Abstract Title Page

Title: The Long-Term Effects of Tulsa Pre-K Program on Academic Outcomes

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Abstract Body

Background / Context:

President Obama and others have demonstrated considerable interest in the Tulsa school-based pre-K program, one of a handful of universal pre-K programs in the U.S. We have been studying the effects of that high-quality pre-K program for over 10 years (Gormley, Phillips, & Gayer, 2008), and this paper will examine the eighth grade impacts of the program.

The number of state-funded pre-kindergarten programs has increased in recent years. The population of students enrolled in pre-K increased steadily from 2002 to 2010, with numbers having leveled off from 2010 to 2013 perhaps due to a concurrent decline in state spending that went along with the Great Recession (Barnett, Carolan, Squires, & Clarke Brown, 2013). Approximately 28% of 4 year olds were enrolled in pre-K in 2013 with another 800,000 students enrolled in Head Start.

The short-term effects of high-quality pre-K on school readiness are now well-established (Duncan & Magnuson, 2013; Gormley, Gayer, Phillips, & Dawson, 2005; Weiland & Yoshikawa, 2013). At the same time, questions have been raised as to whether these effects persist over time. Reputable studies have documented both persistence and fade-out for early childhood education programs (Deming, 2009; Duncan & Magnuson, 2013; Garces, Thomas, & Currie, 2000; Reynolds, Temple, Ou, Arteaga, & White, 2011).

Understanding if short-term gains persist or fade out is of utmost importance for policymakers, educators, and parents for informed funding and placement decisions. Effects may fade if students attend low quality schools, face concurrent stressors or challenges, or are otherwise not supported by schools or parents. In addition, schools may not adapt to the increased skills and cognitive ability of kindergarten students, meaning those who attended pre-K would not reap additional benefits from successive challenges in kindergarten. On the other hand, teachers may enhance or change their curriculum when students arrive in kindergarten with more advanced verbal and math skills due to pre-K attendance. Moreover, the early childhood years are a particularly sensitive time for brain development (Shonkoff & Phillips, 2000), and when young children gain skills early, they can be further enhanced by later educational opportunities.

A recent examination of the effects of the Tulsa pre-K program on 3rd grade test scores suggests evidence of both persistence and fade-out (Hill, Gormley, & Adelstein, 2014). Specifically, positive pre-K effects persisted for boys (though not girls) and for math (though not reading). Some limitations of the study methodology hamper generalizations. For example, in this 3rd grade study, we were unable to assess the effects on grade retention and special education.

Purpose / Objective / Research Question / Focus of Study:

In this paper, with new data from 8th grade – and from 7th graders who were retained in grade – we propose to estimate the effects of the Tulsa pre-K program on grade retention, special education placement, and school attendance and performance, as measured by middle school absenteeism and letter grades. Four sources of administrative data permit enhanced analyses: Tulsa Public Schools data, plus data from the three nearby school districts to which TPS students

are most likely to migrate over time. For all four school districts, we also have outcome data on students who were retained in grade once.

Setting:

Since 1998, Oklahoma has offered universal pre-K to all eligible children (those children 4 years old by September 1 of the school year). Currently, the state reaches 74% of eligible students. In 2006, OK enrolled 70 percent of eligible children (Barnett et al., 2013). Although programs are offered in 98% of school districts, participation is voluntary. The present study is conducted in Tulsa, OK and neighboring communities.

Population / Participants / Subjects:

The original sample of students included 4,114 students who attended kindergarten in Tulsa Public Schools (TPS) in the fall of 2006. Of those, 2,402 (56%) are currently in TPS (N = 1,902; 45%) or neighboring districts (N = 482; 11%) and comprise our final sample. Thirty-four percent of our original sample are 8th graders in TPS, and an additional 13% of our original sample are TPS 7th graders. Ten and two percent of our original sample also are in 8th and 7th grades in neighboring districts, respectively. We were unable to locate 44% of our original sample due to movement outside TPS or these three neighboring districts.

Intervention / Program / Practice:

Oklahoma pre-K is notable for its quality standards. Pre-K lead teachers must have a B.A and be certified in early childhood education. They also are paid according to the same salary and benefits schedule as other public school teachers. Class sizes cannot surpass 20 children, and child-to-staff ratios cannot exceed 10:1. All students in our sample attended kindergarten in 2006, and a sub-set attended Tulsa pre-K the year before (42%).

Research Design:

Random assignment to the treatment (pre-K) and control (no pre-K) conditions would ensure that characteristics of participants in the two groups are, on average, the same. However, pre-K is universally offered to all children in Oklahoma, rendering random assignment impossible. Instead, estimates of treatment effects must take into consideration that one cannot assume unconfoundedness in treatment assignment (Rosenbaum & Rubin, 1983). Analytic strategies to mitigate the threat of selection bias, that is, parents who choose to send their children to pre-K for similar reasons that children might have children with better skills, are described in the next section.

Data Collection and Analysis:

Data are derived from school administrative records from Tulsa Public Schools, Broken Arrow Public Schools, Union Public Schools, and Jenks Public Schools. The data were initially collected in 2006, when the children were in kindergarten in TPS. Follow-ups occurred when the children were in third and seventh/eighth grades. Importantly, the sample includes children who were in pre-K in 2005 and those who were not.

