Enrollment rates of children in universal prekindergarten programs in Vermont in 2016/17

See https://go.usa.gov/xpy3r for the full report.

Appendix A. About the study

Research supports the benefits of high-quality prekindergarten (preK) programs for children, including increases in academic and social-emotional skills at kindergarten entry (Yoshikawa et al., 2013; Zaslow et al., 2010), and multiple approaches are taken at the state and local levels to provide preK (Barnett et al., 2016). Programs vary in quality indicators, number of hours or days provided (that is, dosage), provider types, and requirements (Barnett et al., 2016). Many states have opted for a mixed-delivery system of providers, yet Vermont's system is one of only a handful that are considered universal, with universal defined as every child having an opportunity to enroll. Other jurisdictions with universal preK include Florida, West Virginia, and Washington, DC (Barnett & Gomez, 2016; Wat & Gayl, 2009). Although opinions are mixed on whether universal or targeted policies are best, some research and theory suggest that universal approaches yield the largest benefits (Barnett, 2011; Cascio, 2017). However, research that assesses the implications of different models and policies, such as how child and geographic characteristics are related to enrollment patterns in a universal mixed-delivery system, is limited.

Early education experiences prior to kindergarten vary by child and family characteristics such as race/ethnicity, socioeconomic status, and home language (Rathbun & Zhang, 2016). Availability and awareness of early childhood education programs and geographic location are factors in families' decisions about whether to enroll in a center-based or other nonparental early childhood education setting (Crosby, Mendez, & Helms, 2016; Miller, Votruba-Drzal, & Coley, 2014; Tang, Coley, & Votruba-Drzal, 2012). For example, children in families with lower socioeconomic status are less likely than children in families with higher socioeconomic status to enroll in a center-based program in the year before kindergarten (Rathbun & Zhang, 2016). In a national sample, recent research exploring the distance between a child's home and early education programs has found that distance from programs varied by family income. Specifically, 3- to 5-year-old children in the poorest households attended center-based programs that were closer to home than those attended by children in households with the highest income (2.7 miles compared with 4.6 miles; National Survey of Early Care and Education Project Team, 2016). Research investigating the priorities and processes of childcare decisionmaking suggests that the majority of surveyed parents in low-income families consider two or fewer childcare settings before making a decision (Forry, Isner, Daneri, & Tout, 2014). These results indicate that parents may be conducting a limited search for potential high-quality early childhood education and preK programs in their geographic area.

In Vermont becoming a prequalified provider to participate in the universal preK program requires obtaining a rating of at least three out of five stars on the state's quality rating and improvement system (Vermont Agency of Education, 2016). This standard is consistent with the literature on the benefits of preK programs, pointing to the importance of quality in ensuring positive outcomes for children and suggesting that preK meeting quality standards leads to sustained improved child outcomes (Yoshikawa et al., 2013; Zaslow et al., 2010). Quality rating and improvement systems provide both a public measure of quality and a system of incentives and supports for program improvement; at least 39 states have quality rating systems (The Build Initiative & Child Trends, 2016). Yet recent research found that Tennessee's state-funded preK, which adheres to standards regarding structural indicators of quality, yielded short-term improvements in child outcomes, but by grade 3, students attending the program performed worse on state achievement tests than the control group (Lipsey, Farran, & Durkin, 2018). This research raises questions about the dosage, duration, and quality of preK that lead to desired sustained outcomes.

A recent report to the Vermont state legislature highlights the variability in star ratings across preK programs, with 43 rated three stars, 134 rated four stars, and 151 rated five stars (Vermont Agency of Education, 2017). Table A1 summarizes the meaning of each rating in Vermont's quality rating and improvement system, the STep Ahead Recognition System. Participating programs can receive points in five areas: compliance with state regulations; staff qualifications and training; interaction with and overall support of children, families, and communities; how thoroughly providers assess what they do and plan for improvements; and strength of operating policies and business practices.

Table A1. What each Vermont STep Ahead Recognition System rating means

Rating	Number of points	Meaning
One star	1–4	Generally newer programs just starting in the STep Ahead Recognition System
Two stars	5–8	Have shown a little progress in many areas or more substantial progress in one or two areas
Three stars	9–11	Have made progress in all areas and substantial progress in some areas; they are working to reach specific goals
Four stars	12–14	Established programs meeting standards of quality in all five areas; many of these programs are nationally accredited
Five stars	15–17	Outstanding in all five areas; many of these programs are nationally accredited

Note: For more information on the Vermont STep Ahead Recognition System and results from its validation study, see Warner-Richter et al. (2018).
Source: Vermont Agency of Human Services, Department for Children and Families website (https://dcf.vermont.gov/childcare/providers/stars/stars-meaning).

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Appendix B. Methods

This appendix provides additional information about the sample, data, and methods.

Sample

The study sample consisted of 5,622 children who were enrolled in a prequalified prekindergarten (preK) program in Vermont during the 2016/17 school year. Families register their children for public preK in their local education agency of residence. Children can then be enrolled in any prequalified preK program in the state. During the 2016/17 school year, registration data did not include information about a child's actual program of enrollment. To track which programs children were enrolled in, the Vermont Agency of Education used an algorithm to match children's registration data to assessment data collected by preK programs. After the matching was conducted, children for whom information was missing on the program in which they were enrolled or the local education agency in which they were registered were excluded from the sample.

The analysis sample excluded children who were not matched through Vermont's matching process. Vermont successfully matched approximately 65 percent of the total preK population. Because the online assessment system does not allow for the entry of unique student identifiers, Vermont was unable to match based on student ID.

Difficulties associated with matching children to programs using the algorithm in Vermont's matching process included the fact that many early childhood programs in the state report their name slightly differently in different places, making it difficult to match for these programs. In addition, other data reported by programs may have been inaccurate or inconsistent, affecting the results of the match. Finally, programs that had not been using the online assessment system prior to Act 166 and the assessment requirement may not have started using it yet during the first full year of universal preK implementation; thus children were not included in that data file.

