New Insights from the Tennessee Voluntary Pre-K Program:
Full sample results, school and neighborhood effects.

Symposium Overview
Dale C. Farran, Chair
*Vanderbilt University’s Peabody College*

State investments in pre-kindergarten programs, whether targeted for poor children or universally implemented, have expanded more rapidly than evaluations of their effects. Given the current interest and continuing expansion of state funded pre-k, it is especially important to be clear about the nature of the available evidence for the effectiveness of such programs. Despite widespread claims about proven benefits from pre-k, there is actually strikingly little credible research about the effectiveness of public pre-k programs scaled for statewide implementation.

In 2009, Vanderbilt University’s Peabody Research Institute, in coordination with the Tennessee Department of Education’s Division of Curriculum and Instruction, initiated a rigorous, independent evaluation of the state’s Voluntary Prekindergarten program (TNVPK). TNVPK is a full-day prekindergarten program for four-year-old children expected to enter kindergarten the following school year. For children to attend, families must be eligible for Free or Reduced Price Lunch. The evaluation was funded by a grant from the U. S. Department of Education’s Institute of Education Sciences (R305E090009).

The TNVPK classrooms participating in the evaluation study were among those where more eligible children were expected to apply for the program than there were seats available. Under such circumstances, only some applicants can be admitted and, of necessity, some must be turned away. The participating programs agreed to make this decision on the basis of chance. The classrooms are spread across the state in both urban and rural districts.

This procedure was used for two cohorts of children, TNVPK applicants for the 2009-10 and 2010-11 school years, and resulted in more than 3000 randomly assigned children. Both the children who participated in TNVPK and those who did not are being tracked through the state education database, and information on various aspects of their academic performance and status is being collected each year.

This panel will present three papers involving data from the TNVPK study. The first paper, *State Test Scores and Retention Data for the TNVPK Full Randomized Sample in 3rd Grade*, will provide the first report of 3rd grade outcomes on the full randomized sample of 3000+ children. The second paper, *Teachers, Schools, and Geographic Contexts: Understanding Pre-K Effect Persistence*, examines the interaction of follow up progress for those who attended VPK and their subsequent school and teacher characteristics. The third paper, *The Moderating Effect of Neighborhood Disadvantage on Preschool Effectiveness: Evidence from Tennessee*, presents similar analyses but focused on the relationship between pre-k effectiveness and neighborhood characteristics including density, income inequality, and other factors. Two discussants have agreed to reflect on these new data, Ron Haskins of the Brookings Institute and Greg Duncan of UC Irvine.
State Test Scores and Retention Data for the TNVPK Full Randomized Sample in 3rd Grade

Mark Lipsey (presenter), Dale Farran, and Kelley Durkin
*Vanderbilt University’s Peabody College*

**Background / Context**
Many states have implemented state-funded prekindergarten programs in the last decade, encouraged by claims about the benefits that can be expected and the importance of early experiences for children’s development. However, there is remarkably little methodologically adequate evidence about the effects of such programs. Claims for their success rely largely on small, experimental, model programs implemented 50 or more years ago that no state programs are actually replicating. Other than the Head Start Impact study (Puma et al., 2012), the Tennessee Volunteer Pre-K study is the first randomized sample followed longitudinally to determine effects from a statewide pre-K policy.

**Purpose/Objective/Research Question**
We have previously reported pre-K through 3rd grade outcomes on a subset of 1076 children from the full randomized sample of children (Lipsey, Farran, & Hofer, 2015). The current presentation will provide the first outcome information on the full randomized sample. The second cohort finished 3rd grade in 2015, with the exception of those retained. We will investigate the effects of attending the Tennessee Volunteer Pre-K Program (VPK) on 3rd grade high stakes state test scores (TCAP), cumulative retention rates, attendance, and special education placements in 3rd grade.

**Research Design**
Children signed up for VPK at oversubscribed schools were placed on randomized waiting lists (R-Lists). From these R-Lists, children were assigned either to attend a VPK classroom or not to be admitted because of space. Our access to the state database has allowed us to track these individuals from pre-K onward. Each year we have re-located all the children, matching state ID, names and birthdates.

**Population/Participants/Subjects**
The final sample consists of 2990 children from 111 R-Lists, who were age and income eligible in pre-K, were on an active R-List, and had some state data beyond the pre-K year. Of these children, 1852 were assigned to attend VPK and 1138 were not assigned to attend VPK. Using the state data, we determined how many of these children actually ended up attending VPK. 992 children did not attend VPK at all (control children) and 1974 children attended VPK for 20 days or more (treatment children). 23 children only briefly attended VPK (for 1-19 days). The sample is evenly divided between males (49.4%) and females (50.6%). About half of the children are white (48.9%), 25.2% are Black, 21.9% Hispanic, and 4.0% multi-racial or other. The final active sample represents 29 districts and 58 schools across the state of Tennessee.

