Appendix C: ECLS-B Technical Appendix

Technical Appendix for the Pritzker-Bridgespan Analysis of the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B)

In an effort to provide philanthropists with rough estimates of the number of children who are at risk of entering kindergarten not ready to learn and the types of barriers they face to achieving kindergarten readiness, we built directly off of the work of Julia Isaacs and Katherine Magnuson as published in a series of papers from the Brookings Institution.[135] We drew extensively on appendix materials from their work as well as personal communication with Julia Isaacs. We are grateful for Isaacs's helpful comments; her assistance implies no responsibility for the final product, which rests solely with Bridgespan and the Pritzker Children's Initiative.

Data

In this paper, we use the Early Childhood Longitudinal Study–Birth Cohort (ECLS-B), released by the National Center for Education Statistics (NCES). ECLS-B began with 10,688 unique births in 2001. Children's parents were interviewed in a series of four waves, corresponding with ages of nine months, two years, four years, and kindergarten.[136] Our final study sample includes roughly 4,600 children whose families remained in the survey and whose readiness for kindergarten was assessed. We use NCES-derived weights that correct for attrition bias that occurred over the course of the study.[137] Nonetheless, if sample attrition was systematically associated with the likelihood that a child was ready for kindergarten, our estimates of kindergarten readiness will be biased.

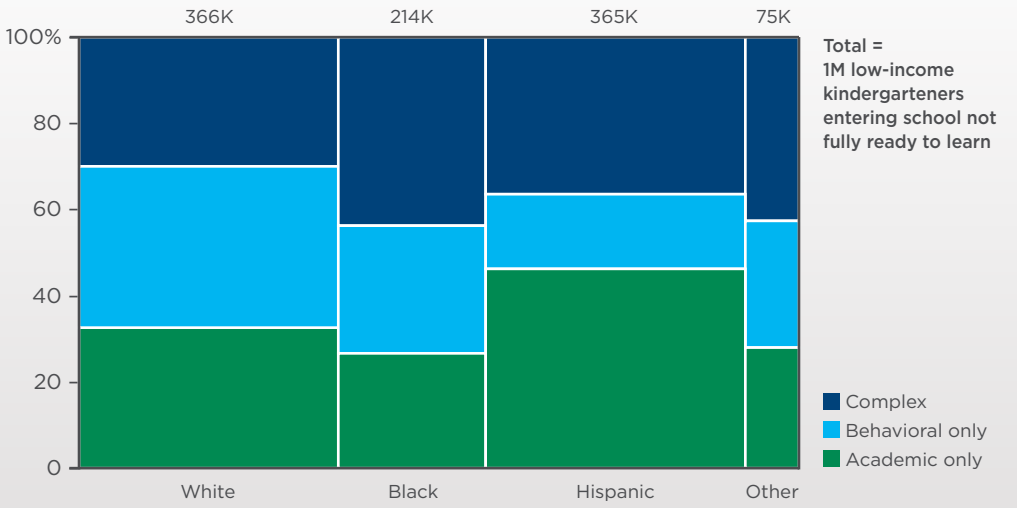
135 See Julia Isaacs and Katherine Magnuson, "Income and Education as Predictors of Children's School Readiness," Brookings Center on Children and Families at the Brookings Institution, December 2011, and Julia Isaacs, "Starting School at a Disadvantage: The School Readiness of Poor Children," Brookings Center on Children and Families at the Brookings Institution, March 2012.

