as shown in Figure 18.

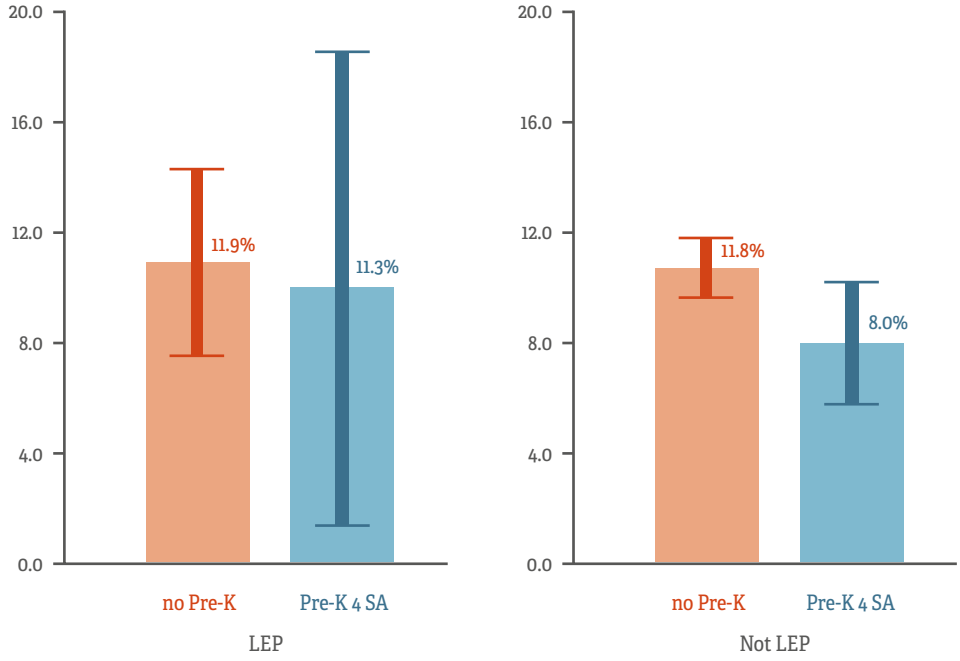


Figure 18. Probability of being assigned to a special education program in kinder through third grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as limited English proficient (LEP).

Grade Repetition. As previously mentioned, students repeated a grade between kinder and second at an exceptionally low rate—less than half of a percent overall. Pre-K 4 SA, however, eliminated the likelihood of grade repetition for LEP students as shown in Figure 19. The effect size on grade repetition for economically disadvantaged students equaled negative 1.7 percentage points; while its effect on non-LEP students was negative but not statistically significant.

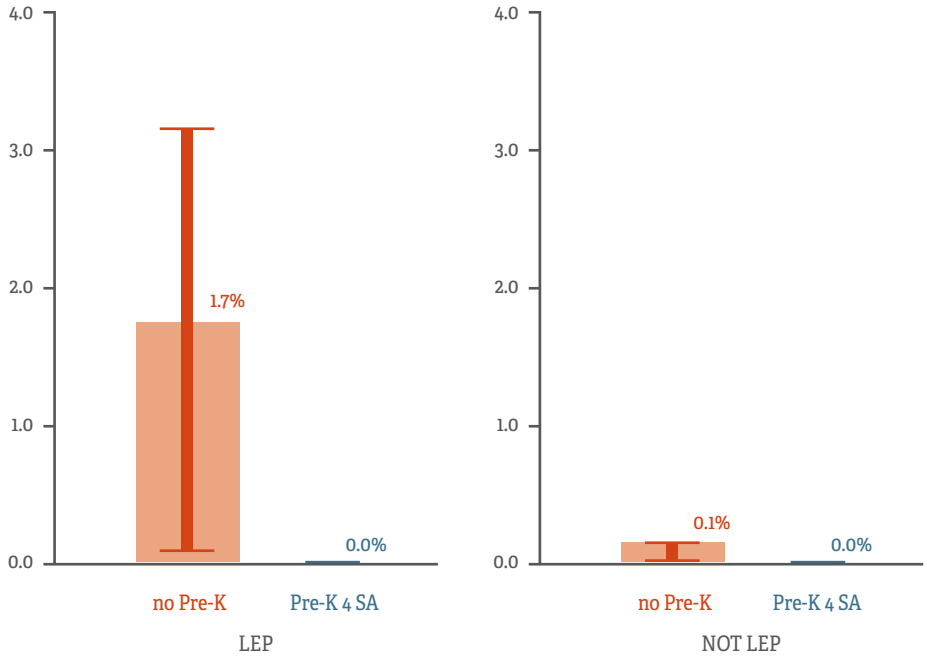


Figure 19. Probability of repeating a grade in kinder through second grade with 95 percent confidence intervals of students who experienced no public pre-k and Pre-K 4 SA by status as limited English proficient (LEP).

