



## Moving up but not getting ahead: Family socioeconomic position in pregnancy, social mobility, and child cognitive development in the first seven years of life

Sara B. Johnson<sup>a,b,c,\*</sup>, Radhika S. Raghunathan<sup>a</sup>, Mengying Li<sup>b</sup>, Divya Nair<sup>d</sup>, Pamela A. Matson<sup>a</sup>

<sup>a</sup> Department of Pediatrics, Johns Hopkins School of Medicine, Division of General Pediatrics, Baltimore, MD, USA

<sup>b</sup> Department of Population, Family & Reproductive Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

<sup>c</sup> Department of Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

<sup>d</sup> Department of International Health, Johns Hopkins Bloomberg School of Public Health, USA

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### ABSTRACT

**Objectives:** Understanding when and how socioeconomic position (SEP) influences cognitive development is key to reducing population inequalities in health and achievement. The objective of this study was to determine the unique association between prenatal family SEP and child cognitive development, and to determine whether marked postnatal social mobility was associated with improvements in child cognitive performance to age 7.

**Methods:** Data were from children enrolled in the US National Collaborative Perinatal Project (NCP) (n = 28,761) during 1959–1965, a dataset large enough to observe marked mobility, which remains uncommon. Multivariable linear regression was used to examine the relationship between SEP (i.e., parental income, education, occupation) during gestation and cognitive performance at 8 months (Bayley Scales of Infant Development Mental Development Index) and at 7 years (Wechsler Intelligence Scale for Children).

**Results:** Holding demographic and perinatal factors constant, family SEP during gestation was not associated with cognitive performance at 8 months (B = -0.03, 95% CI: -0.07–0.01) but was positively associated with performance at 7 years even after accounting for SEP at 7 years (B = 1.28, 95% CI: 1.11–1.45). Children whose families experienced the most extreme upward mobility (from the lowest to highest income quartile) showed a 12 percentile increase in cognitive performance in the first 7 years of life. Those with the most extreme downward mobility (from the highest to lowest income quartile) still experienced an 8 percentile increase in cognitive performance in this interval.

**Conclusions:** The proportion of children in poverty today is similar to 1965 and intergenerational mobility has declined markedly. Prenatal SEP may contribute to inequalities in child cognitive performance that even extraordinary social mobility cannot erase. To optimize cognitive development across generations, current means-tested programs to support families with young children should be supplemented by universal approaches to ensure access to opportunity before young people become parents.

### 1. Introduction

In the United States, nearly one in five children (17%) lives in poverty (Kidscount Data Center, 2021). Above and beyond lack of material resources, growing up in a household with low socioeconomic position (SEP) may expose children to a constellation of social and environmental conditions that undermine healthy development including psychosocial stressors at the family and community levels,

housing and food insecurity, exposure to pollutants, and structural barriers to opportunity such as residential segregation (Donnelly et al., 2017; Evans, 2004; Evans & English, 2002; Kroenke, 2008). Life course research demonstrates that adverse social environments in childhood can negatively impact behavioral and emotional well-being and cognitive abilities, which, in turn, influence physical and mental health, educational attainment, and economic mobility in adulthood (Danese & McEwen, 2011; Danese et al., 2009; Felitti et al., 1998; Suglia et al.,

\* Corresponding author. Johns Hopkins School of Medicine, Department of Pediatrics, 200 N. Wolfe St., Suite 2051, Baltimore, MD, 21287, USA.  
E-mail address: [sjohnson@jhu.edu](mailto:sjohnson@jhu.edu) (S.B. Johnson).

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2017). As a group, children who grow up in low-SEP households, particularly those who experience early-life, persistent, or extreme poverty, are more likely to demonstrate developmental delays, poorer school achievement, and poorer performance on neurocognitive tests compared to non-poor children (Farah et al., 2006, 2008; Johnson et al., 2016; Noble et al., 2007; Olds et al., 2007). Further, low SEP in childhood is associated with lower earnings and poorer health in adulthood (Danese et al., 2009; Donnelly et al., 2017; Duncan et al., 2014). Intergenerational persistence, that is, the correspondence between parents' SEP at the child's birth and the child's SEP in adulthood, both reflects and perpetuates health inequity (Marmot & Bell, 2012). Understanding how the socioeconomic environment shapes children's cognitive development and, critically, when and how socioeconomic inequities in child development can be reversed, is essential to designing interventions to optimize health, achievement, and productivity across the life course and generations (Marmot & Bell, 2012).