**Data Collection and Analysis**
We collected data on children’s attendance, grade retention, special education placement, and disciplinary infractions each year, and TCAP scores in Reading, Math, and Science for 3rd grade from the state database. Missing data were imputed (m = 50).
To investigate the effect of assignment to attend VPK, we conducted intent-to-treat analyses (ITT) using multilevel regression (linear regression for continuous outcomes and logistic regression for discrete outcomes). Children were nested within R-Lists and Districts and student covariates were included (e.g., age, gender, Black, Hispanic, and having English as the primary language). Separate models will be presented for the outcomes of TCAP scores in Reading, Math, and Science, cumulative retention rates, attendance, special education placements, and disciplinary infractions.

Not surprisingly, students did not always adhere to their random assignment and some children who were assigned to attend VPK never did (8%), and some children who were not assigned to attend VPK did attend (13%). Consequently, we are also conducting treatment-on-the-treated analyses (TOT) to investigate the effect of attending VPK. In the current abstract we summarize what we have found in the ITT analyses but will present on both ITT and TOT analyses.

Findings/Results
ITT analyses indicated that being assigned to attend VPK was related to lower TCAP Math and Science scores (Table 1). There were no significant effects on TCAP Reading scores. There were also no significant effects of being assigned to attend VPK on school attendance for any year.

As the odds ratio effect size metrics indicate, somewhat fewer of the children assigned to VPK were retained in kindergarten, but retention rates evened out thereafter and none of these effects reached statistical significance (Table 2). A greater proportion of the children assigned to VPK had special education placements, and that difference was statistically significant. We are doubtful that this can be meaningfully interpreted as an intervention effect, however. The VPK participants had the opportunity to be identified for special education services while in the pre-K program, and school systems are slow to drop those designations.

Conclusions
State-funded pre-K is currently of great policy interest. The Obama administration has rolled out a federal program for pre-K expansion and many states have been enhancing their programs in recent years. Moreover, there is widespread belief in the transformative effects of pre-K. There is surprisingly little methodologically strong research specifically on short or long term effects of state-funded pre-K to support these beliefs. This TN-VPK study is the first randomized study of a state pre-K program.

The current results represent a distinctive research contribution, and suggest that there were null or negative effects of being assigned to attend VPK on state achievement scores, attendance, and retention rates. This should stimulate recognition of the need for further rigorous studies of state-funded pre-K.
References
https://my.vanderbilt.edu/tnprekevaluation/files/2013/10/VPKthrough3rd_final_withcover.pdf

Table 1

<table>
<thead>
<tr>
<th>ITT Estimates, Standard Errors, and Standardized Mean Difference Effect Sizes for TCAP Scores and Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>TCAP Reading</td>
</tr>
<tr>
<td>TCAP Math</td>
</tr>
<tr>
<td>TCAP Science</td>
</tr>
<tr>
<td>Attendance Kindergarten</td>
</tr>
<tr>
<td>Attendance 1st Grade</td>
</tr>
<tr>
<td>Attendance 2nd Grade</td>
</tr>
<tr>
<td>Attendance 3rd Grade</td>
</tr>
</tbody>
</table>

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

Table 2

<table>
<thead>
<tr>
<th>ITT Estimates, Standard Errors, and Odds Ratio Effect Sizes for Cumulative Retention and Special Education in 3rd Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Retained in K</td>
</tr>
<tr>
<td>Retained thru 1st Grade</td>
</tr>
<tr>
<td>Retained thru 2nd Grade</td>
</tr>
<tr>
<td>Special Education in 3rd Grade</td>
</tr>
</tbody>
</table>

**p<.01, *p<.05
Teachers and Schools: Understanding Pre-K Effect Persistence

Mark Lachowicz (presenter), Alvin Pearman, Matthew G. Springer
Vanderbilt University’s Peabody College

Background
In recent years, numerous states have significantly expanded access to pre-Kindergarten (pre-K), and policymakers at the federal level are considering legislation that would fund near-universal access across the country. Although some evaluations of pre-K programs have shown substantial long-term benefits (e.g., lower rates of dropping out of school, less criminal behavior, and less unemployment) (e.g., Gorey, 2001; Heckman et. al, 2010; Husted and Barnett, 2005; Nores et. al, 2005), other studies found that test score gains attributable to pre-K programs fade out by third grade or sooner (e.g., Magnuson et al., 2007a; Deming, 2009; Puma et al., 2010; Lipsey et al., 2013). Better understanding of social program fadeout is critically important if policymakers and practitioners want to realize the full potential of early childhood interventions that often show tremendous early promise. If we could fix pre-k fadeout, we would expect even more long-term benefits with regard to high school graduation, criminal behavior, and employment.