Disciplinary Action. Pre-K 4 SA did not produce heterogeneous effects on disciplinary action by LEP status.

				95 percent Confidence Intervals		
LEP	**COEFF.**	**SE**	**P-VALUE**	**LOWER**	**UPPER**	**OBS**
Third-grade math score, standardized	0.17	0.11	0.01	0.06	0.49	1,984
Third-grade reading score, standardized	0.29	0.13	0.02	0.04	0.54	1,984
Days present, kinder to third grade	20.95	3.91	0.00	13.29	28.62	2,020
Classified in special education, kinder to third grade	-0.01	0.05	0.90	-0.11	-0.10	2,020
Repeated grade, kinder to second grade	-0.02	0.01	0.04	-0.03	-0.00	2,020
Received disciplinary action, kinder to third grade	0.00	0.04	0.97	-0.08	0.08	2,020

NOT LEP	**COEFF.**	**SE**	**P-VALUE**	**LOWER**	**UPPER**	**OBS**
Third-grade math score, standardized	-0.05	0.04	0.25	-0.03	0.13	9,674
Third-grade reading score, standardized	0.07	0.04	0.12	-0.02	0.15	9,675
Days present, kinder to third grade	12.03	1.41	0.00	9.27	14.78	9,855
Classified in special education, kinder to third grade	-0.04	0.01	0.01	-0.07	-0.01	9,855
Repeated grade, kinder to second grade	-0.00	0.00	0.11	-0.00	-0.00	9,855
Received disciplinary action, kinder to third grade	0.03	0.02	0.11	-0.01	0.06	9,855

Table 4. Pre-K 4 SA's Average Treatment on the Treated Effect Sizes by Limited English Proficient (LEP) Status

COMPARISON OF PRE-K 4 SA & PUBLIC PRE-K IMPACTS

How did effects of Pre-K 4 SA compare to those of public pre-k?

To compare Pre-K 4 SA impacts to public pre-k impacts, the study population needed to be limited to students who were identified as economically disadvantaged, homeless, or limited English proficient. This subpopulation represents nine out of 10 students—nearly all students—served by public prekindergarten. Limiting the study population to this target population ensured comparisons were internally valid. A more detailed discussion of this research design can be found in Appendix 1.

Pre-K 4 SA—like a stronger dose of medicine—amplified the positive impact of public prekindergarten. While public prekindergarten improved student outcomes for its enrolled students, Pre-K 4 SA produced larger student gains. This analogy of a stronger dosage is fitting because Pre-K 4 SA provided a full-day of instruction by degree instructors with specialties in early education. In contrast, about half of the public pre-kindergarten programs examined provided a full-day program and instructors with graduate degrees in early education were an exception.

In Figures 20 through 24, this section contrasts student outcomes of a target population of students who did participate in public pre-kindergarten, those who participated in public pre-k, and those who participated in Pre-K 4 SA, respectively. As mentioned earlier, the target population consisted of students identified as economically disadvantaged, homeless, or limited English proficient. At the end of this section, Table 6 provides a summary of estimated effect sizes, their 95 percent confidence intervals, and other supporting statistics.

THIRD-GRADE READING

Public pre-k students achieved a higher third-grade reading score on average compared to students who did not participate in public pre-k; however, the difference was not statistically significant nor meaningful. Pre-K 4 SA students achieved a higher third-grade reading score on average relative to both comparison groups: students who did not participate in public pre-k and those who did. The difference caused by Pre-K 4 SA was statistically significant and meaningful. As shown in Figure 20, Pre-K 4 SA increased reading scores equal to 0.17 standard deviations or the equivalent of a change in percentile ranking of 6.7 percentage points relative to the performance of students who did not enroll in public pre-k. Moreover, the average score earned by Pre-K 4 SA students was statistically equivalent to the state average.