There is reason to believe that socioeconomic conditions begin to shape children's life chances even before birth. The brain is particularly sensitive to the environment during periods of rapid development, including during gestation (National Research Council and Institute of Medicine, 2000; Newman et al., 2011; Shonkoff & Garner, 2012; Szyf et al., 2005). Maternal low SEP during pregnancy is associated with increased risk for premature birth, growth restriction, and low birth weight (Aber et al., 1997; Jonas et al., 1992; Olson et al., 2010) and may expose the fetus to elevated levels of psychosocial stress, poor nutrition, or toxins (Sandman et al., 2012; Seckl & Meaney, 2004). After birth, low SEP is associated with less cognitive stimulation in the home, greater exposure to family psychosocial stressors, and poorer nutrition (Conger et al., 2010; Hart & Risley, 1995; Johnson et al., 2016; Lipina et al., 2013).

Intensive interventions delivered at the family or child level, particularly in the first three years of life, have shown promise in reducing socioeconomic inequities in cognitive performance (Heckman & Mosso, 2014). For example, the Nurse-Family Partnership, a home visiting program delivered to mothers with low-SEP from pregnancy through age 2, was associated with higher child IQ at age 6 compared to controls (Olds et al., 2007). The Perry Preschool Project, a preschool-based intervention for 3- to 5-year-olds from low-SEP families in the 1960s, demonstrated improvements in IQ in childhood, although these effects decayed as children were followed into adulthood (Heckman & Mosso, 2014; Schweinhart et al., 2005).

Despite evidence that some impacts of early poverty on life course health and productivity are modifiable with intervention, and that intervention programs in pregnancy show benefit for cognitive development, major gaps remain in our understanding of when in life low SEP begins to measurably impact children's cognitive development and whether such effects are reversible. Upward social mobility, the movement of families to positions of greater advantage in society (Müller & Pollak, 2015), is hypothesized to reduce or eliminate the impact of early socioeconomic deprivation on long-term outcomes (Glymour et al., 2014). However, most previous research has examined the cognitive correlates of low SEP at one point during development or has examined SEP as a non-time varying influence on children's outcomes. Examining the cases in which SEP changes markedly during early life can provide insight into when and how changing circumstances shape child development and the potential impacts of interventions (Duncan et al., 2014).

In this study, using the National Collaborative Perinatal Project (NCPP), a very large longitudinal prospective cohort study, we examined the role of early family SEP in cognitive development in the first seven years of life. First, we examined the independent associations of SEP during gestation with cognitive performance in infancy and middle childhood. Then we investigated whether children who experienced marked income mobility during the first seven years of life, either upward or downward, exhibited parallel changes in cognitive performance. Despite its age, the NCPP is the largest longitudinal study of prenatal and early childhood outcomes ever conducted in the US; as such, it is still used

to evaluate key questions in child and family health. Marked income mobility was rare in the 1950s and remains so today, particularly for historically marginalized and minoritized racial and ethnic groups (Akee et al., 2019; Winship, 2018). In fact, upward social mobility has declined markedly from the 1940s to today (Chetty et al., 2017). The NCPP dataset provides sufficient sample size to examine whether marked social mobility can ameliorate the effects of early poverty on children's cognitive development to age seven.

## 2. Methods

### 2.1. Study cohort

The NCPP was a prospective study that included 53,043 pregnancies designed to investigate the antecedents of somatic, neurodevelopmental, and psychological disorders of childhood (Broman et al., 1975; Niswander & Gordon, 1972). Women were recruited at 12 sites across the US (Baltimore MD, Boston MA, Buffalo NY, Memphis TN, Minneapolis MN, New Orleans LA, New York NY (2 hospitals), Philadelphia PA, Portland OR, Providence RI, and Richmond VA) between 1959 and 1965. Pregnant women were typically enrolled at their first prenatal visit and followed until their children reached age 7 (mean time of enrollment: 21.3 weeks gestation, standard deviation [SD] 8.3) (Huang et al., 2014). Mothers could participate with multiple pregnancies. Child neurocognitive assessments were performed at 8 months and 7 years of age. Seventy-nine percent of children were followed to age 7.