136 Some children who attended kindergarten in 2007 were interviewed in a fifth wave.

137 Specifically, we use WK45T0 to calculate summary measures related to kindergarten readiness.

Additional analytical findings

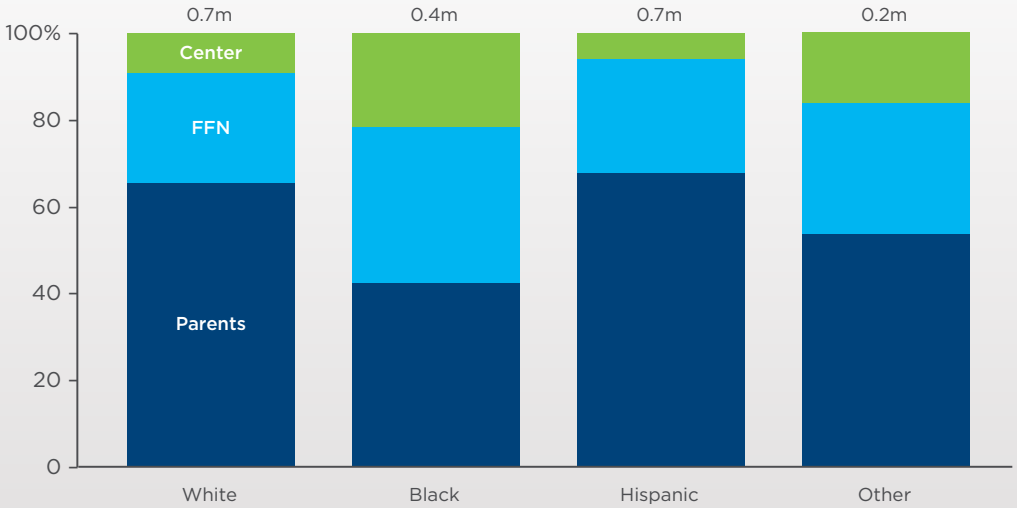
Figure A-1: Low-income kindergarteners entering school not fully ready to learn, by ethnicity



Source: Analysis of ECLS-B (2006-7) and American Community Survey (2012).

Figure A-2: Estimated primary care setting for low-income kindergarteners at age 2, by ethnicity

Low-income (<200% federal poverty line) children in kindergarten, by place of care at age 2



Source: Analysis of ECLS-B (2006-7) and American Community Survey (2012).

Creating the measure of kindergarten readiness

We measure each child's readiness for kindergarten based on the results from assessments of his or her abilities relative to those of peers, consistent with the approach in Isaacs and Magnuson (2011). In the domains of math, reading, learning-related behaviors, and externalizing problem behaviors, we followed three steps:

1. Create a continuous measure of each child's readiness.
2. Normalize that measure across all kindergarteners.
3. Identify children who were more than one standard deviation below the mean in at least one category, labeling them "not ready."

Table A-1 summarizes the variables and methods used to construct the continuous measure of readiness within each domain:

Table A-1. Variables and methods used to create continuous measure of child's readiness within domains

Domain	Variable(s)	Description	Method
Math	X*MSCR2	IRT composite score	Excluded missing values
Reading	X*RSCR2	IRT composite score	Excluded missing values
Learning-related behaviors	T*PAYATT, T*CONCEN, T*FIDGET, T*SHWIMG, T*EAGER, T*NDEPND, T*FINISH	Teacher-rated behavioral characteristics (on a 1-5 scale)	Sum values of variables after reverse-coding T*CONCEN and T*FIDGET
Externalizing problem behaviors	T*TEMPER, T*AGRESS, T*ANNOYS, T*ACTIVE, T*MPULSV, T*DISRPT	Teacher-rated behavioral characteristics (on a 1-5 scale)	Sum values of variables after reverse-coding all variables

* Refers to the wave in which the child first entered kindergarten (either four or five)

For the fifth domain, the child's health, we used the parents' report of the child's health. Children who were reported to be in "excellent," "very good," or "good" health were ready for kindergarten (if they were proficient in each of the other four domains) and those reported as being in "fair" or "poor" health were not ready for kindergarten. Only 2 percent of kindergarteners were judged to be in "fair" or "poor" health by their parents.

Reflections on our measure of kindergarten readiness

As the focus on kindergarten readiness has grown among both researchers and policy makers, measures of readiness have proliferated. There are two broad parameters that differentiate measures of readiness:

1. The "domains" of readiness, or skills, in which a child must achieve "proficiency" in order to be kindergarten ready.
   a. Domains cover academic as well as physical, social, and emotional readiness.
2. The metric by which "proficiency" is defined.
   a. Measures are *criterion-based* if children are judged against an absolute threshold of ability.
   b. Measures are *norm-based* if children's abilities are judged relative to those of other children.

The domains we use to assess kindergarten readiness among subjects in ECLS-B are conceptually similar to those identified by the National Education Goals Panel (NEGP), a working group whose findings have been validated by others since their publication in 1995.[138] The NEGP identified 1) physical well-being and motor development, 2) language development, 3) cognition and general knowledge, 4) social-emotional development, and 5) approaches to learning. In an effort to estimate children's abilities in these domains using information available in ECLS-B, our measure incorporates children's assessed abilities to perform math and reading tasks (relevant to NEGP domains 2 and 3), learning-related behaviors (domain 5), externalizing problem behaviors (domain 4), and parent-reported physical health (domain 1). Of the five domains used in our measure of readiness, the parent-reported physical health of the child probably approximates the NEGP domains with the least fidelity; parents of ECLS-B subjects appear to have highly optimistic views of their children's health.