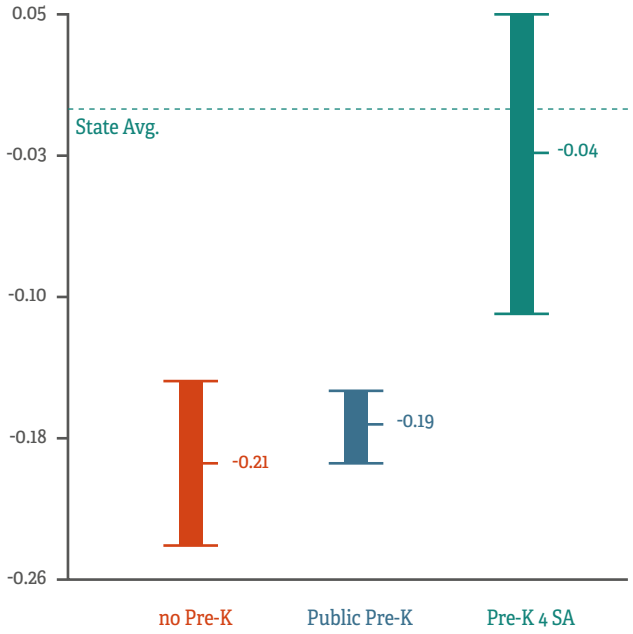


Figure 20. Third-grade reading scores standardized and with 95 percent confidence intervals of students who experienced no public pre-k, public pre-k, and Pre-K 4 SA.

THIRD-GRADE MATH

Public pre-k students achieved a higher third-grade math score on average compared to students who did not participate in public pre-k; however, the difference was not statistically significant nor meaningful. Pre-K 4 SA students achieved a higher third-grade math score on average relative to both comparison groups: students who did not participate in public pre-k and those who did. The difference caused by Pre-K 4 SA was statistically significant and meaningful. As shown in Figure 21, Pre-K 4 SA increased reading scores equal to 0.15 standard deviations or the equivalent of a change in percentile ranking of 5.9 percentage points relative to the performance of students who did not enroll in public pre-k.

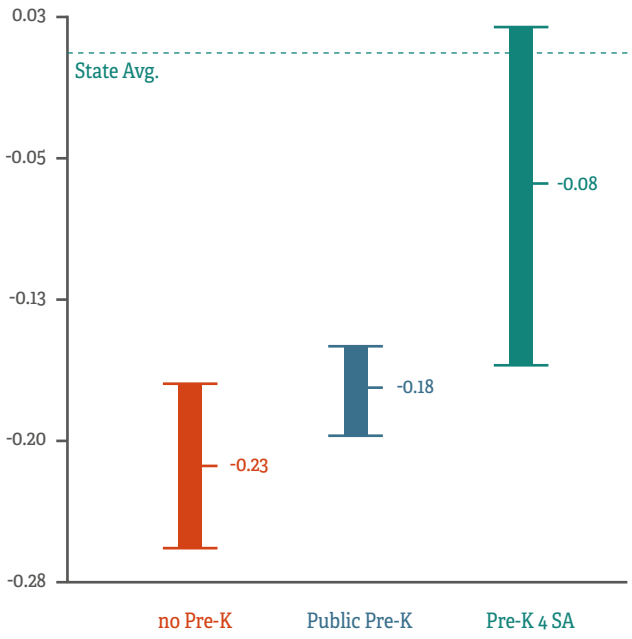


Figure 21. Third-grade math scores standardized and of with 95 percent confidence intervals of students who experienced no public pre-k, public pre-k, and Pre-K 4 SA.

SCHOOL ATTENDANCE

Public pre-k caused school attendance to increase by 10.3 days or 1.6 percent relative to the target population who did not enroll in public pre-k as shown in Figure 22. Pre-K 4 SA caused school attendance to increase by 17.9 days or 2.7 percent relative to the target population who did not enroll in public pre-k.