This analysis was restricted to live-born children from singleton pregnancies without congenital malformations or anomalies. Only white and Black individuals were included given the small proportion of those in other groups (7% of the sample). Additional inclusion criteria were applied to reduce potential confounding from perinatal risk: children born 37–42 weeks gestation, birth weight  $\geq 2500$  g, and 5-min Apgar scores  $>6$ . A total of 35,451 children met these eligibility criteria; of these children, 6690 did not participate in 7-year cognitive assessments, yielding an analytic sample of 28,761, of which, 8234 were siblings. Participants with 7 year assessments were similar to those without, except that mothers who participated in the 7 year assessments were slightly younger (23.7 years (SD: 6.0) vs. 24.4 years (SD: 5.3)) at enrollment. Completion of the 7-year assessment was not associated with cognitive performance at 8 months of age.

#### 2.1.1. Measures

**SEP.** Mothers reported their socioeconomic characteristics during their pregnancy and at the 7-year assessment. Family income was reported using eleven categories according to the year in which the child was registered (1959–1965) to account for inflation across the enrollment period. Each parent's occupation was assigned an occupational code. Following previous studies with this cohort (Non et al., 2014), a SEP index was constructed to capture family income, parental education, and parental occupation. Individual SEP indicators were dichotomized (0 vs. 1) and summed. Family income was dichotomized as  $< \$3000$  (~130% of poverty for a family of four in 1959 (US Census Bureau, 2016)) versus  $\geq \$3000$ . Each parent's education was dichotomized as less than high school vs. high school or more. Each parent's occupational code was categorized by the NCPP investigators as manual or non-manual occupation or not working. The SEP index ranged from 0 to 5, with higher scores indicating higher SEP. Separate indices were constructed for SEP in pregnancy (alpha = 0.71) and age 7 (alpha = 0.63).

**Family income mobility.** Mobility was examined based on family income given the dynamic nature of this indicator compared to education or occupation. First, children were divided into quartiles based on family income at registration. Then, because our interest was marked mobility, we confined our analysis to families who were the best- and worst-off over time; we cross-classified family income quartile during

pregnancy with family income quartile at age 7. This resulted in eight mobility groups: four groups among those with the highest income during pregnancy (remained highest, 1, 2, or 3 income quartiles downward mobility) and four groups among those with the lowest income during pregnancy (remained lowest, 1, 2, or 3 income quartiles upward mobility).

**Child cognitive performance.** At 8 months, the Bayley Scales of Infant Development Mental Development Index Subscale (MDI) was used to assess cognitive, language, and social development (Bayley, 1969). This research-specific version of the MDI included 83 items (Jusko et al., 2012). Approximately 95% of children were tested between 7.5 and 9.0 months of

age (Ananth et al., 2017). At 7 years, the Wechsler Intelligence Scale for Children was used to estimate full-scale intelligence quotient (FSIQ) based on seven subtests (vocabulary, information, comprehension, digit span, picture arrangement, block design, and digit/symbol coding) (Wechsler, 1949).

**Covariates.** Information was collected about maternal parity, age, and smoking status (none, <1 pack, 2 packs or more), child sex, child's race (white or Black), gestational age, breastfeeding (any in the first 8 days of life vs. none), father absence (father/husband absent vs. not during pregnancy and at 7 years), and a chronic child health problem as indicated by prolonged or recurrent hospitalization in the first year of

**Table 1**

Demographic characteristics and cognitive performance of study participants and indicators of socioeconomic position during pregnancy and at 7 years of age, National Collaborative Perinatal Project, 1959–65.

