Cognitive Ability at Kindergarten Entry and Socioeconomic Status

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abstract

OBJECTIVE: To examine how gradients in socioeconomic status (SES) impact US children's reading and math ability at kindergarten entry and determine the contributions of family background, health, home learning, parenting, and early education factors to those gradients.

METHODS: Analysis of 6600 children with cognitive assessments at kindergarten entry from the US Early Childhood Longitudinal Birth Cohort Study. A composite SES measure based on parent's occupation, education, and income was divided into quintiles. Wald *F* tests assessed bivariate associations between SES and child's cognitive ability and candidate explanatory variables. A decomposition methodology examined mediators of early cognitive gradients.

RESULTS: Average reading percentile rankings increased from 34 to 67 across SES quintiles and math from 33 to 70. Children in lower SES quintiles had younger mothers, less frequent parent reading, less home computer use (27%–84%), and fewer books at home (26–114). Parent's supportive interactions, expectations for their child to earn a college degree (57%–96%), and child's preschool attendance (64%–89%) increased across quintiles. Candidate explanatory factors explained just over half the gradients, with family background factors explaining 8% to 13%, health factors 4% to 6%, home learning environment 18%, parenting style/beliefs 14% to 15%, and early education 6% to 7% of the gaps between the lowest versus highest quintiles in reading and math.

CONCLUSIONS: Steep social gradients in cognitive outcomes at kindergarten are due to many factors. Findings suggest policies targeting levels of socioeconomic inequality and a range of early childhood interventions are needed to address these disparities.

WHAT'S KNOWN ON THIS SUBJECT: Previous research has established steep socioeconomic status gradients in children's cognitive ability at kindergarten entry. Few studies have had comprehensive data to examine the contribution of a wide range of risk and protective factors across early childhood to these gradients.

WHAT THIS STUDY ADDS: Family background, health, home learning, parenting, and early care and education factors explain over half the gaps in reading and math ability between US children in the lowest versus highest socioeconomic status quintiles, suggesting a need for comprehensive early interventions.

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The first 5 years of life are critical for the development of language and cognitive skills.[1] By kindergarten entry, steep social gradients in reading and math ability, with successively poorer outcomes for children in families of lower social class, are already apparent.[2–4] Early cognitive ability is, in turn, predictive of later school performance, educational attainment, and health in adulthood[5–7] and may serve as a marker for the quality of early brain development and a mechanism for the transmission of future health inequalities.[8] Early life represents a time period of most equality and yet, beginning with in utero conditions and extending through early childhood, a wide range of socially stratified risk and protective factors may begin to place children on different trajectories of cognitive development.[9,10]

A variety of early environment factors including maternal age,[2] preconception health status,[11,12] maternal depression,[13] birth weight,[14] breastfeeding,[15] shared reading,[16] home computer use,[17] parent interactions and aspirations,[18,19] preschool attendance,[20–22] and primary caregiving arrangements[23] are associated with early cognitive development. A recent investigation from the UK Millennium Cohort Study found that a variety of parenting, home learning, and early education factors explained a small portion of the socioeconomic status (SES) gradients in children's cognitive ability by age 5.[2] Although some US studies have examined selected factors at different stages of childhood,[24–27] few have had comprehensive data to examine the socioeconomic distribution of a wide variety of risk and protective factors across early childhood and their role as potential independent mediators of the SES gradients in cognitive ability at kindergarten entry.

Families, child health professionals, educators, and policy makers are seeking guidance on factors that might contribute to SES gradients in early cognitive development. This study uses nationally representative data from the US Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) to examine the magnitude of SES gradients in reading and math ability at kindergarten entry and the independent contribution of factors in the family background, health, home learning, parenting, and early education domains to these gradients. Candidate explanatory factors were chosen on the basis of empirical studies suggesting their potential contribution to the gradient and data availability.[2] The ECLS-B data set contains rich longitudinal data on various family, health, and home environment variables, along with direct measures of cognitive abilities at school entry. Findings are discussed in the context of implications for policy and for pediatric practice.

METHODS

Sample

The ECLS-B is a nationally representative panel study of 10 700 children born in the United States in 2001.[28,29] The child's primary caregiver, usually the mother, completed in-person interviews in English or Spanish and direct parenting and child development assessments were also conducted in the home when children were ~9 months and 2, 4, and 5–6 years of age. The overall weighted response rate for the baseline interview was 74% with follow-up rates ranging from 91% to 93%. The kindergarten round of data collection included a planned sample reduction of 15% from those completing a preschool interview.