To supplement administrative data, we collected survey data from parents. The survey was distributed in English and Spanish to parents in August 2006 and asked questions about the child's preschool experiences, siblings, parental marital status, whether living with the biological father, highest level of education attained by both parents, primary language spoken at home, child's and parents' place of birth, availability of internet, and number of books in the home. The overall response rate was 63%.

In this paper, retention in grade, special education placement, school absenteeism, and GPA serve as outcomes. All administrative data were obtained from the respective school districts. Grade retention was inferred by being in seventh rather than eighth grade given that all students in our initial sample were in kindergarten in 2006, a strategy confirmed by TPS administrators. Special education placement, and type of placement, was obtained from administrative records for the 2014-15 academic year. We specifically examined designation as a learning disabled student (comparing those not identified as special education). The overall percentage of days absent during the prior academic year (2013-14) served as our indicator of school absenteeism. Finally, GPA was calculated as the average of the final grades on all courses the last school year (2013-2014) and was on a 4-point scale (4 = A, 3 = B, 2 = C, 1 = D, 0 = F).

Our first set of analyses will examine the descriptive differences in our four outcomes by pre-K status. Next, we will use OLS or logistic regression to predict outcomes from pre-K status and covariates (age, race/ethnicity, kindergarten test scores, parental marital status, free/reduced lunch status in K and current, and gender). Although the use of covariates in multiple regression should mitigate threats posed by selection bias, such a technique cannot rule out alternative explanations.

As a final step, we will employ propensity score matching with multiple imputation. Twenty multiply imputed will be created using Stata techniques. Estimates for all techniques will be combined based on the variance between and within imputations (Rubin, 1987).

Propensity score estimation involves predicting the likelihood of attending pre-K on a wide variety of contextual variables, which will come from survey and administrative data. Observed values for each individual are then entered into the propensity score equation, resulting in a predicted probability that each student attended pre-K for each student (Guo & Fraser, 2010). A key innovation in our approach also will be to use boosted regression, which incorporates nonparametric regression or classification trees to find the best model fit in terms of minimizing prediction error. Boosted regression can use all available covariates and is not subject to the particular modeling choices made by the analyst (McCaffrey, Ridgeway, & Morral, 2004; Stuart, 2010). We employed characteristics from administrative data and the parent survey in the creation of propensity scores. Balance across covariates will be assessed by the absolute standardized difference, calculated as the absolute difference in means between matched treatment and comparison groups (Rosenbaum & Rubin, 1985).

Next, we will use kernel matching, which is an average of the difference between a treated participant and all matched controls, weighted by the proximity of treated to matched students based on propensity scores. All individuals will be matched using this technique.

As an auxiliary technique, we will use an instrumental variable approach with proximity between student residence and a school-based pre-K program in 2006 as a proxy for pre-K attendance. While not perfect, this technique will be a good robustness check on our primary results.

Findings / Results:

Descriptive statistics are found in Table 1 in Appendix B. The sample includes students from diverse racial/ethnic backgrounds and socioeconomic status, as indicated by maternal education and free/reduced lunch status. Very preliminary analyses suggest that pre-K attendance (vs. no pre-K) may be associated with a decreased likelihood of being retained in grade, net gender, race/ethnicity, age, free/reduced lunch status, and school district. Our findings also will include results from multiple regressions with covariates, propensity score matching, and instrumental variable analyses on our four outcomes: retention in grade, special education placement, school absenteeism, and GPA.

Results will demonstrate the long-term impacts of pre-K attendance in Tulsa. Using a variety of estimation techniques, we aim to demonstrate if and to what extent a high-quality pre-K program decreases the likelihood of grade retention and special education placement, decreases school absenteeism, and increases GPA.

Conclusions:

In conclusion, results will inform the literature on the long-term effects of pre-K. Employing administrative data on over 2,000 middle school students with three estimation strategies, we will determine whether and which aspects of school engagement and performance are associated with attending Tulsa pre-K. Understanding the long-term impacts of high quality pre-K is critical as more states adopt universal pre-K and federal initiatives promote its expansion.

Appendices

Appendix A. References

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Appendix B. Tables and Figures

Table 1. Descriptive characteristics of Tulsa pre-K study participants

Characteristic	*M* (*SD*) / %	Available *N*
Pre-K 05-06	48%	4113
Head Start 05-06	11%	4113
Age @ K	5.43 (.53)	2235
English language learner @ K	18%	2598
Female	47%	4111
Race/ethnicity		
White	35%	4057
Black	31%	4057
Hispanic	23%	4057
Native American	10%	4057
Asian	1%	4057
Free/reduced lunch status @ K		
Free	68%	4060
Reduced	10%	4060
Paid	22%	4060
Maternal education		
No high school	20%	2155
High school	26%	2155
Some college	38%	2155
College degree	16%	2155
Current district		
TPS	80%	2238
Jenks	3.5%	2238
Broken Arrow	5%	2238
Union	11.5%	2238
Current Grade		
8th	75%	2240
7th	25%	2240