Characteristic		Pregnancy			7-Years		
		%/Mean	95% CI		%/Mean	95% CI	
Child race	Black	46.8%	46.2%	53.8%			
	White	53.2%	52.6%	53.8%			
Child sex	Male	51.0%	50.43%	51.5%			
	Female	49.0%	48.5%	49.6%			
Maternal age (yrs)		24.6	24.5	24.6			
Maternal parity		2.0	1.9	2.0			
Gestational age at birth (wks)		40.0	40.0	40.0			
Maternal smoking	None	54.2%	53.7%	54.8%			
	1 pack	26.6%	25.2%	26.7%			
	≥2 packs	19.2%	18.7%	19.7%			
Breastfeeding	No	80.1%	80.0%	80.6%			
	Yes	19.9%	19.3%	20.3%			
Health problem <sup>a</sup>		0.2%	0.14%	0.25%			
SEP index		2.23	2.21	2.25	2.49	2.47	2.50
Mother's education	< HS	52.7%	52.1%	53.2%	46.6%	46.0%	47.2%
	HS	33.9%	33.4%	33.5%	37.3%	36.8%	37.9%
	> HS	13.3%	12.3%	13.7%	16.0%	15.6%	16.4%
Father's education	< HS	51.1%	50.4%	51.7%	49.6%	48.8%	50.9%
	HS	32.2%	31.6%	32.8%	30.2%	29.3%	31.0%
	> HS	16.7%	16.2%	17.1%	19.9%	19.4%	20.4%
Mother's occupation	Not working	12.0%	11.6%	12.3%	32.4%	31.8%	33.0%
	Manual	52.5%	51.9%	53.1%	40.8%	40.2%	41.3%
	Non-manual	35.5%	34.9%	36.0%	26.8%	26.3%	27.3%
Father's occupation	Not working	0.2%	0.1%	0.2%	0.4%	0.2%	0.4%
	Manual	73.5%	73.0%	74.0%	70.6%	69.6%	71.6%
	Non-manual	26.3%	25.8%	26.9%	29.0%	27.9%	30.1%
Family income (dollars)	0	0.5%	0.4%	0.6%	0.5%	0.4%	0.6%
	1 to 1999	13.7%	13.3%	14.1%	3.2%	2.9%	3.3%
	2000 to 3999	39.9%	39.3%	40.5%	17.5%	17.0%	17.9%
	4000 to 5999	25.9%	25.3%	26.4%	22.3%	21.8%	22.8%
	6000 to 7999	12.2%	11.8%	12.6%	20.2%	19.7%	20.7%
	8000 to 9999	4.5%	4.3%	4.8%	11.9%	11.5%	12.2%
10,000 +	3.1%	2.9%	3.3%	24.4%	23.9%	24.9%	
Father absence	Absent	19.6%	19.1%	20.1%	27.7%	27.2%	28.2%

SEP: socioeconomic position.

<sup>a</sup> Chronic child health problem in the first year of life.

life (yes/no). All models were also adjusted for recruitment site.

### 2.1.2. Statistical analysis

**Missing data:** Missingness in SEP variables ranged from 0% to 30% (paternal education). Multiple imputation with chained equations was performed to generate 10 imputed datasets and analyses were performed with imputed data (Stuart et al., 2009).

**SEP and child cognitive performance.** First, we evaluated the relationship between SEP during pregnancy and cognitive performance at 8 months of age using multivariable linear regression, accounting for parity, maternal age, breastfeeding, smoking in pregnancy, father absence in pregnancy, gestational age, infant sex, race, and site. Models were estimated using robust standard errors to account for correlation between siblings. Then we examined the relative associations of prenatal SEP and contemporaneous SEP with cognitive performance at age 7. We fit two models, one that included only prenatal SEP as the predictor and one that included both prenatal SEP and 7 year SEP. Models were adjusted for the same variables as the 8-month models plus father absence at 7 years and child chronic health problems.

**Income mobility and child cognitive performance.** We examined child cognitive performance at age 7 as a function of family income mobility categories to understand whether social mobility was associated with changes in child cognitive performance. To facilitate comparison, the 8 month and 7 year cognitive performance scores were transformed into rank percentiles within the sample. The mean of the 8-month MDI percentiles and 7 year FSIQ percentiles were plotted for each of the 8 groups.

**Supplemental Analyses.** First, to examine potential effect modification, we stratified the analysis by race. Next, we excluded siblings, retaining only the oldest eligible child to evaluate the robustness of our findings. Analyses were performed in Stata version 15 (StataCorp, College Station, TX). This study was determined to be exempt by our institution's Institutional Review Board.

## 3. Results

Characteristics of the sample are summarized in Table 1. Children's relative cognitive performance increased with development. At 8 months of age, the mean MDI score was 80.3 (95% CI: 80.2–80.3). By 7 years of age, the mean FSIQ score was 97.6 (95% CI: 97.4–97.8). Family SEP index increased from 2.2 (95% CI: 2.1–2.2) in pregnancy to 2.5 (95% CI: 2.5–2.5) at 7 years.

### 3.1. Prenatal socioeconomic status and cognitive performance at 8 Months & 7 Years of age

Holding demographic and perinatal risk factors constant, family SEP during gestation was not associated with cognitive performance at 8 months (B = 0.03 95% CI -0.07–0.01, Table 2). However, SEP during gestation was significantly positively associated with cognitive performance at 7 years (B = 2.31, 95% CI: 2.18–2.43, Table 3). Family SEP during gestation remained significantly positively associated with cognitive performance at age 7 years even after accounting for contemporaneous SEP (B = 1.28, 95% CI: 1.11–1.45, Table 3).