Like most measures of readiness that are based on nationally representative surveys of young children, our measure is norm-based; children are deemed not ready for kindergarten if they fall one standard deviation or more below the mean in any one of the four non-health domains. This cutoff point is widely used by researchers, and there is some evidence that being more than one standard deviation below mean performance carries statistically meaningful implications for a child's subsequent achievement in school.[139] However, this norm-based approach has three important limitations:

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138 S.L. Kagan, E. Moore, and S. Bradekamp, *Reconsidering children's early development and learning: Toward common views and vocabulary,* Washington, DC: National Education Goals Panel Goal 1 Technical Planning Group, (1995).

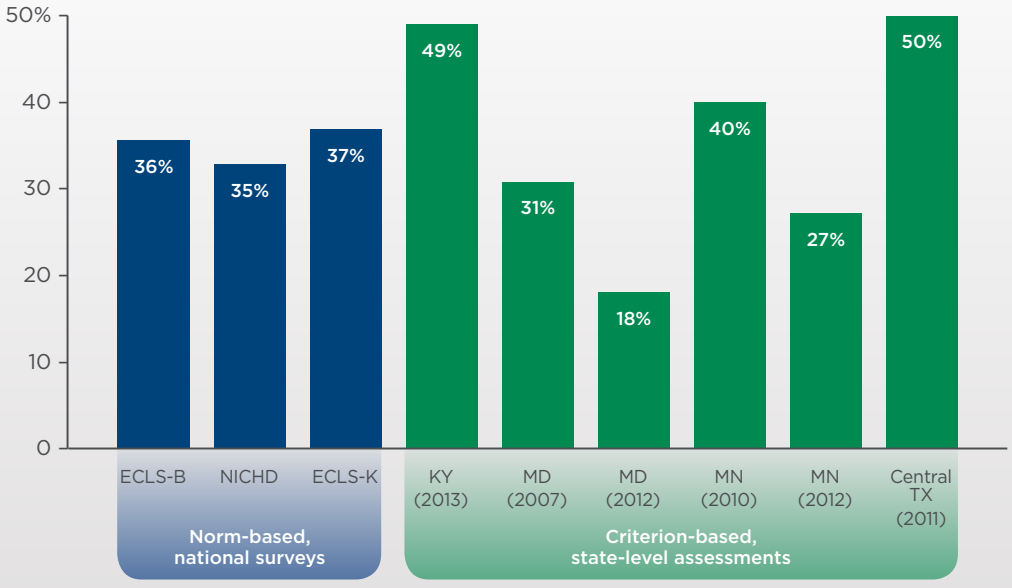
139 See Tamara Halle, Elizabeth Hair, Margaret Burchinal, Rachel Anderson, and Martha Zaslow, "In the Running for Successful Outcomes: Exploring the evidence for thresholds of school readiness," December 2012. Prepared for Laura Radel, Office of the Assistant Secretary for Planning and Evaluation, HHS.

1. The resulting estimate of the rate of kindergarten readiness among American children is sensitive to the somewhat arbitrary assignment of one standard deviation as the key threshold; though there may not be an important difference between two children who are 0.9 and 1.1 standard deviations below the mean in a given domain of readiness, our decision to assign one of those children as ready and the other as unready affects our count of children who are not ready.
2. This measure could not be relied upon to track improvements in kindergarten readiness over time, as it reports the share of children in a certain portion of the distribution of all children's skills. That is, if all children improved incrementally (i.e. the mean of the distribution shifted) but the shape of the distribution of skills remained the same, then the number of children estimated to be ready for kindergarten would not change.
3. Most states that assess kindergarteners' readiness use criterion-based measures, increasing the need to benchmark our findings in ECLS-B to reported rates of readiness in states.

Keeping these limitations in mind, the lack of well-evidenced, widely agreed-upon criterion-based thresholds for kindergarten readiness suggests that the measure presented here is appropriate for presenting rough estimates of the number of American children at risk of entering kindergarten not ready to learn.

Figure A-3 compares several norm-based and criterion-based measures, with the consensus that about one in three kindergarteners do not enter school ready to learn (across all income levels).

Figure A-3: Comparison of norm-based national measures of kindergarten readiness and criterion-based state measures of kindergarten readiness
Percent of kindergarteners not fully ready



Source: State and national kindergarten-readiness measures.

Coding observable characteristics of children and their families in ECLS-B

Some of the characteristics by which we categorize children are time invariant, such as race/ethnicity and mother's birth age. When assigning kindergarteners to categories on the basis of an observable characteristic that could change over time (poverty status, mother's marital status, mother's educational attainment, and mother's employment status), we reported the modal value of the variable across the four waves in which the child's family was interviewed. In instances where there was no mode, we used the value from the child's first interview (at nine months).