To understand the representativeness of the study sample, the sample (n = 5,622) and the full population of children enrolled in preK in Vermont in 2016/17 (N = 8,664) were compared. There were some small but statistically significant differences. Specifically, 97 percent of the study sample was White compared with 96 percent of the full preK population, and 33 percent of the study sample was eligible for the national school lunch program compared with 31 percent of the full preK population (table B1).

Table B1. Comparison of characteristics between the study sample and the full population of children enrolled in prekindergarten in Vermont in 2016/17

Characteristic	Percent of children in the study sample (n = 5,622)	Percent of the full population of children attending prekindergarten (N = 8,664)	Test of equality: z-score (p-value)
White	97	96	2.71* (.007)
Male	53	53	–0.37 (.715)
Has an individualized education program	13	na	na
English learner student	<1	<1	–1.53 (.127)
Eligible for the national school lunch program	33	31	3.15* (.002)

* Difference between percentages is statistically significant at $p < .05$.
na indicates that data were not provided by the Vermont Agency of Education so no comparison was made.
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Data on kindergarteners who were enrolled in universal preK in Vermont in 2016/17 and on those who did not were not available at the time of the study. However, the study team was able to compare the study sample of 4- and 5-year-olds who were enrolled in preK in Vermont in 2016/17 with the full population of children who were enrolled in kindergarten in Vermont in 2017/18. This helped in discerning whether the sample was representative of the full population of children eligible to enroll in universal preK in 2016/17.

There were small differences between 4- and 5-year-old children enrolled in preK in 2016/17 and the full population of kindergarteners in 2017/18 (table B2). In the sample of 4- and 5-year-olds enrolled in preK in 2016/17 (*n* = 3,178), 97 percent were White, 53 percent were male, less than 1 percent were English learner students, and 35 percent were eligible for the national school lunch program; in the full population of kindergarteners in 2017/18 (*n* = 5,745), 90 percent were White, 52 percent were male, 3 percent were English learner students, and 40 percent were eligible for the national school lunch program. Differences in the percentages of English learner students and children eligible for the national school lunch program may be due to differences in reporting and identification at the preK versus kindergarten levels rather than to true differences in the demographic characteristics of these two groups; however, the possibility that fewer children who were enrolled in public preK are English learner students or eligible for the national school lunch program compared with the full population cannot be ruled out.

Table B2. Comparison of characteristics between the study sample of 4- and 5-year-olds enrolled in prekindergarten in Vermont in 2016/17 and the full population of children enrolled in kindergarten in Vermont in 2017/18

Characteristic	Percent of children in the study sample (*n* = 3,178)	Percent of children in kindergarten in 2017/18 (*N* = 5,745)	Test of equality: *z*-score (*p*-value)
White	97	90	12.52* (.000)
Male	53	52	0.66 (.513)
Has an individualized education program	13	14	–0.97 (.333)
English learner student	<1	3	–9.60* (.000)
Eligible for the national school lunch program	35	40	–5.40* (.000)

* Difference between percentages is statistically significant at $p < .05$.
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

A comparison between the study sample of preK programs (*n* = 282) and the full population of prequalified preK programs in 2016/17 (*n* = 383) revealed that there was a lower percentage of three-star programs in the study sample compared with the population of prequalified preK programs (table B3).

Table B3. Comparison of characteristics between the sample of prekindergarten programs and all prequalified prekindergarten programs in Vermont in 2016/17

Characteristic	Percent of prequalified programs in the sample (*n* = 282)	Percent of all prequalified programs (*N* = 383)	Test of equality: *z*-value (*p*-value)
Public school program	39	36	1.05 (.293)
Private program	61	64	1.05 (.293)
Three-star program	5	9	3.95* (.000)
Four-star program	40	40	0.08 (.934)
Five-star program	55	50	–1.81 (.070)

* Difference between percentages is statistically significant at $p < .05$.
Source: Authors' analysis of VT Agency of Education data for 2016/17.

Data

The data for this study included administrative data from the Vermont Agency of Education for the sample of 5,622 children who were enrolled in 282 preK programs in the 2016/17 school year. The variables used in the analysis, a list of labor market areas in Vermont, and a list of the local education agencies in Vermont are provided in tables B4 and B5 and box B1.

Table B4. List of variables

Data element	Description	Source
Child characteristics		
Student ID	De-identified unique student identifier	Vermont Agency of Education
Individualized education program	An indicator of whether a child has an individualized education program	Vermont Agency of Education
The national school lunch program	An indicator of eligibility for the national school lunch program	Vermont Agency of Education
Age cohort	A categorical variable that reflects cohorts of children who were 3-, 4-, or 5-years-old.	Vermont Agency of Education
Child local education agency	Name of the local education agency in which the child resides	Vermont Agency of Education
Child residence labor market area	The labor market area for each child's residence	Vermont Department of Labor (2015)
Prequalified preK programs in local education agency	Continuous measure of the total number of state prequalified preK programs in the local education agency of residence	Vermont Agency of Education (2015)
Child zip code	The child's zip code of residence	Vermont Agency of Education
Child longitude and latitude	Latitude and longitude associated with each child's zip code of residence	U.S. Census (2017)
Program characteristics		
Program type	A mutually exclusive categorical variable indicating which of four program types a child was enrolled in during the spring of the 2016/17 school year: a public school prekindergarten (preK) program within the boundaries of the child's local education agency, a public school preK program outside the boundaries of a child's local education agency, a private childcare center or family childcare home within the boundaries of a child's local education agency, or a private childcare center or family childcare home outside the boundaries of a child's local education agency. A binary indicator for public school program or private program was also used in the study. In addition to universal preK services, private childcare centers and family childcare homes may provide Head Start services or additional childcare funded through a state subsidy or private pay.	Vermont Agency of Education
STep Ahead Recognition System (STARS) quality rating	A mutually exclusive ordinal variable indicating whether a program received a score of three, four, or five stars on the state's STARS quality rating and improvement scale. The scale goes from one to five, although prequalified programs range from three to five.	Vermont Agency of Education
Program local education agency	Name of the local education agency in which the program is located	Vermont Agency of Education
PreK program labor market area	The labor market for each preK program	Vermont Department of Labor (2015)
Program zip code	Zip code for the program in which the child is enrolled	Vermont Agency of Education
Program longitude and latitude	Latitude and longitude associated with each program zip code	U.S. Census (2017)
Program distance	Distance from child's zip code of residence to the program in which the child is enrolled	Calculated by the study team

Source: Authors' compilation.