### 3.2. Family income mobility

Fig. 1 illustrates child cognitive performance at 8 months and 7 years of age by family income mobility. Among children whose families had the highest incomes during pregnancy, cognitive performance improved by 7 years of age, even if families experienced substantial downward mobility. Conversely, among children with the lowest incomes during pregnancy, a substantial bolus of additional family income was required to overcome the trend toward declining relative cognitive performance over time. Among the subset of children born poorest, three of the four income mobility groups lost ground over time. Only the most extreme

**Table 2**

Results of multivariable linear regression models evaluating the association between socioeconomic position (SEP) measured in pregnancy and Bayley Scales Mental Development Index at 8 months of age, National Collaborative Perinatal Project, 1959–65.

	Coef	95% CI	
SEP index in pregnancy	-0.03	-0.07	0.01
Father absent in pregnancy	0.01	-0.12	0.14
Breastfed	<b>0.31</b>	0.18	0.44
Gestational age (weeks)	<b>0.20</b>	0.17	0.23
Maternal age at delivery (years)	<b>0.02</b>	0.01	0.03
Female child	0.04	-0.06	0.13
Black child	0.04	-0.12	0.21
Maternal parity at delivery	<b>-0.11</b>	-0.15	-0.07
Maternal cigarette smoking			
None (Ref)	-	-	-
1 pack	<b>0.12</b>	0.00	0.23
2+ packs	0.01	-0.13	0.15

SEP: socioeconomic position.

Bolded coefficients indicate  $p < 0.05$ .

**Table 3**

Results of multivariable linear regression models evaluating the association between socioeconomic position (SEP) in pregnancy (Model A) and SEP in pregnancy plus SEP at 7 years of age (Model B) and full-scale IQ (FSIQ) at 7 years of age, National Collaborative Perinatal Project, 1959–65.

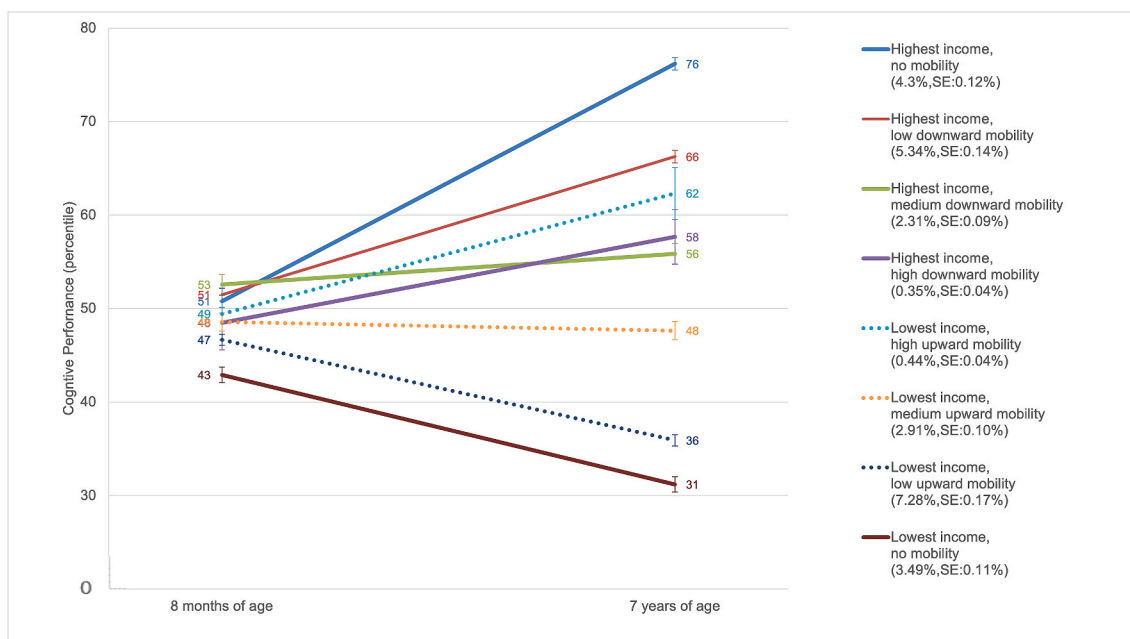
	Model A: SEP in pregnancy			Model B: SEP in pregnancy & 7 years		
	Coef	95% CI		Coef	95% CI	
Family SEP index in pregnancy	<b>2.31</b>	2.18	2.43	<b>1.28</b>	1.11	1.45
Family SEP index, 7 years				<b>1.50</b>	1.33	1.68
Father absent, pregnancy	<b>-0.47</b>	-0.86	-0.08	-0.21	-0.69	0.19
Father absent, 7 years				<b>-0.72</b>	-1.09	-0.35
Breastfed	<b>2.79</b>	2.38	3.21	<b>2.62</b>	2.21	3.04
Gestational age (weeks)	<b>0.09</b>	0.01	0.18	<b>0.09</b>	0.01	0.18
Maternal age at delivery (years)	<b>0.15</b>	0.12	0.18	<b>0.16</b>	0.13	0.19
Female child	-0.07	-0.35	0.21	-0.09	-0.37	0.19
Black child	<b>-5.05</b>	-5.54	-4.55	<b>-5.27</b>	-5.76	-4.78
Maternal parity at delivery (#)	<b>-0.62</b>	-0.73	-0.52	<b>-0.56</b>	-0.66	-0.45
Maternal cigarette smoking						
None (ref)				ref		
1 pack	<b>-0.67</b>	-1.02	-0.22	<b>-0.54</b>	-0.88	-0.20
2+ packs	<b>-0.62</b>	-0.84	-0.04	<b>-0.47</b>	-0.87	-0.08
Chronic child health problem <sup>a</sup>	<b>-5.52</b>	-9.39	-1.66	<b>-5.62</b>	-9.47	-1.78