Approximately 6850 parents completed ECLS-B interviews through the year their child entered kindergarten in 2006 or 2007. Sample size figures are rounded to the nearest 50 following ECLS-B rounding rules. The study sample includes 6600 children with valid cognitive assessments at kindergarten entry. This excludes ~100 children whose mother was not the primary respondent at baseline. Because of substantial missing data on 2 direct parenting measures (29%), multiple imputation via chained equations was used to handle missing covariate data.[30] This approach uses regression models to predict missing data from available variables with 20 imputation iterations selected. Descriptive statistics and regression results were compared on imputed versus nonimputed data, and results were similar.

To produce population-based estimates, data records were assigned a sampling weight. ECLS-B weights adjust for various forms of survey nonresponse including poststratification to match population totals for key demographic variables. This study was approved by the University of California, Los Angeles Institutional Review Board.

Measures

Reading and Math Assessments

A direct cognitive assessment was developed for ECLS-B that included items from the ECLS kindergarten cohort and several standardized instruments, such as the Peabody Picture Vocabulary Test[31] and PreLAS 2000,[32] to provide data on early reading (basic language and literacy skills, vocabulary, understanding, interpretation), and mathematics skills (number sense, counting, operations, geometry, pattern understanding). It was designed to be a broad measure of children's knowledge and skills and could be administered in 30 to 45 minutes and in alternate languages. Scale scores representing the proportion of items correct out of 85 for reading and 71 for math were converted to percentile rankings.

SES

A composite SES measure was created by National Center for Education Statistics researchers based on parent's occupation, education, and household income at each wave and this was averaged across the child's lifetime and divided into quintiles. Quintile 1 represents the lowest and quintile 5 the highest SES group. Last value carried forward and hot deck imputation,[33] which replaces missing data from respondents matched on selected variables, were used for missing data at each wave.

Explanatory Factors

Candidate explanatory factors were grouped into 5 domains.

"Family background factors" included child's race/ethnicity (white, black, Hispanic, Asian, multiracial/other), mother's age, family structure, and household size. Child's age at assessment was included as a control variable.

"Early health factors" included mothers' reported prepregnancy BMI, whether they smoked or drank alcohol during pregnancy, and whether they breastfed. Maternal depression was measured with the abbreviated Center for Epidemiologic Studies Depression Scale at baseline, preschool, and kindergarten. Twelve items measured depressive symptoms (eg, sad, lonely) on a 4-point scale (rarely/never to usually/always) summed to create a continuous scale (0–36) and averaged across assessments. Child's birth weight comes from the birth certificate (normal vs low birth weight) and parents' reported on child's overall health status at age 2 (excellent/very good versus good/fair/poor).

"The home learning environment" included measures of learning activities and material resources in the home. At each survey, respondents were asked how frequently any family member reads to the child in a typical week (1 = not at all, 2 = once or twice, 3 = 3–6 times, 4 = daily). A composite reading measure averaged responses across waves. At age 4, respondents reported whether they have a home computer the child uses and whether they visited a library with the child in the past month. Number of books in the home represents an average measure across all survey waves. At age 2, parents reported the number of toys in the home, number of children's DVDs, and frequency of indoor game playing (daily vs other).

"Parenting style and beliefs" included measures of parent teaching style, rule setting, and expectations for the child's educational attainment. At 9 months, the Nursing Child Assessment Teaching Scale measured parent-child interactions during a structured teaching task. Positive interactions for 50 parent behaviors were summed with higher scores indicating greater teaching and responsiveness. At age 2, the Two Bags Task measured parent supportiveness during a structured play activity. A composite scale represents an average of scores (range 0–7) in 3 domains: sensitivity, positive regard, and cognitive stimulation. At age 4, respondents were asked whether they had rules about bedtime, food, and chores and about educational attainment expectations for their child.

"Early care and education" included measures of early care arrangements, preschool, and participation in organized classes. Primary child care arrangement at age 2 represents where the child spent the most time (no nonparental care, relative care, nonrelative care, center-based care). Preschool attendance was coded to include children who attended preschool, prekindergarten, Head Start, or center-based care programs in the year before kindergarten entry. Parents also reported whether their child attended 7 organized classes (eg, drama and art classes). Responses were coded as 0, 1, and ≥2.