Table B5. Vermont labor market areas

Common title	Official title
Barre-Montpelier	Barre, VT MicroNECTA
Bennington	Bennington, VT MicroNECTA
Brattleboro	Brattleboro, VT-NH LMA (Vt part)
Burlington-South Burlington	Burlington-South Burlington, VT MetroNECTA
Colebrook, NH-VT (Vt part)	Colebrook, NH-VT LMA (Vt part)
Derby	Derby, VT LMA
Highgate	Highgate, VT LMA
Littleton, NH-VT (Vt part)	Littleton, NH-VT LMA (Vt part)
Manchester	Manchester, VT LMA
Middlebury	Middlebury, VT LMA
Morristown-Waterbury	Morristown-Waterbury, VT LMA
Newbury	Newbury, VT LMA
North Adams, MA-VT (Vt part)	North Adams, MA-VT MicroNECTA (Vt part)
Northfield-Waitsfield	Northfield-Waitsfield, VT LMA
Randolph	Randolph, VT LMA
Rutland	Rutland, VT MicroNECTA
Springfield	Springfield, VT LMA
St. Johnsbury	St. Johnsbury, VT LMA
White River Junction	Lebanon, NH-VT MicroNECTA (Vt part)
Woodstock	Woodstock, VT LMA

Source: Vermont Department of Labor, 2015.

Box B1. Vermont local education agencies

Addison Central
Addison Northeast
Addison Northwest
Addison Rutland
Barre
Battenkill Valley
Bennington Rutland
Blue Mountain
Burlington
Caledonia Central
Caledonia North
Champlain Valley
Chittenden East
Colchester
Essex Caledonia
Essex North
Essex Westford
Franklin Northeast
Franklin Northwest
Franklin West
Grand Isle
Hartford
Harwood
Lamoille North
Lamoille South
Maple Run
Mill River
Milton
Montpelier
North Country
Norwich
Orange East
Orange North
Orange Southwest
Orleans Central
Orleans Southwest
Rivendell
Rutland Central
Rutland City
Rutland Northeast
Rutland Southwest
South Burlington
Southwest Vermont
Springfield
St. Johnsbury
Two Rivers
Washington Central
Washington Northeast
Washington South
White River Valley
Windham Central
Windham Northeast
Windham Southeast
Windham Southwest
Windsor Central
Windsor Southeast
Winooski

Source: Vermont Agency of Education, 2017.

Methods

To address research question 1 (on the extent to which children with different characteristics were enrolled in public school preK programs, private preK programs, and programs at each STARS quality rating) and research question 2 (on the extent to which preK children were enrolled in a program within the boundaries of their local education agency), the study team conducted descriptive analyses, including finding means, standard deviations, and percentages, to examine child and geographic characteristics by program type and STep Ahead Recognition System quality rating for children enrolled in a prequalified preK program in Vermont in 2016/17. To assess statistically significant differences in the descriptive findings, one-way analysis of variance or chi-square analyses were conducted, as appropriate, based on the nature of the data. For analyses where more than two groups were compared, post hoc tests were conducted. Statistically significant differences with a *p*-value of less than .05 are indicated.

Three logistic regression analyses were conducted to address research question 3 on the association between child characteristics—specifically, individualized education program status, eligibility for the national school lunch program, age cohort, and number of prequalified programs in the child's local education agency—and three outcome variables: the odds of being enrolled in a public school preK program compared with the odds of being enrolled in a private preK program, the odds of being enrolled in a five-star program compared with the odds of being enrolled in a three- or four-star program, and the odds of being enrolled in a program within the boundaries of a child's local education agency compared with the odds of being enrolled in a program outside those boundaries. Odds ratios represent the odds of being enrolled in one program compared with the odds of being enrolled in another, holding all other variables constant. An odds ratio of 1 represents no difference. An odds ratio greater than 1 represents higher odds of being enrolled in the program, and an odds ratio of less than 1 represents lower odds of being enrolled in the program. For all models, fit statistics, including Bayesian information criterion and Akaike's information criterion, were examined and positively favored the models presented compared with a model with sex included. Sensitivity analysis clustering by county and by local education agency was also conducted for each model, with results indicated in the notes in tables C9–C11.

Three logistic regression analyses were conducted using the model:

$$Logit\ (p) = \beta_0 + \beta_1 IndividualizedEducationProgram + \beta_2 NationalSchoolLunchProgramStatus_i + \beta_3 AgeCohort_i + \beta_4 Numberof Programs_i$$

where *p* is the probability of being enrolled in a specific type of preK program and β is the coefficients for the four independent variables of interest. In model 1, *p* is the probability of being enrolled in a public preK program compared with the probability of being enrolled in a private preK program. In model 2, *p* is the probability of being enrolled in a five-star program compared with the probability of being enrolled in a three- or four-star program. In model 3, *p* is the probability of being enrolled in a program within the boundaries of a child's local education agency compared with the probability of being enrolled in a program outside those boundaries.

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Appendix C. Supporting analysis

This appendix contains supporting descriptive tables and detailed results from statistical tests and the logistic regression analyses.