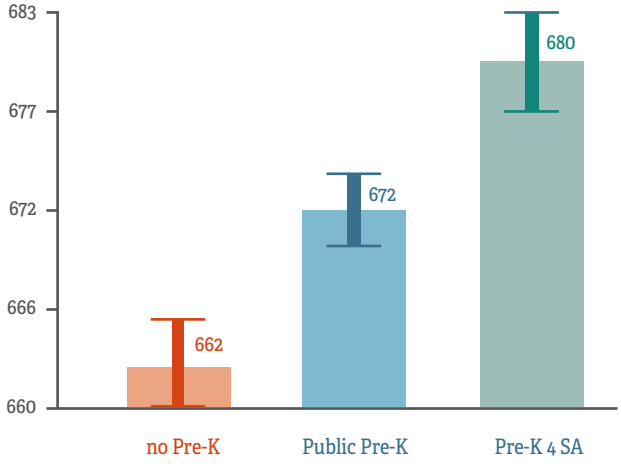


Figure 22. Days present in kinder to third-grade with 95 percent confidence intervals of students who experienced no public pre-k, public pre-k, and Pre-K 4 SA.

SPECIAL EDUCATION

Public pre-k decreased the likelihood of being classified in special education by 2.2 percentage points or 17.7 percent relative to the target population who did not enroll in public pre-k as shown in Figure 23. Pre-K 4 SA decreased the likelihood of being classified in special education by 3.8 percentage points or 30.6 percent relative to the target population who did not enroll in public pre-k.

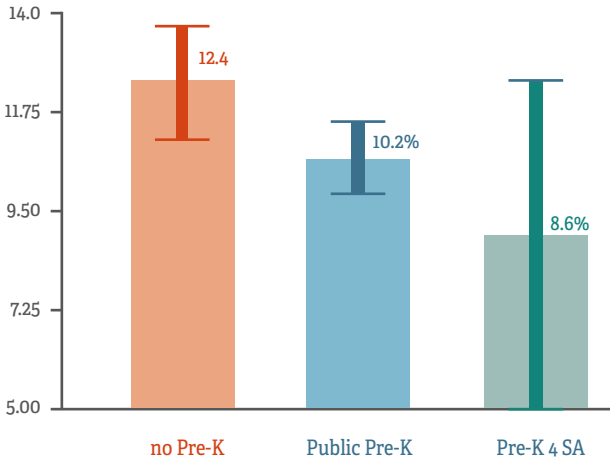


Figure 23. Probability of being assigned to a special education program in kinder through third grade with 95 percent confidence intervals of students who experienced no public pre-k, public pre-k, and Pre-K 4 SA.

GRADE REPETITION

Public pre-k reduced the need to repeat a grade between kindergarten and second grade on average but not by a statistically significant amount. In contrast, Pre-K 4 SA eliminated the need to repeat a grade between kindergarten and second grade. Without Pre-K 4 SA, 0.4 percent of students repeated at least one grade between kindergarten and second grade as shown in Figure 24.

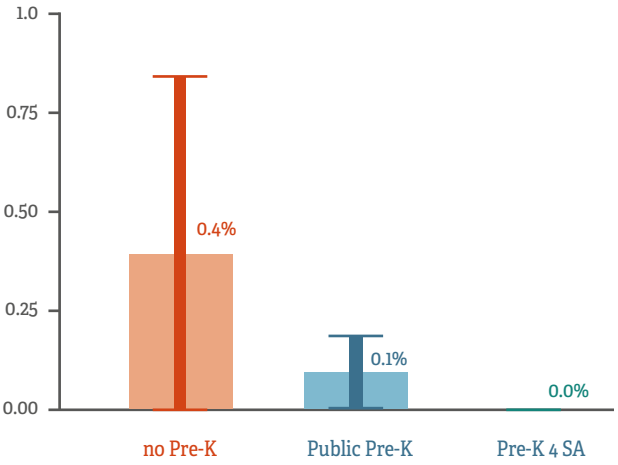


Figure 24. Probability of repeating a grade in kinder through second grade with 95 percent confidence intervals of students who experienced no public pre-k, public pre-k, and Pre-K 4 SA.

DISCIPLINARY ACTION

Public pre-k and Pre-K 4 SA produced no discernable effect on the probability of receiving a disciplinary action from their kindergarten to their third-grade schools for students of the targeted population.