Analysis

All statistical analyses were performed by using Stata (version 12.0). Survey estimation procedures were applied, and the Taylor-series linearization method adjusted the standard errors for the complex survey design. Wald *F* tests assessed bivariate associations between SES and children's cognitive ability and candidate explanatory factors. A decomposition methodology examined the contribution from different sources in explaining the SES gradient in early cognitive outcomes.[34] Similar to the methodology used in the UK Millennium Cohort Study, we focus on the quintile 1–quintile 5 (Q1–Q5) and quintile 1–quintile 3 (Q1–Q3) gaps and calculate the percentile points and the percentage of the raw gaps explained by each candidate explanatory factor and each domain of factors.[2] This was done by taking the product of the mean gap in each explanatory factor (mean difference between Q1–Q5 and Q1–Q3) by the β coefficients from linear regression models that predict reading and math ability from SES and all candidate explanatory factors. The decomposition methodology shows the independent impact of each candidate mediator on the gradient, while controlling for the impact of all other factors. Because the model may omit variables associated with the explanatory factors and the outcome, results cannot be considered causal.

RESULTS

SES Gradients in Cognitive Ability

Figure 1 reveals steep SES gradients in US children's reading and math ability at kindergarten entry. Average reading percentile rankings increased

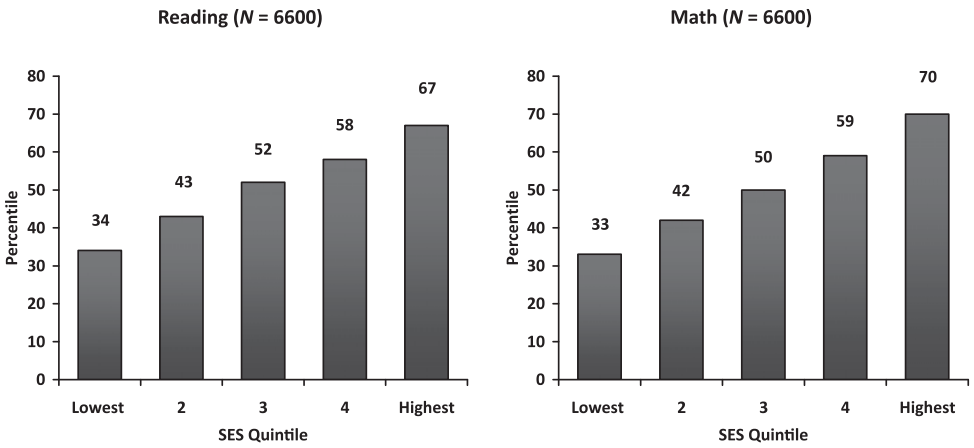

FIGURE 1
Reading and math scores at kindergarten entry by SES, ECLS-B study, 2001–2007.

from 34 to 67 across SES quintiles, creating a gap of 33 percentile points between the lowest and highest SES groups. The gap between the lowest and middle quintiles was 18. Similarly, average math percentile scores increased from 33 to 70 across SES quintiles, creating a gap of 37 percentile points.

SES Gradients in Child and Family Characteristics and Behaviors

Steep SES gradients were apparent across all candidate explanatory factors (Table 1). Children in the lowest SES quintile were more likely to have younger mothers (mean age 25 vs 33 in highest SES quintile) and reside in single-mother households (40% vs 5%). Mothers' Center for Epidemiologic Studies Depression Scale scores decreased from a mean of 6.5 to 3.7 across SES quintiles (0.60 SD gap). Average family reading scores increased from 2.6 to 3.5 across SES quintiles indicating a higher likelihood of daily reading in the highest SES group. Average number of books in the home increased from 26 to 114 across SES groups and child use of a home computer nearly tripled (27% to 84%). Direct measures of parents' interactions and supportiveness of children's learning improved across SES quintiles with scores increasing from 32.9 to 36.6 on the Nursing Child Assessment Teaching Scale (0.85 SD gap) and from 3.8 to 4.9 on the Two Bags Supportiveness scale (1.25 SD gap). Higher SES parents were more likely to have rules about bedtime, food, and chores with a near doubling of increase across SES quintiles for food rules (from 56% to 92%). By age 4, steep gradients in parents' aspirations for their child's future were already apparent with just over half of parents in the lowest SES quintile expecting their child to earn a college degree (57%) compared with almost all those in the highest SES quintile (96%). Preschool attendance and participation in $\geq$2 classes/activities at age 4 increased across SES quintiles (from 64% to 89% and from 10% to 41%, respectively). Maternal alcohol use during pregnancy was the only indicator in which risk was greater for higher SES groups.