Descriptive tables

Tables C1–C4 are supplements to figures 2, 5, 6, 7, and 8 in the main report. The tables show results from tests of statistically significant differences among the descriptive findings, including results from one-way analysis of variance and chi-square analyses, as appropriate. Statistically significant differences are indicated, including post hoc analyses, when conducted.

Table C1. Statistical tests of differences in the average number of prequalified prekindergarten programs located within the boundaries of a child's local education agency, by program type, STep Ahead Recognition System quality rating, and local education agency boundary status of the program enrolled in for children enrolled in a prequalified prekindergarten program in Vermont in 2016/17

	Program type		STep Ahead Recognition System quality rating			Location		
Statistic	Public school program (n = 2,759)	Private program (n = 2,863)	Three-star program (n = 192)	Four-star program (n = 1,983)	Five-star program (n = 3,447)	Within local education agency boundaries (n = 4,665)	Outside local education agency boundaries (n = 957)	Total (n = 5,622)
Mean (number of programs)	7.5	10.3	7.4[ab]	9.0[a]	9.0[b]	7.2	9.3	7.5
Standard deviation	4.6	6.5	5.0	5.2	6.2	9.3	5.6	4.6
Test of differences between groups	F = 339.3* p-value = .000		F = 6.8* p-value = .001			F = 99.3* p-value = .000		

* Difference between groups is statistically significant using an analysis of variance F-test with $p < .05$.
n is the total number of children in the sample enrolled in each program category.
Note: For comparisons with more than two groups, matching superscripts indicate a statistically significant difference ($p < .05$) between groups using a post hoc test. For example, superscript a indicates that there is a statistically significant difference between the average number of prekindergarten programs in a child's local education agency between children enrolled in a three-star program (mean = 7.4) and children enrolled a four-star program (mean = 9.0). There was a range of 0 to 23 prequalified preK programs within the boundaries of the local education agencies.
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C2. Statistical tests of differences in the percentages of children enrolled in public school and private prequalified prekindergarten programs in Vermont in 2016/17, by student individualized education program status, eligibility for the national school lunch program, and age

	Has an individualized education program		Eligible for the national school lunch program		Age		
Program type	Yes	No	Yes	No	3-years-old	4-years-old	5-years-old
Public school	64	47	64	42	44[c]	53[c]	50
Private program	36	53	36	58	56[ab]	47[a]	50[b]
Test of equality of proportions	X^2 = 72.4* p-value = .000		X^2 = 233.4* p-value = .000		X^2 = 47.4* p-value = .000		

* Difference between percentages is statistically significant using a Pearson chi-square with $p < .05$.
Note: For comparisons with more than two groups, matching superscripts indicate a statistically significant difference ($p < .05$) between groups using a post hoc test. For example, superscript c indicates that there is a statistically significant difference between the percentage of 3-year-olds enrolled in a public school program (44 percent) and the percentage of 4-year-olds enrolled in a public school program (53 percent).
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C3. Statistical tests of differences in the percentages of children enrolled in three-, four-, and five-star prequalified prekindergarten programs in Vermont in 2016/17, by student individualized education program status, eligibility for the national school lunch program, and age

STep Ahead Recognition System quality rating	Has an individualized education program		Eligible for the national school lunch program		Age		
	Yes	No	Yes	No	3-years-old	4-years-old	5-years-old
Three-star program	2[a]	4[a]	2[d]	4[d]	4	3	6
Four-star program	30[b]	36[b]	35	36	35[f]	35[g]	46[fg]
Five-star program	69[c]	60[c]	64[e]	60[e]	62[h]	62[i]	48[hi]
Test of equality of proportions	$X^2 = 21.8196$* *p*-value = .000		$X^2 = 22.6115$* *p*-value = .000		$X^2 = 8.4262$ *p*-value = .077		

* Difference between percentages is statistically significant using a Pearson chi-square with $p < .05$.
Note: For comparisons with more than two groups, matching superscripts indicate a statistically significant difference ($p < .05$) between groups using a post hoc test. For example, superscript e indicates that there is a statistically significant difference between the percentage of children enrolled in a five-star program who are eligible for the national school lunch program (64 percent) and the percentage of children enrolled in a five-star program who are not eligible for the national school lunch program (60 percent).
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C4. Statistical tests of differences in the percentages of children enrolled in prequalified prekindergarten programs within the boundaries of their local education agency and outside those boundaries in Vermont in 2016/17, by individualized education program status, eligibility for the national school lunch program, and age

Local education agency boundary status	Has an individualized education program		Eligible for the national school lunch program		Age		
	Yes	No	Yes	No	3-years-old	4-years-old	5-years-old
Within local education agency boundaries	90	82	94	77	82	84	82
Outside local education agency boundaries	10	18	6	23	18	16	18
Test of equality of proportions	$X^2 = 31.7853$* *p*-value = .000		$X^2 = 254.4139$* *p*-value = .000		$X^2 = 2.923$ *p*-value = .232		

* Difference between percentages is statistically significant using a Pearson chi-square with $p < .05$.
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Tables C5–C8 show enrollment across four program types: public school preK programs within the boundaries of a child's local education agency, public school preK programs outside the boundaries of a child's local education agency, private programs within the boundaries of a child's local education agency, and private programs outside the boundaries of a child's local education agency. Private programs include private centers as well as family child care homes. In addition, the tables provide information about:

- Enrollment by program type and STep Ahead Recognition System quality rating (table C5).
- Average distance between a child's home zip code and program zip code (table C6).
- Average number of preK programs within the boundaries of a child's local education agency of residence (table C7).
- Enrollment by whether the child's program was within the labor market area of residence (table C8).