Purpose
Swain, Springer, and Hofer (2015) recently reported on the important role teacher effectiveness plays in augmenting the persistence of the benefits for pre-K participants. Results indicated a modest, positive interaction between teacher quality and state pre-K exposure on early elementary cognitive measures, such that better teacher quality in years subsequent to pre-K was associated with more persistent positive pre-K effects. Moreover, the relationship between teacher quality and pre-K participation appeared to be particularly important for students who showed early cognitive deficits and language barriers prior to pre-K enrollment. Building on this work, this study intends to better inform the potential moderating role of teacher and schooling characteristics on the persistence of pre-K effects.

Data and Sample
These data come from the 3000 students who were randomly assigned to attend the Tennessee Voluntary Pre-K program or not admitted. Although during the symposium we plan to describe the moderating capacity of teachers and schools on pre-k effectiveness for the full RCT sample, the preliminary analyses reported below involve the roughly 1,000 children who comprise the Intensive Sub-Study Sample. These children (700 attendees and 300 control children) were administered a battery of Woodcock Johnson cognitive assessments on an annual basis between pre-kindergarten and 3rd grade. We have paired student-level data for the children with detailed teacher and school-level information. Student, teacher, and school information comes from a unique state-level research-practice partnership between Vanderbilt University and the State of Tennessee. In total, we can match at least 90% of the full RCT student sample to at least one teacher in each year/grade combination. We have valid teacher ratings from the state’s comprehensive teacher evaluation system for at least 85% of teachers in each year/grade combination. With the Sub study sample we can examine achievement growth trajectories from pre-K through 3rd grade; for the full sample, we will examine school and teacher effects on the high stakes state test give in 3rd grade.

Analysis and Findings
Preliminary results based on a growth curve analysis examining the trajectories of children on a composite measure of achievement showed that ratings of teacher effectiveness collected by the
state and overall school quality (defined in terms of average school-level proficiency rates) emerged as significant moderators of pre-K effects in second and third grade. Specifically, for children who attended pre-K, more persistent effects were observed when these children were paired with higher quality teachers in grade 2 ($b = 5.93, SE = 1.92, p < .01$) and grade 3 ($b = 8.89, SE = 2.81, p < .01$). In addition, differential pre-k effects were observed with respect to overall school quality, with students who previously attended pre-K experiencing persistent pre-K effects when they subsequently attended a higher quality school in grade 2 ($\beta = .68, SE = .17, p < .001$) and grade 3 ($\beta = .84, SE = .22, p < .001$). We cannot rule out the possibility that the incremental effects of having a higher quality teacher are invariant to overall school quality, meaning that children who attended pre-K and who subsequently had a high quality teacher in grade 2 and 3 experienced persistent pre-k effects regardless of the overall quality of the school itself.

Conclusions
These and other findings that focus on standardized state-wide assessments during third grade (which we will report during the symposium) will inform educational researchers and policymakers about conditions that lead to larger long-term pre-K effects for children, particularly those from historically disadvantaged or low-performing backgrounds.
References


doi:10.1097/00001163-20050100-00003


doi:10.3102/01623737027003245


The Moderating Effect of Neighborhood Disadvantage on Preschool Effectiveness: Evidence from Tennessee
Alvin Pearman (presenter)
Vanderbilt University’s Peabody College

Background
The experimental evidence for the positive effects of preschool exposure comes from a small set of interventions implemented in confined geographical areas. For instance, the Perry Preschool Project, commonly cited as one of the more compelling randomized control trials of preschool effectiveness, served low-income children living in the attendance zone of a single elementary school in Ypsilanti, MI. On the other hand, states looking to expand access to prekindergarten for large segments of their child population will need to accommodate children living in neighborhoods that differ markedly from those served by the Perry Preschool Project. Despite an extensive neighborhood effects literature that has documented qualitative differences in the experience of poverty across places, including a stark urban-rural divide that has implications for the types of resources available to children and families, researchers of preschool effects have largely assumed away neighborhood differences. As a result, little is known as to whether poor children’s residential environments matter for how children engage and respond to preschool interventions.