Decomposition of the SES Gradients in Children's Reading and Math Ability

Table 2 shows the results of the decomposition analysis. Candidate explanatory factors explained about half the Q1–Q5 and Q1–Q3 SES gaps in reading ability. Focusing on the Q1-Q5 gap, family background factors explained 8% with small contributions from mother's age, child's age, family structure, and household size. In the health domain, small contributions from mother's prepregnancy BMI, maternal depression, breastfeeding, birth weight, and child's global health status explained ~4% of the gap. Factors in the home learning environment explained 18%, with sizable contributions from parent reading (10%) and home computer use (7%). Parenting style and beliefs explained ~15% of the gap, with contributions from parent's positive interactions and supportiveness (6%), rules about food (3%), and high expectations for their child's educational attainment (6%). Factors in the early education domain explained ~7% with contributions from preschool attendance (4%) and participation in organized classes/activities (3%).

Similar results were found for children's math outcomes. Candidate explanatory factors explained just over half of the Q1–Q5 and Q1–Q3 SES gaps in children's math ability (57% and 60%, respectively). Focusing on the Q1-Q5 gap, ~13% was explained by family background factors including children's race/ethnicity, mother's age, child's age, and household size. In the health domain small contributions from mother's prepregnancy BMI, maternal depression, breastfeeding, birth weight, and global child health

TABLE 1 SES Gradients in Family and Child Characteristics and Behaviors, ECLS-B Study, 2001–2007 (N = 6600)

	SES					Wald Test P
	Q1 (lowest)	Q2	Q3	Q4	Q5 (highest)	
Family background						
Child race/ethnicity (%)						<.05
White, non-Hispanic	21.3	41.8	57.1	71.1	78.0	
Black, non-Hispanic	25.9	17.8	13.1	9.2	4.3	
Hispanic	48.3	32.9	22.4	13.8	7.1	
Asian/Pacific Islander	1.5	2.3	1.6	2.3	6.1	
Multiracial/other	3.0	5.2	5.8	3.6	4.4	
Mother's age (mean)	25.3	25.4	27.5	30.0	32.9	<.05
Child age at assessment (mean, in mo)	67.9	68.4	68.1	68.2	68.2	NS
Family structure (%)						<.05
Two parents	56.7	70.2	78.2	87.0	94.6	
Single mother	40.3	26.4	19.7	11.0	5.1	
Other	3.1	3.3	2.0	1.9	0.3	
Household size (mean)	4.7	4.5	4.3	4.0	4.0	<.05
Health						
Mother prepregnancy BMI (mean)	25.5	25.3	25.4	24.7	24.0	<.05
Prenatal smoking (%)	17.0	18.3	15.4	4.7	2.0	<.05
Prenatal alcohol use (%)	2.8	1.7	2.2	3.2	7.1	<.05
Maternal depression (mean)	6.5	5.7	4.9	4.1	3.7	<.05
Ever breastfed (%)	55.6	58.9	63.5	78.6	86.5	<.05
Low child birth weight (%)	9.7	8.1	7.5	6.3	5.6	<.05
Good/fair/poor child health status (%)	23.1	16.0	10.4	8.3	6.6	<.05
Home learning environment						
Parent reading (mean)	2.6	2.8	3.0	3.2	3.5	<.05
Home computer (%)	27.2	48.6	63.4	76.1	83.7	<.05
No. children's books (mean)	25.6	42.5	65.6	88.3	113.7	<.05
No. children's toys (mean)	25.3	33.1	35.9	38.5	37.5	<.05
No. children's DVDs (mean)	6.2	8.8	11.1	13.7	15.9	<.05
Library visit (age 4) (%)	35.4	38.6	38.9	48.1	56.6	<.05
Daily game playing (age 2) (%)	76.6	82.2	80.8	84.8	86.8	<.05
Parenting style/beliefs						
Positive interactions (mean)	32.9	33.3	34.7	35.7	36.6	<.05
Parent supportiveness (mean)	3.8	4.1	4.4	4.6	4.9	<.05
Rules about bedtime (%)	81.8	84.9	88.6	91.9	95.5	<.05
Rules about food (%)	55.7	67.3	79.7	86.8	92.2	<.05
Rules about chores (%)	64.6	70.4	73.1	76.0	74.9	<.05
Expects child to earn college degree (%)	57.2	59.9	71.6	86.2	96.5	<.05
Early care and education						
Primary care arrangement (age 2) (%)						<.05
No nonparental care	67.3	50.6	46.6	47.6	43.9	
Relative care	16.9	26.5	21.6	16.7	9.3	
Nonrelative care	6.5	10.9	15.4	20.3	23.0	
Center-based care	9.2	12.0	16.4	15.4	23.8	
Preschool attendance (year before kindergarten entry) (%)	63.7	64.7	74.4	82.6	89.4	<.05
Number of organized classes/activities (%)						<.05
0	75.2	68.9	55.9	40.5	26.1	
1	14.8	18.5	26.8	32.2	32.7	
≥2	10.0	12.7	17.4	27.4	41.2	