Table C5. Percentages of children enrolled in three-, four-, and five-star prequalified prekindergarten programs in Vermont in 2016/17, by program type

STep Ahead Recognition System quality rating	Public school: Within local education agency boundaries Row percent (Column percent)	Public school: Outside local education agency boundaries Row percent (Column percent)	Private: Within local education agency boundaries Row percent (Column percent)	Private: Outside local education agency boundaries Row percent (Column percent)	Row total percent
Three-star program	35.4 (2.5)	0.0 (0.0)	35.9 (3.5)	28.7 (6.2)	3.4 (*n* = 192)
Four-star program	47.6 (35.0)	1.4 (40.9)	34.2 (34.4)	16.8 (37.5)	35.3 (*n* = 1,983)
Five-star program	48.8 (62.5)	1.1 (59.1)	35.5 (62.1)	14.6 (56.3)	61.3 (*n* = 3,447)
Column total percent	(47.9) (*n* = 2,693)	(1.2) (*n* = 66)	(35.1) (*n* = 1,972)	(15.8) (*n* = 891)	100.0 (*n* = 5,622)
Test of equality of proportions			X^2 = 35.0648* *p*-value = .000		

* Difference between percentages is statistically significant using a Pearson chi-square with $p < .05$.

Note: Row percent is the number of children in the study sample who were enrolled in a program of each type with each quality rating divided by the total number of children in the study sample who were enrolled in a program with each quality rating. For example, 35.4 percent of children were enrolled in a three-star program were enrolled in a public school prekindergarten program within their local education agency boundaries. Column percent is the number of children in the study sample who were enrolled in a program of each type with each quality rating divided by the total number of children in the study sample who were enrolled in each type of program. For example, 2.5 percent of children were enrolled in a public school prekindergarten program within the boundaries of their local education agency were enrolled in a three-star program. Percentages may not sum to 100 because of rounding.

Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C6. Average estimated distance between children's residence zip code and the zip code of their prequalified prekindergarten program in Vermont in 2016/17, by program type and STep Ahead Recognition System quality rating

Statistic	Program type: Public school: Within local education agency boundaries (*n* = 2,693)	Program type: Public school: Outside local education agency boundaries (*n* = 66)	Program type: Private: Within local education agency boundaries (*n* = 1,972)	Program type: Private: Outside local education agency boundaries (*n* = 891)	STep Ahead Recognition System quality rating: Three-star program (*n* = 192)	STep Ahead Recognition System quality rating: Four-star program (*n* = 1,983)	STep Ahead Recognition System quality rating: Five-star program (*n* = 3,447)
Mean (miles)	2.3[abc]	7.1[ad]	3.1[bde]	7.5[ce]	4.9[fg]	3.3[f]	3.4[g]
Standard deviation	4.1	6.4	5.6	7.9	5.3	4.6	6.3
Test of differences between groups		*F* = 217.06* *p*-value = .000				*F* = 6.80* *p*-value = .001	

* Difference between groups is statistically significant using an analysis of variance *F*-test with $p < .05$.

n is the total number of children in the sample enrolled in each program category.

Note: For comparisons with more than two groups, matching superscripts indicate a statistically significant difference ($p < .05$) between groups using a post hoc test. For example, superscript f indicates that there is a statistically significant difference between the average estimated distance that a child travels to a three-star program (mean = 4.9) and the average estimated distance that a child travels to a four-star program (mean = 3.3).

Source: Authors' analysis of Vermont Agency of Education data for 2016/17 and U.S. Census (2017).

Table C7. Average number of prequalified prekindergarten programs within the boundaries of a child's local education agency in Vermont in 2016/17, by program type enrolled in and STep Ahead Recognition System quality rating

	Program type				Step Ahead Recognition System quality rating		
	Public school		Private				
Statistic	Within local education agency boundaries (*n* = 2,693)	Outside local education agency boundaries (*n* = 66)	Within local education agency boundaries (*n* = 1,972)	Outside local education agency boundaries (*n* = 891)	Three-star program (*n* = 192)	Four-star program (*n* = 1,983)	Five-star program (*n* = 3,447)
Mean (number of programs)	7.6[ab]	3.3[acd]	11.5[bce]	7.5[de]	7.4[fg]	9.0[f]	9.0[g]
Standard deviation	4.6	4.6	6.0	6.7	5.0	5.2	6.2
Test of differences between groups	*F* = 243.73* *p*-value = .000				*F* = 6.83* *p*-value = .001		

* Difference between groups is statistically significant using an analysis of variance *F*-test with $p < .05$.
n is the total number of children in the sample enrolled in each program category.
Note: For comparisons with more than two groups, matching superscripts indicate a statistically significant difference ($p < .05$) between groups using a post hoc test. For example, superscript a indicates a statistically significant difference in the average number of prekindergarten programs within the boundaries of a child's local education agency between children who were enrolled in a public school program within the boundaries of their local education agency (mean = 7.6) and children who were enrolled in a public school program outside the boundaries of their local education agency (mean = 3.3).
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C8. Percentages of children enrolled in prequalified prekindergarten programs in Vermont in 2017/17 outside their labor market area of residence and within their labor market area of residence, by program type enrolled in and STep Ahead Recognition System quality rating

	Program type				STep Ahead Recognition System quality rating			
	Public school		Private					
Labor market area status	Within local education agency boundaries (*n* = 2,693) Row percent (Column percent)	Outside local education agency boundaries (*n* = 66) Row percent (Column percent)	Within local education agency boundaries (*n* = 1,972) Row percent (Column percent)	Outside local education agency boundaries (*n* = 891) Row percent (Column percent)	Three-star program (*n* = 192) Row percent (Column percent)	Four-star program (*n* = 1,983) Row percent (Column percent)	Five-star program (*n* = 3,447) Row percent (Column percent)	Total (*n* = 5,622) Row percent (Column percent)
Outside labor market area	31.0 (3.0)	6.5 (25.8)	37.2 (4.9)	25.3 (7.4)	2.3 (3.1)	42.9 (5.7)	54.8 (4.2)	100.0 (4.6)
Within labor market area	48.7 (97.0)	0.9 (74.2)	35.0 (95.1)	15.4 (92.6)	3.5 (96.9)	34.9 (94.3)	61.6 (95.8)	100.0 (95.4)
Test of equality of proportions	X^2 = 98.4522* *p*-value = .000				X^2 = 7.4275* *p*-value = .024			