Purpose
This study estimates the differential effect of preschool exposure among low-income children living in neighborhoods with varying levels of disadvantage. The motivating question guiding this study is whether the effects of attending preschool on children’s later achievement were different depending on the extent to which poor children were exposed at baseline to disadvantaged neighborhoods characterized by elevated rates of poverty, unemployment, welfare receipt, single-parent families, and relatively low levels of educational attainment and occupational status among neighborhood residents.

Data and Sample
The data for this study come from two sources. First, student-level data were gathered as part of a large-scale, experimental evaluation of the Tennessee Voluntary Pre-Kindergarten Program (TN-VPK). TN-VPK was an optional, full-day prekindergarten program for economically-disadvantaged four-year-olds living across Tennessee that began during the 2009-10 school year. Second, children were linked to their neighborhood of residence at baseline and were assigned a composite measure of neighborhood disadvantage based on data from the 2008-12 American Community Survey (ACS).

Research Design
The research design exploited the fact that children applying to TN-VPK exceeded the number of available seats in many preschools in Tennessee. As a result, only some children could be admitted into these pre-K classrooms, and a decision was required to determine which children would be granted admission. With the aid of a team of researchers at Vanderbilt University, staff at each participating TN-VPK program enrolled children on a random basis: some children were randomly assigned to attend preschool, others were randomly assigned to a control condition that was to receive no prekindergarten. This procedure was the basis for two cohorts of children. Before the start of the 2009-10 and 2010-11 school years, nearly 3000 economically-disadvantaged children whose families applied for admission into TN-VPK were randomly assigned to either the study’s treatment or control condition.
For the last several years, researchers at Vanderbilt have tracked the educational status and academic achievement of TN-VPK participants and non-participant through a statewide public school database. In addition, of these nearly 3000 children who applied to TN-VPK, Vanderbilt researchers obtained parental consent at baseline for over 1,000 children to be assessed directly by researchers on a wide range of achievement and non-cognitive outcomes on an annual basis, including an array of baseline measures assessed prior to preschool exposure. The analysis reported in this study is based on these roughly 1,000 children who comprised the Intensive Sub-Study Sample (ISS) and for whom baseline addresses were available.

**Analysis**

The primary analysis examined the extent to which exposure to concentrated neighborhood disadvantage at baseline moderated the effects of pre-k exposure on children’s later performance on statewide achievement tests during third grade. I condition the estimated treatment effect using a full set of control variables, including a series of cognitive assessments from the Woodcock Johnson III Achievement Battery measured at baseline (prior to pre-k). To determine the extent to which this treatment effect varied by neighborhood condition, I introduced an interaction term between our binary indicator of preschool attendance and a standardized measure of children’s exposure to neighborhood disadvantage at baseline. Any significant interaction would then be interpreted as the increment (or decrement) to the effects of preschool on later achievement associated with a one standard deviation increase in neighborhood disadvantage.

**Findings**

Analyses revealed a statistically-significant and substantively-meaningful interaction between neighborhood disadvantage and pre-k exposure on statewide reading tests, such that children living in the most disadvantaged communities in Tennessee appeared to benefit the most from attending pre-k. Poor children who attended prekindergarten and lived in the most severely-distressed neighborhoods at baseline scored 0.3 standard deviations higher on statewide reading tests in third grade relative to similar peers who did not attend pre-K. Conversely, low-income children who lived in the most advantaged neighborhoods at baseline and attended pre-K actually experienced a depressive effect on their third-grade reading achievement. Although children living in disadvantaged neighborhoods who attended pre-K also appeared to perform better than similar peers who did not attend pre-K on third-grade math achievement, this estimate was unstable and failed to reach conventional significance thresholds. I found no evidence that pre-K enrollment had any effect on statewide science tests, regardless of children’s neighborhood composition.

**Conclusions**

Interestingly, the children who seemed to benefit from Tennessee’s expansive preschool initiative were those who lived in neighborhoods most similar to the ones found in the Perry Preschool Project, one of the few early childhood interventions used to justify claims for universal or near-universal prekindergarten despite its limited geographic scale. The results reported here suggest that a proper “scaling up” of preschool interventions may have less to do with increasing the number of children served and more to do with zeroing in on places. Ultimately, the results of this study suggest that early learning initiatives may benefit from considerations of how residential conditions differ, even among low-income children, and should encourage future research into how children’s neighborhood contexts relate to the implementation and efficacy of preschool interventions.