status explained ~6% of the gap. Factors in the home learning environment explained 18% with contributions from reading (8%), home computer use (6%), and number of children's books (4%). Parenting style and beliefs explained ~14% of the gap, with contributions from parent positive interactions and supportiveness (7%), rules about food (4%), and high expectations for the child's educational attainment (4%). Factors in the early education domain explained 6% with contributions from preschool attendance (2%) and participation in organized classes/activities (4%).

Table 3 shows the full specification results of the linear regression models predicting reading and math ability at kindergarten entry.

DISCUSSION

This study documents steep SES gradients in reading and math ability by kindergarten entry in a representative sample of US children. Likewise, beginning in utero and extending throughout early childhood, key risk and protective factors for children's cognitive development show steep gradients by SES. Many factors including maternal age and household composition, maternal and early childhood health, key elements of the home environment (family routines, parent-child interaction, parent aspirations), and experiences in preschool and early learning activities partially mediate SES gradients in US children's cognitive ability at kindergarten entry. This study represents one of the more comprehensive investigations of candidate explanatory factors, yet our analyses explained just over half of the gaps between the highest and lowest, and lowest and middle, SES quintiles with regard to early reading and math scores, suggesting that many additional factors are involved.

In the UK Millennium Cohort study, parenting, home learning, and family interaction factors explained 16% to 17% of the SES gradients in cognitive ability by age 5 and preschool and early child care 2% to 3%.[2] Perhaps owing to different or more comprehensive measures, health, home environment, and early education factors had a larger impact in ECLS-B. Both studies showed an important role for

TABLE 2 Decomposition of the SES Gradients in Children's Reading and Math Ability (N = 6600)