Table A-2 summarizes the variables and methods used to construct each variable.

Table A-2. Variables and methods used to categorize children based on observable characteristics

Domain	Variable(s)	Notes
Poverty status	X*HTOTAL, X*INCOME, P*HHINCY	Imputed exact dollar income assuming random uniform distribution within income band in X*INCOME (except for low-income families with exact income provided in P*HHINCY). Compared to poverty thresholds corresponding with number of family members (in X*HTOTAL).
Race/ ethnicity	Y1CHRACE	Categories "White," "Black," and "Other" include only non-Hispanic children.
Maternal education	Y1MOMED	
Primary place of care	X*PRIMNW, P*PRTYPE, P*CHRS, P*CHROTH, P*RHRS, P*RHROTH, P*NHRS, P*NHROTH, P*HSHRS	Begin with ECLS coding of child's "primary" place of care (X*PRIMNW). Recategorize as "parental" care if the total number of hours/week in center-based care (P*CHRS + P*CHROTH + P*HSHRS) is less than 10 and if the total number of hours in FFN care (P*RHRS + P*RHROTH + P*NHRS + P*NHROTH) is less than 10. Recategorize as FFN care if the total number of hours/week in FFN care is greater than 10 and greater than the total number of hours/week in center-based care. Recategorize as center-based care if the total number of hours/week in center-based care is greater than 10 and is greater than or equal to the number of hours spent in FFN care.
Mother's marital status	Y1MARSTA	Only distinguish between married and not married.
Mother's age at birth	BCMOMAGE	

* Refers to the wave in which place of care is being observed

Estimating the number of children currently not ready for kindergarten

In order to arrive at estimates of the *number* of kindergarteners who are not ready for kindergarten today, we applied the percentage likelihoods that any given type of child would be ready for kindergarten (estimated in the Early Childhood Longitudinal Study) to the number of kindergarteners matching that description in the 2012 American Community Survey (ACS).[140] For instance, 82 percent of non-Hispanic White kindergarteners whose families had incomes above 350 percent of the federal poverty line (FPL) in the Early Childhood Longitudinal Study—Birth Cohort (ECLS-B) were ready for kindergarten—we assumed that this within-segment rate has not changed since 2006–7. In order to estimate the number of non-Hispanic White kindergarteners who are today ready for kindergarten, we applied that 82 percent rate to the number of non-Hispanic White kindergarteners with family incomes above 350 percent FPL (estimated to be about 825,000) living in the United States from the ACS.

In order to estimate the number of children ages birth to five who are at risk of entering kindergarten not ready to learn, we used a similar approach as described above, applying rates calculated in ECLS-B for a given type of child (e.g., child of a single mother in poverty) to the number of children ages birth to five estimated to have those traits in 2012. The assumption underlying these estimates is that children with certain observable characteristics will, in the absence of intervention, be ready for kindergarten at the same rate as kindergarteners with those same characteristics.

In general, we only rescaled the segments of population of children by poverty status and race/ethnicity. For instance, we assumed that the percent of children in poverty who received primarily parental care at two years remained at 61 percent; however, the share of all children who were both in poverty and receiving primarily parental care grew because we scaled up the share of all children in poverty. Therefore, if parents' educational attainment, child-care choices, marital statuses, or other variables of interest systematically changed within income or racial categories between 2007 and 2012, our estimates may be biased.

Finally, in calibrating our estimate of the likelihood that the average American kindergartener is ready, we applied the readiness rates for each poverty/race cell from ECLS-B to the population estimates from the ACS. Summing across the cells, we calculated the number of kindergarteners who would not have been ready in 2012 (roughly 1.5 million) and divided that number by the number of kindergarteners in the ACS in 2012 (roughly 4.2 million) to estimate the likelihood that the average American kindergartener was ready in 2012 (36 percent).

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140 This approach is especially important because it incorporates two important trends that have changed the profile of infants and toddlers in the US since the end of the ECLS-B data collection period: the rise of childhood poverty and the increased share of children who are Hispanic. The share of children ages birth to five in poverty was 21 percent in 2007 and 26 percent in 2012. Similarly, the share of children birth to five who were Hispanic was 26 percent in 2012.

Note on the precision of estimates

When calculating standard errors for estimates of kindergarten-readiness rates for a particular group, we account for complex survey design by calculating jackknife standard errors.

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