			95 percent Confidence Intervals		
INTERVENTION	COEFF.	P-VALUE	LOWER	UPPER	OBS
Third-grade math score, standardized	0.17	0.536	-0.036	0.69	7,921
Third-grade reading score, standardized	0.51	0.061	-0.002	0.104	7,924
Days present, kinder to third grade	10.280	0.00	8.254	12.305	8.076
Classified in special education, kinder to third grade	-0.022	0.008	-0.038	-0.006	8.076
Repeated grade, kinder to second grade	-0.003	0.094	-0.007	-0.001	8.076
Received disciplinary action, kinder to third grade	0.004	0.624	-0.011	0.018	8.076

NOT LEP	COEFF.	P-VALUE	LOWER	UPPER	OBS
Third-grade math score, standardized	-0.170	0.001	0.072	0.268	7,921
Third-grade reading score, standardized	0.149	0.05	0.046	0.253	7,924
Days present, kinder to third grade	17.923	0.00	14.417	21.358	8,076
Classified in special education, kinder to third grade	-0.038	0.048	-0.076	0.00	8,076
Repeated grade, kinder to second grade	-0.004	0.030	0.00	0.00	8,076
Received disciplinary action, kinder to third grade	0.007	0.721	-0.029	0.042	8,076

Table 5. Public Pre-K 4 SA's Average Treatment on the Treated Effect Sizes of Students who were Economically Disadvantaged, Homeless or Limited English Proficient

APPENDIX 1. RESEARCH DESIGN

This section describes this study's research design. It outlines the student outcomes of interest. It provides details on how comparison groups were defined for each research question. It also describes the methodologies used to estimate effect sizes and the standard used to define statistical significance. This section concludes with a description of the limitations of the methodologies used.

STUDENT OUTCOMES OF INTEREST

Student outcomes assessed include the following:

1. Attendance from kindergarten through third-grade;
2. Probability of repeating a grade from kindergarten through third-grade;
3. Probability of receiving a disciplinary action from kindergarten through third-grade;
4. Probability of being classified in special education from kindergarten through third-grade;
5. Scaled score on state-mandated third-grade reading exam standardized; and
6. Scaled score on state-mandated third-grade math exam standardized.

Scaled scores were standardized. Scores were centered on the state average and divided by the standard deviation of the distribution of scaled scores. Consequently, zero represents the state average and student scores are transformed to represent their distance from the state average in units equal to the distribution's standard deviation.

COMPARISONS

This study examined different study populations to answer each of its four research questions. The first research question compared the share of public school first graders who enrolled in public prekindergarten in Bexar County to the share of public school first graders who enrolled in public prekindergarten in other urban counties of Texas, specifically Dallas, Harris, Tarrant, and Travis.

The second research question compared four-year-old Bexar County students who enrolled in Pre-K 4 SA in fiscal year-ending 2014 to Bexar County students who did not enroll in public prekindergarten, and who later enrolled in third grade at a public school also attended by a Pre-K 4 SA student.

The third research question involved the identification of heterogeneous effects—distinct treatment effects on observable subgroups of students. This study tested for the presence of heterogeneous effects of subgroups defined by gender, race and ethnicity, immigration status, economically disadvantaged status, limited English proficiency status, homeless status at the time of registration for prekindergarten, and three measures of teacher-student interactions that capture emotional support, instructional support, and classroom organization, respectively. Ultimately, only two types of subgroups were identified to uniquely benefit from Pre-K 4 SA: students identified as economically disadvantaged and limited English proficient (LEP), respectively.

To answer the fourth research question, which compares Pre-K 4 SA impacts to public pre-k impacts, the comparisons made needed to be limited to students who were identified as economically disadvantaged, homeless, or limited English proficient. This subpopulation represents nearly nine out of 10 students—nearly all students—served by public prekindergarten. Furthermore, no other observed student attributes were available that better identified students who were eligible for public prekindergarten but who did not take advantage of public prekindergarten.

Quasi-treatment groups used to estimate student outcomes defined participation in prekindergarten (both Pre-K 4 SA and public pre-k, respectively) by prekindergarten students with a minimum attendance rate of 90 percent, the regulatory minimum of compulsory grades in Texas. Consequently, the effects estimated

by this study represent average treatment-on-the-treated effect sizes; in other words, the expected effect produced when students attend the legal minimum number of school days.

All study populations used to answer research questions two to four were also limited to students who attended Bexar County public schools from prekindergarten to third grade. This limitation allowed for a single and consistent study sample to be analyzed across all outcome variables.