	Reading				Math			
	Percentile Point Gap		As % Total Gap		Percentile Point Gap		As % Total Gap	
	Q1–Q5	Q1–Q3	Q1–Q5	Q1–Q3	Q1–Q5	Q1–Q3	Q1–Q5	Q1–Q3
Raw gap	33.5	18.3			37.1	17.5		
Total explained	17.5	8.4	52	47	21.1	10.6	57	60
Total unexplained	16.0	9.9	48	53	16.0	6.9	43	40
Family background	2.8	1.1	8	6	4.8	2.2	13	13
Child race/ethnicity	−0.1	−0.4	0	−2	2.6	1.3	7	7
Mother's age	0.6	0.2	2	1	1.0	0.3	3	2
Child's age	0.7	0.4	2	2	0.8	0.5	2	3
Family structure	0.7	0.4	2	2	0.1	0.0	0	0
Household size	0.8	0.5	2	3	0.3	0.2	1	1
Health	1.3	0.8	4	5	2.1	1.2	6	7
Mother prepregnancy BMI	0.3	0.0	1	0	0.2	0.0	1	0
Prenatal smoking	−0.3	0.0	−1	0	−0.3	0.0	−1	0
Prenatal alcohol use	−0.2	0.0	−1	0	0.0	0.0	0	0
Maternal depression	0.3	0.2	1	1	0.7	0.4	2	2
Ever breastfed	0.5	0.1	1	1	0.5	0.1	1	1
Low child birth weight	0.1	0.1	1	1	0.3	0.1	1	1
Good/fair/poor child health status	0.6	0.4	2	2	0.7	0.5	2	3
Home learning environment	5.9	2.9	18	16	6.8	3.4	18	19
Parent reading	3.5	1.5	10	8	3.0	1.3	8	8
Home computer	2.2	1.4	7	8	2.4	1.5	6	9
No. children's books	0.7	0.3	2	2	1.3	0.6	4	3
No. children's toys	−0.3	−0.2	−1	−1	−0.2	−0.2	0	−1
No. children's DVDs	−0.4	−0.2	−1	−1	0.1	0.1	0	0
Library visit (age 4)	0.1	0.0	0	0	0.2	0.0	1	0
Daily game playing (age 2)	0.2	0.1	1	0	0.0	0.0	0	0
Parenting style/beliefs	5.1	2.5	15	14	5.3	2.8	14	16
Positive interactions	0.9	0.4	3	2	0.8	0.4	2	2
Parent supportiveness	1.1	0.6	3	4	1.7	1.0	5	6
Rules about bedtime	−0.1	−0.1	0	0	−0.1	−0.1	0	0
Rules about food	1.1	0.7	3	4	1.4	0.9	4	5
Rules about chores	0.0	0.0	0	0	−0.1	−0.1	0	0
Expects child to earn college degree	2.1	0.8	6	4	1.5	0.6	4	3
Early care and education	2.4	1.1	7	6	2.1	1.0	6	6
Primary care arrangement (age 2)	0.0	0.1	0	1	0.0	0.2	0	1
Preschool attendance (year before kindergarten entry)	1.4	0.6	4	3	0.7	0.3	2	2
No. of organized classes/activities	1.0	0.4	3	2	1.4	0.5	4	3

Results were calculated rounding β coefficients to 3 decimal places. Column totals may be affected by rounding.

parenting and the home learning environment. Positive, responsive relationships with caring adults are among the most important influences in early cognitive development,[35–37] and previous studies also indicate the central role of cognitive stimulation in the home.[18] In this study, reading and computer use, but not the number of toys and children's DVDs, had a sizable impact on early cognitive gradients. Parent supportiveness, positive interactions, and higher expectations for their child's learning were also important. Notably, by age 4, almost all parents in upper SES families expect a college degree for their child compared with only approximately half of those in the lowest SES quintile. Future research could examine the impact of interventions to raise parent aspirations for their children on parenting behaviors and child cognitive outcomes.

More than a decade ago, Hart and Risley documented how children from different social classes achieve dramatically different trajectories of vocabulary development as a result of what has become known as the 30 million word gap.[38] The current study demonstrates similarly dramatic gradients in cognitive function using a national sample of children. Although growing policy attention is currently directed at the 30 million word gap, the results of this study support "whole child" and "whole family" policies to address early socioeconomic gaps in cognitive ability. This might include upstream policies targeting levels of socioeconomic inequality in society and a range of comprehensive early childhood interventions, potentially including a mix of early health and home visiting services, universal early education opportunities, and programs and policies to promote the family relationship context of the achievement gaps. Interventions focused on single factors such as preschool attendance or parental reading in isolation will likely have limited impact on inequality reduction. New multifaceted interventions designed to address a broad array of early parenting and home environment factors, while also providing enhanced preschool instruction, have shown impressive gains in cognitive skills for children from disadvantaged families.[39]

Because pediatricians have nearly universal, relatively frequent and recurring contact with young children and their families, they are uniquely well positioned to have an impact on developmental outcomes through anticipatory guidance at well-child visits, early developmental screening, practice-based developmental interventions, community linkage and referral programs, and advocacy for

TABLE 3 Linear Regression Models Predicting Child Reading and Math Ability at Kindergarten Entry, ECLS-B Study, 2001–2007 (N = 6600)