* Difference between percentages is statistically significant using a Pearson chi-square with $p < .05$.
n is the total number of children in the sample enrolled in each program category.
Note: Row percent is the number of children in the study who were enrolled in a program of each type in each labor market area status divided by the total number of children in the study sample who enrolled in a program in each labor market area status. For example, 0.9 percent of children enrolled in a program within their labor market area were enrolled in a public school program outside the boundaries of their local education agency. Column percent is the number of children in the study sample who were enrolled in a program of each type in each labor market area status divided by the total number of children in the study sample who were enrolled in each program type. For example, 4.9 percent of children enrolled in a private program within the boundaries of their local education agency were enrolled in a program outside their labor market area.
Source: Authors' analysis of Vermont Agency of Education data for 2016/17; U.S. Census (2017); Vermont Department of Labor (2015).

Logistic regression results

Three separate logistic regression models were used to examine the relationship between children's demographic characteristics and the odds of being enrolled in a public school program compared with the odds of being enrolled in a private program, the odds of being enrolled in a five-star program compared with the odds of being enrolled in a three- or four-star program, and the odds of being enrolled in a program within the boundaries of their local education agency compared with the odds of being enrolled in a program outside those boundaries. The findings associated with each model are presented in tables C9–C11.

Table C9. Logistic regression results for the association between child demographic characteristics and enrollment in a public school prekindergarten program compared with enrollment in a private program

Characteristic	Odds ratio	Percent change in likelihood	95 percent confidence interval
Has an individualized education program	1.8***	80	1.5–2.1
Eligible for the national school lunch program	2.3***	130	2.0–2.6
4- and 5-year-old cohort	1.4***	40	1.2–1.5
Number of prequalified prekindergarten programs in child's local education agency	0.9***	–90	0.9–0.9

*** Significant at $p < .001$.

$n = 5{,}622$

Note: An odds ratio of 1 indicates an equal likelihood of being enrolled in a public school program or a private program, an odds ratio greater than 1 indicates a higher likelihood of being enrolled in a public school program, and an odds ratio of less than 1 indicates a lower likelihood of being enrolled in a public school program. For example, children with an individualized education program have a higher likelihood of being enrolled in a public school program than in a private program. Odds ratios can be converted to percentage change in likelihood by subtracting 1 from values over 1 and then multiplying by 100 and by multiplying by 100 and changing the sign from positive to negative for values under 1, to represent a decrease in likelihood. The percent change in likelihood indicates the percent likelihood of being enrolled in a public school program compared with the likelihood of being enrolled in a private program. For example, a child with an individualized education program is 80 percent more likely than a child without an individualized education program to be enrolled in a public school program. Examination of fit statistics (Bayesian information criterion and Akaike's information criterion) positively favored this model compared with a model with sex included. Sensitivity analysis clustering by county and local education agency did not change the interpretation of results (all *p*-values remained less than .05).

Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C10. Logistic regression results for the association between child demographic characteristics and enrollment in a five-star prekindergarten program compared with enrollment in a three- or four-star program

Characteristic	Odds ratio	Percent change in likelihood	95 percent confidence interval
Has an individualized education program	1.4***	40	1.2–1.7
Eligible for the national school lunch program	1.1	10	1.0–1.3
4- and 5-year-old cohort	1.0	0	1.0–1.1
Number of prequalified prekindergarten programs in child's local education agency	1.0	0	1.0–1.0

*** Significant at $p < .001$.

$n = 5{,}622$

Note: An odds ratio of 1 indicates an equal likelihood of being enrolled in a five-star program or a three- or four-star program. An odds ratio greater than 1 indicates a higher likelihood of being enrolled in a five-star program. For example, children with an individualized education program have a higher likelihood of being enrolled in a five-star program than in a three- or four-star program. Odds ratios can be converted to percentage change in likelihood by subtracting 1 from values over 1 and then multiplying by 100. The percent change in likelihood indicates the percent likelihood of being enrolled in a five-star program compared with being enrolled in a three- or four-star program. For example, a child with an individualized education program is 40 percent more likely than a child without an individualized education program to be enrolled in a five-star program. Examination of fit statistics (Bayesian information criterion and Akaike's information criterion) positively favored this model compared with a model with sex included. Sensitivity analysis clustering by local education agency did not change the interpretation of results; however, clustering by county did provide a more conservative estimate, such that the odds ratio for individualized education program was no longer statistically significant.

Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table C11. Logistic regression results for the association between child demographic characteristics and enrollment in a prekindergarten program within the boundaries of a child's local education agency compared with enrollment in a program outside those boundaries

Characteristic	Odds ratio	Percent change in likelihood	95 percent confidence interval
Has an individualized education program	1.7***	70	1.3–2.2
Eligible for the national school lunch program	4.9***	390	3.9– 6.0
4- and 5-year-old cohort	1.1	10	0.9–1.1
Number of prequalified prekindergarten programs in child's local education agency	1.1***	10	1.0–1.0

*** Significant at $p < .001$.

$n = 5{,}622$

Note: An odds ratio of 1 indicates an equal likelihood of being enrolled in a program within the boundaries of a child's local education agency or a program outside those boundaries. An odds ratio over 1 indicates a higher likelihood of being enrolled in a program within the boundaries of a child's local education agency. For example, children with an individualized education program have a higher likelihood of being enrolled in a program within the boundaries of their local education agency than in a program outside those boundaries. Odds ratios can be converted to percentage change in likelihood by subtracting 1 from values over 1 and then multiplying by 100. The percent change in likelihood indicates the percent likelihood of being enrolled in a program within the boundaries of a child's local education agency compared with being enrolled in a program outside those boundaries. For example, a child with an individualized education program is 70 percent more likely than a child without an individualized education program to be enrolled in a program within the boundaries of his or her local education agency compared with being enrolled in a program outside those boundaries. Examination of fit statistics (Bayesian information criterion and Akaike's information criterion) positively favored this model compared with a model with sex included. Sensitivity analysis clustering by county did not change the interpretation of results.

Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

References

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Appendix D. Distribution of prequalified prekindergarten programs

Tables D1 and D2 provide the distribution of the number of prequalified prekindergarten (preK) programs in Vermont during the 2016/17 school year by program type and STep Ahead Recognition System (STARS) quality rating, arranged by local education agency and county. Knowing the number of public school and private preK programs and the number of preK programs with each STARS quality rating for each local education agency could help policymakers identify gaps in availability across the state (see table D1). Knowing the number of public school and private preK programs and number of preK programs with each STARS quality rating for each county could help policymakers better understand the availability of preK programs across their and other regions of the state (see table D2). Especially in a state as rural as Vermont, understanding the context by region or county can provide important information to education stakeholders and policymakers in the state.

Table D1. Distribution of public school and private prekindergarten programs and programs with three-, four-, and five star STep Ahead Recognition System quality ratings in Vermont, by local education agency, 2016/17

		Program type		STep Ahead Recognition System quality rating			
Local education agency	Statistic	Public school	Private	Three-star program	Four-star program	Five-star program	Total (*N* = 383)
Addison Central	Number	4	7	1	4	6	11
	Percent	36.4	63.6	9.1	36.4	54.5	100.0
Addison Northeast	Number	1	5	0	2	4	6
	Percent	16.7	83.3	0.0	33.3	66.7	100.0
Addison Northwest	Number	1	2	0	0	3	3
	Percent	33.3	66.7	0.0	0.0	100.0	100.0
Addison Rutland	Number	3	2	1	0	4	5
	Percent	60.0	40.0	20.0	0.0	80.0	100.0
Barre	Number	2	3	0	1	4	5
	Percent	40.0	60.0	0.0	20.0	80.0	100.0
Battenkill Valley	Number	1	1	1	1	0	2
	Percent	50.0	50.0	50.0	50.0	0.0	100.0
Bennington Rutland	Number	3	8	2	2	7	11
	Percent	27.3	72.7	18.2	18.2	63.6	100.0
Blue Mountain	Number	0	0	0	0	0	0
	Percent	0.0	0.0	0.0	0.0	0.0	0.0
Burlington	Number	5	16	0	3	18	21
	Percent	23.8	76.2	0.0	14.3	85.7	100.0
Caledonia Central	Number	4	2	0	2	4	6
	Percent	66.7	33.3	0.0	33.3	66.7	100.0
Caledonia North	Number	3	5	4	0	4	8
	Percent	37.5	62.5	50.0	0.0	50.0	100.0
Champlain Valley	Number	3	20	0	9	14	23
	Percent	13.0	87.0	0.0	39.1	60.9	100.0
Chittenden East	Number	3	4	1	2	4	7
	Percent	42.9	57.1	14.3	28.6	57.1	100.0
Colchester	Number	1	7	2	4	2	8
	Percent	12.5	87.5	25.0	50.0	25.0	100.0
Essex Caledonia	Number	2	2	0	0	4	4
	Percent	50.0	50.0	0.0	0.0	100.0	100.0
Essex North	Number	0	0	0	0	0	0
	Percent	0.0	0.0	0.0	0.0	0.0	0.0
Essex Westford	Number	3	11	3	4	7	14
	Percent	21.4	78.6	21.4	28.6	50.0	100.0
Franklin Northeast	Number	5	0	0	3	2	5
	Percent	100.0	0.0	0.0	60.0	40.0	100.0
Franklin Northwest	Number	4	4	1	7	0	8
	Percent	50.0	50.0	12.5	87.5	0.0	100.0

Local education agency	Statistic	Program type		STep Ahead Recognition System quality rating			Total (*N* = 383)
		Public school	Private	Three-star program	Four-star program	Five-star program	
Franklin West	Number	3	2	2	0	3	5
	Percent	60.0	40.0	40.0	0.0	60.0	100.0
Grand Isle	Number	2	3	0	2	3	5
	Percent	40.0	60.0	0.0	40.0	60.0	100.0
Hartford	Number	0	6	1	3	2	6
	Percent	0.0	100.0	16.7	50.0	33.3	100.0
Harwood	Number	5	5	1	6	3	10
	Percent	50.0	50.0	10.0	60.0	30.0	100.0
Lamoille North	Number	5	0	0	1	4	5
	Percent	100.0	0.0	0.0	20.0	80.0	100.0
Lamoille South	Number	2	7	1	3	5	9
	Percent	22.2	77.8	11.1	33.3	55.6	100.0
Maple Run	Number	3	7	3	6	1	10
	Percent	30.0	70.0	30.0	60.0	10.0	100.0
Mill River	Number	4	0	0	4	0	4
	Percent	100.0	0.0	0.0	100.0	0.0	100.0
Milton	Number	1	3	0	2	2	4
	Percent	25.0	75.0	0.0	50.0	50.0	100.0
Montpelier	Number	0	4	0	3	1	4
	Percent	0.0	100.0	0.0	75.0	25.0	100.0
North Country	Number	7	7	2	7	5	14
	Percent	50.0	50.0	14.3	50.0	35.7	100.0
Norwich	Number	0	2	0	1	1	2
	Percent	100.0	100.0	0.0	50.0	50.0	100.0
Orange East	Number	2	8	2	4	4	10
	Percent	20.0	80.0	20.0	40.0	40.0	100.0
Orange North	Number	2	0	1	0	1	2
	Percent	100.0	0.0	50.0	0.0	50.0	100.0
Orange Southwest	Number	1	1	0	1	1	2
	Percent	50.0	50.0	0.0	50.0	50.0	100.0
Orleans Central	Number	1	0	0	0	1	1
	Percent	100.0	0.0	0.0	0.0	100.0	100.0
Orleans Southwest	Number	3	2	1	2	2	5
	Percent	60.0	40.0	20.0	40.0	40.0	100.0
Rivendell	Number	2	1	0	1	2	3
	Percent	66.7	33.3	0.0	33.3	66.7	100.0
Rutland Central	Number	3	2	1	1	3	5
	Percent	60.0	40.0	20.0	20.0	60.0	100.0
Rutland City	Number	1	5	0	4	2	6
	Percent	16.7	83.3	0.0	66.7	33.3	100.0
Rutland Northeast	Number	5	1	0	3	3	6
	Percent	83.3	16.7	0.0	50.0	50.0	100.0
Rutland Southwest	Number	4	1	0	4	1	5
	Percent	80.0	20.0	0.0	80.0	20.0	100.0
South Burlington	Number	2	10	1	3	8	12
	Percent	16.7	83.3	8.3	25.0	66.7	100.0
Southwest Vermont	Number	2	11	0	4	9	13
	Percent	15.4	84.6	0.0	30.8	69.2	100.0
Springfield	Number	0	8	0	5	3	8
	Percent	0.0	100.0	0.0	62.5	37.5	100.0
St. Johnsbury	Number	1	6	0	3	4	7
	Percent	14.3	85.7	0.0	42.9	57.1	100.0
Two Rivers	Number	1	3	0	1	3	4
	Percent	25.0	75.0	0.0	25.0	75.0	100.0
Washington Central	Number	5	3	1	6	1	8
	Percent	62.5	37.5	12.5	75.0	12.5	100.0