METHODOLOGIES

Research Question 1. The effect of Pre-K 4 SA on prekindergarten enrollment was calculated using a difference-in-differences methodology. The effect size equaled the change in pre-k enrollment in Bexar county before and after the Pre-K 4 SA election minus the change in pre-k enrollment in other urban counties of Texas during the same time period. Subtracting out the changes in pre-k enrollment in other urban counties controlled for statewide trends in public pre-k enrollment that would have occurred in Bexar County outside the Pre-K 4 SA election. Effect size estimates were calculated using two regression equations: one representing changes before and during the Pre-K 4 SA election and a second after the election.

Research Questions 2 to 4. This study used a quasi-experimental research design to estimate Pre-K 4 SA and public prekindergarten effects, respectively. This research design is referred to as inverse probability weighing and is often used in policy impact studies that use observation data.

Survey researchers have long used weighting techniques to create representative samples. They add lower weights to groups that are over-represented in a sample and higher weights for groups that are under-represented. In the same fashion, inverse probability weighing adds lower weights to groups that are over-represented in their assigned category of treatment or control and higher weights to groups that are under-represented in their assigned category of treatment or control.

In this study, this weighting procedure eliminated the measurable differences in confounding variables (such as gender or economically disadvantaged status) between treatment and control groups as shown in Appendix 1.

In this study, over- and under-representation were based on a student's characteristics before prekindergarten: gender, race and ethnicity, economically disadvantaged status, limited English proficiency status, immigrant status, and homeless status. Refer to Appendix 1 for a technical description of this procedure.

In summary, the research design of this study controlled for the following confounding variables:

- Gender;
- Race and ethnicity (Hispanic, White, Black, Asian, and Other);
- Economically disadvantaged status;
- Limited English proficiency status;
- Immigrant status; and
- Homeless status at time of registration for prekindergarten.

After weights were added, the difference between the average student outcome of a quasi-treatment group and that of the quasi-control group were estimated using a regression model.

HYPOTHESES TESTING

This evaluation used two-sided hypotheses tests with a critical value of 0.05 to identify the presence of non-zero effect sizes. This study reports effect sizes as statistically significant if they have a p-value of 0.05 or less.

STUDY LIMITATIONS

Research Question 1. The difference-in-differences methodology used to answer research question one is unable to account for trends that relate to public pre-kindergarten enrollment in Bexar County and that have the same timing as Pre-K 4 SA's introduction into Bexar County. Though no plausible trend was identified, its existence cannot be entirely ruled out.

Research Questions 2 to 4. Findings produced by quasi-experimental research designs such as the ones used by this study are less definitive than random control trials. In particular, unobserved data limits all studies that work with observational data. For example, this study does not include a direct measure of each student's grit, the perseverance and passion for long-term goals, in estimating pre-kindergarten effects (Duckworth, 2007). If participants in pre-kindergarten disproportionately possess grit, and if variables included are poor proxies for grit, then grit may be a confounding variable. If this is the case, then not controlling for grit will cause pre-kindergarten program effects to be overstated. Of course, there may also be other lurking factors that bias effect sizes downward. Because these variables are unobserved, their confounding effects cannot be dismissed, only mitigated through research design and methodology and a proper grounding in established theory.

DATA

Research Question 1. The Education Research Center at the University of Texas (ERC) facilitated access to the state's longitudinal data system, which included public education administrative data collected by Texas public schools. To answer research question one, this study used enrollment reports from fiscal year-ending 2014 to 2018 stored within the ERC.

Research Questions 2 to 4. The evaluation of Pre-K 4 SA impacts relied on ERC and Pre-K 4 SA data. The ERC data included attendance reports from fiscal year-ending 2014 to 2018, disciplinary action reports from fiscal year-ending 2014 to 2018, enrollment reports from fiscal year-ending 2014 to 2018, and STAAR accountability testing data from fiscal year-ending 2018. Pre-K 4 SA provided personally identifiable information on its first cohort of students who enrolled in their program in fiscal year-ending 2014 and data describing the instructional quality of each of its classrooms.

APPENDIX 2. ROBUSTNESS CHECKS

This study performed three checks of the robustness of estimated effects on student outcomes that were used to answer research questions two to four. The first robustness check tested the effectiveness of inverse propensity weighting to eliminate the relationship between student attributes and likelihood of receiving treatment: participating in Pre-K 4 SA or public pre-k, respectively. As shown in Panel A of Table 6, before inverse propensity score weighting occurred, indicators of Hispanic ethnicity, limited English proficiency (LEP), and economic disadvantage were highly predictive of participation in Pre-K 4 SA. In Panel B of Table 6, after inverse propensity score weighting occurred, indicators of Hispanic ethnicity, limited English proficiency (LEP), and economic disadvantage (in addition to other pre-treatment attributes) did not predict participation in Pre-K 4 SA.