	Reading β (SE)	Math β (SE)
SES		
Q1 (lowest)	Reference	Reference
Q2	4.30 (1.25)*	3.35 (1.15)*
Q3	9.88 (1.83)*	6.93 (1.61)*
Q4	10.79 (1.94)*	10.07 (1.77)*
Q5 (highest)	16.08 (2.20)*	16.02 (1.84)*
Family background		
Child race/ethnicity		
White, non-Hispanic	Reference	Reference
Black, non-Hispanic	3.10 (1.40)*	−3.00 (1.46)*
Hispanic	−0.17 (1.54)	−3.81 (1.42)*
Asian/Pacific Islander	12.16 (1.64)*	9.48 (1.38)*
Multiracial/other	−1.42 (2.28)	−4.39 (2.10)*
Mother's age	0.09 (0.09)	0.13 (0.06)*
Child age at assessment	1.96 (0.10)*	2.10 (0.11)*
Family structure		
Two parents	Reference	Reference
Single mother	−1.73 (1.11)	0.08 (0.06)
Other	−3.43 (2.57)	−4.29 (2.51)
Household size	−1.12 (0.35)*	−0.38 (0.32)
Health		
Mother prepregnancy BMI	−0.19 (0.08)*	−0.13 (0.06)*
Prenatal smoking	2.30 (1.45)	2.14 (1.36)
Prenatal alcohol use	−4.04 (2.75)	−0.50 (2.54)
Maternal depression	−0.11 (0.11)	−0.26 (0.09)*
Ever breastfed	1.58 (0.98)	1.71 (0.93)
Low child birth weight	−3.44 (1.14)*	−6.43 (1.03)*
Good/fair/poor child health	−3.49 (1.25)*	−4.33 (1.15)*
Home learning environment		
Parent reading	3.97 (0.84)*	3.41 (0.77)*
Home computer	3.83 (0.94)*	4.26 (0.74)*
No. children's books	0.01 (0.01)	0.01 (0.01)
No. children's toys	−0.02 (0.01)	−0.01 (0.01)
No. children's DVDs	−0.04 (0.02)	0.01 (0.03)
Library visit (age 4)	0.33 (0.81)	0.94 (0.77)
Daily game playing (age 2)	1.62 (1.15)	−0.66 (1.07)
Parenting style/beliefs		
Positive interactions	0.25 (0.10)*	0.22 (0.09)*
Parent supportiveness	1.04 (0.60)	1.62 (0.60)*
Rules about bedtime	−1.05 (1.55)	−1.00 (1.57)
Rules about food	2.95 (1.13)*	3.93 (1.14)*
Rules about chores	0.27 (0.95)	−0.62 (1.02)
Expects child to earn college degree	5.27 (1.11)*	3.87 (1.02)*
Early care and education		
Primary care arrangement (age 2)		
No nonparental care	Reference	Reference
Relative care	1.78 (1.23)	2.07 (1.07)
Nonrelative care	1.02 (1.22)	0.60 (1.06)
Center-based care	−0.47 (1.23)	0.54 (1.22)
Preschool attendance (year before kindergarten)	5.32 (1.08)*	2.76 (0.94)*
No. of organized classes/activities		
0	Reference	Reference
2	1.46 (1.07)	1.92 (0.95)*
≥2	2.52 (1.03)*	3.44 (1.19)*

*$P < .05$.

broader social change to support child development.[40–44] This study reinforces the potential benefits of practice-based programs that support parenting and the home learning environment, such as "Reach Out and Read" and "Healthy Steps for Young Children,"[16,45,46] as well as community-based programs that help guide families through systems of care for developmental support, like Help Me Grow.[47] Efforts to connect pediatric practices with home visitor and early care and education providers may provide referral opportunities for promoting early brain development.[48–52]

This study has several limitations. The results represent associations among variables and may not reveal causal mechanisms. The variables in the ECLS-B data are among the best and most extensive available; however, they still explain only slightly over half of the SES gradients. More detailed early care and education measures could impact the associations. A decomposition methodology is the most parsimonious approach to examine multiple contributors to the gradient, but estimates depend on all factors; for example, maternal depression may operate through parent reading and not have a large independent contribution.

CONCLUSIONS

This study found that a steep SES gradient defines the cognitive abilities of US children at school entry. The gradient is partially explained by a range of health, home learning, parenting, and early education factors, many of which are amenable to change, given the right interventions. The range and diversity of influences suggests the need for systematic "whole child" efforts to address inequalities in development. This might include a mix of policies and multifaceted early childhood interventions targeting key risk and protective factors across multiple domains. Reduction of the sizeable social gradient in early cognitive development could have lifelong health benefits for the most disadvantaged children, and represent a key step toward eliminating adult health disparities.

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