Local education agency	Statistic	Program type		STep Ahead Recognition System quality rating			Total (*N* = 383)
		Public school	Private	Three-star program	Four-star program	Five-star program	
Washington Northeast	Number	2	0	0	0	2	2
	Percent	100.0	0.0	0.0	0.0	100.0	100.0
Washington South	Number	2	0	0	1	1	2
	Percent	100.0	0.0	0.0	50.0	50.0	100.0
White River Valley	Number	5	4	0	8	1	9
	Percent	55.6	44.4	0.0	88.9	11.1	100.0
Windham Central	Number	3	4	0	5	2	7
	Percent	42.9	57.1	0.0	71.4	28.6	100.0
Windham Northeast	Number	3	4	0	2	5	7
	Percent	42.9	57.1	0.0	28.6	71.4	100.0
Windham Southeast	Number	2	13	1	5	9	15
	Percent	13.3	86.7	6.7	33.3	60.0	100.0
Windham Southwest	Number	2	2	0	3	1	4
	Percent	50.0	50.0	0.0	75.0	25.0	100.0
Windsor Central	Number	2	3	1	3	1	5
	Percent	40.0	60.0	20.0	60.0	20.0	100.0
Windsor Southeast	Number	1	5	1	3	2	6
	Percent	16.7	83.3	16.7	50.0	33.3	100.0
Winooski	Number	1	3	0	0	4	4
	Percent	25.0	75.0	0.0	0.0	100.0	100.0
Total	Number	138	245	36	154	193	383
	Percent	36.0	64.0	9.4	40.2	50.4	100.0

Source: Authors' analysis of Vermont Agency of Education data for 2016/17.

Table D2. Distribution of public school and private prekindergarten programs and programs with three-, four-, and five-star STep Ahead Recognition System quality ratings in Vermont, by county, 2016/17

County	Statistic	Program type		STep Ahead Recognition System quality rating			Total (*N* = 383)
		Public school	Private	Three-star program	Four-star program	Five-star program	
Addison	Number	8	16	2	9	13	24
	Percent	33.3	66.7	8.3	37.5	54.2	100.0
Bennington	Number	6	17	2	8	13	23
	Percent	26.1	73.9	8.7	34.8	56.5	100.0
Caledonia	Number	8	14	5	5	12	22
	Percent	36.4	63.6	22.7	22.7	54.6	100.0
Chittenden	Number	19	74	7	27	59	93
	Percent	20.4	79.6	7.5	29.0	63.4	100.0
Essex	Number	5	1	0	1	5	6
	Percent	83.3	16.7	0.0	16.7	83.3	100.0
Franklin	Number	15	13	6	16	6	28
	Percent	53.6	46.4	21.4	57.1	21.4	100.0
Grand Isle	Number	2	3	0	2	3	5
	Percent	40.0	60.0	0.0	40.0	60.0	100.0
Lamoille	Number	8	7	1	5	9	15
	Percent	53.3	46.7	6.7	33.3	60.0	100.0
Orange	Number	8	12	3	8	9	20
	Percent	40.0	60.0	15.0	40.0	45.0	100.0
Orleans	Number	6	9	2	6	7	15
	Percent	40.0	60.0	13.3	40.0	46.7	100.0
Rutland	Number	19	14	1	16	16	33
	Percent	57.6	42.4	3.0	48.5	48.5	100.0
Washington	Number	17	15	2	18	12	32
	Percent	53.1	46.9	6.3	56.3	37.5	100.0
Windham	Number	9	23	1	13	18	32
	Percent	28.1	71.9	3.1	40.6	56.3	100.0

County	Statistic	Program type		STep Ahead Recognition System quality rating			Total (*N* = 383)
		Public school	Private	Three-star program	Four-star program	Five-star program	
Windsor	Number	8	27	4	20	11	35
	Percent	22.9	77.1	11.4	57.1	31.4	100.0
Total	Number	138	245	36	154	193	383
	Percent	36.0	64.0	9.4	40.2	50.4	100.0

Note: Percentages may not sum to 100 because of rounding.
Source: Authors' analysis of Vermont Agency of Education data for 2016/17.