PANEL A: BEFORE INVERSE PROPENSITY WEIGHTING

INTERVENTION	FEMALE	HISPANIC	BLACK	ASIAN	OTHER	LEP	ECON. DISADV.	HOMELESS
Coeff	-0.0303	-0.0337	0.0047	0.0103	0	-0.1649	-0.1923	-0.0017
SE	0.025	0.018	0.013	0.007	0.002	0.022	0.019	0.005
P-value	0.223	0.062	0.708	0.145	0.986	0	0	0.716
N	6607	6607	6607	6607	6607	6607	6607	6607

PANEL B: AFTER INVERSE PROPENSITY WEIGHTING

INTERVENTION	FEMALE	HISPANIC	BLACK	ASIAN	OTHER	LEP	ECON. DISADV.	HOMELESS
Coeff	-0.026	-0.0057	0.0057	0.0003	0.0007	0.0043	0.0043	-0.0014
SE	0.03	0.021	0.013	0.007	0.003	0.033	0.017	0.004
P-value	0.381	0.78	0.816	0.964	0.964	0.896	0.795	0.748
N	6607	6607	6607	6607	6607	6607	6607	6607

Table 6. Robustness Check 1: Inverse Weights Eliminate Student Attribute's Ability to Predict Treatmen

The second robustness check of effect size estimates involved trimming the student populations at the tails of the propensity score distribution and then re-estimating the effect size estimates with the reduced study sample. In the primary model of this study used to estimate Pre-K 4 SA impacts, propensity scores ranged from less than one percent to approximately 20 percent likelihood of assignment to treatment or control, respectively. In this robustness check, this study kept students with a probability of assignment between 5 and 15 percent.

In Panel A of Table 7, the effect sizes of Pre-K 4 SA Impacts before trimming the study population are compared to the effect sizes of Pre-K 4 SA Impacts after trimming the study population as shown in Panel B of Table 7. There is no meaningful variation in impact sizes nor statistical significance.

	PANEL A: BEFORE				PANEL B: AFTER			
OUTCOMES	COEFF.	SE	P-VALUE	OBS	COEFF.	SE	P-VALUE	OBS
Third-grade math score, standardized	0.095	0.039	0.015	11,688	0.092	0.041	0.025	10,358
Third-grade reading score, standardized	0.112	0.042	0.007	11,689	0.101	0.042	0.017	10,360
Days present, kinder to third grade	13.371	1.348	0.000	11,906	14.026	1.480	0.000	10,542
Classified in special education, kinder to third grade	-0.0033	0.015	0.025	11,906	-0049	0.013	0.000	10,542
Repeated grade, kinder to second grade	-0.004	0.002	0.023	11,906	-0.004	0.002	0.045	10,542
Received disciplinary action, kinder to third grade	0.022	0.015	0.147	11,906	-0.016	0.014	0.257	10,542

Table 7. Robustness Check 2: Pre-K 4 SA Impacts Before and After High and Low Propensity Score Students are Removed

The third and final robustness check involved estimating the effect sizes produced by Pre-K 4 SA without control variables. As shown in Table 8, the direction and statistical significance of estimated effects remain unchanged after control variables are eliminated from the analysis.

				95 percent Confidence Intervals		
LEP	COEFF.	SE	P-VALUE	LOWER	UPPER	OBS
Third-grade math score, standardized	0.132	0.052	0.012	0.029	0.235	11,688
Third-grade reading score, standardized	0.150	0.051	0.003	0.050	0.250	11,689
Days present, kinder to third grade	17.988	1.979	0.000	14.109	21.867	11,906
Classified in special education, kinder to third grade	-0.047	0.017	0.006	-0.081	-0.013	11,906
Repeated grade, kinder to second grade	-0.002	0.001	0.025	-0.004	-0.000	11,906
Received disciplinary action, kinder to third grade	0.009	0.019	0.645	-0.028	0.046	11,906

Table 8. Robustness Check 3: Pre-K 4 SA's Average treatmen on the Treated Effect Sizes without Control Variablers

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