SEP: socioeconomic position.

Bolded coefficients indicate  $p < 0.05$ .

<sup>a</sup> Chronic child health problem in first year of life.

upward mobility was associated with an increase in cognitive performance from the 50th to the 62nd percentile (12 points). Children in the most advantaged families at birth who remained most advantaged at age 7 increased their cognitive performance nearly twice as much in this interval, from the 51st to the 76th percentile (25 points). Further, children whose families were more advantaged in pregnancy were more likely to be insulated from decreases in cognitive performance in the event of downward mobility—those with the highest incomes in pregnancy who experienced the most extreme downward mobility still gained 8 points across the follow-up period, from the 49th percentile to the 57th percentile.



**Fig. 1.** Family income mobility and child cognitive performance on the Bayley Mental Development Index (8 months of age) and Wechsler Full Scale IQ (7 years of age) among children in the lowest and highest income groups during gestation. Error bars reflect standard errors. Children could stay at the same income level across this interval or move up or down up to three family income quartiles (i.e., low, medium, or high mobility). Dashed lines indicate upward mobility. Sample proportions (%) and standard errors (SE) are provided to account for variability across imputed datasets.

### 3.3. Sensitivity analyses by child race

We examined potential differences by race in sensitivity analyses (see Appendix, Tables A1–A3). In race-stratified models, mean cognitive performance scores at 8 months were similar among white children ( $M = 80.43$ , 95% CI: 80.37–80.50) and Black children ( $M = 80.06$ , 95% CI: 79.98–80.13). Among white children, there was a very small significant inverse relationship between family SEP in pregnancy and cognitive performance ( $B = -0.05$ , 95% CI: 0.10 to  $-0.01$ , Table A2); however, among Black children, SEP in pregnancy was not associated with cognitive performance ( $B = 0.01$ , 95% CI: 0.05–0.08). In contrast, prenatal SEP was significantly positively associated with cognitive performance at 7 years in both groups, with and without accounting for 7 year SEP (Table A3); however, the relationship was 36% smaller among Black children ( $B = 0.90$ , 95% CI: 0.64–1.16) compared to white children ( $B = 1.36$ , 95% CI: 1.12–1.60). Race-stratified analyses revealed similar trajectories of cognitive performance between white and Black children who experienced mobility (results not shown).

### 3.4. Additional sensitivity analyses

Mothers could participate with more than one child. Although we accounted for correlations among siblings statistically, in sensitivity analyses, we compared the results of models that included only the oldest child to those that included all siblings. We found the results were consistent with those presented above.

## 4. Discussion

In a large sample of children followed from gestation to 7 years of age, lower family SEP during pregnancy was associated with poorer cognitive performance at 7 years of age, after accounting for contemporaneous family SEP. For the majority of children whose families were poorest in pregnancy, upward income mobility did not result in improvements in cognitive performance across the first seven years of life. Only children who experienced exceptional mobility, those who moved from the least to the most advantaged group, showed improvements in cognitive

performance. Notably, however, these improvements were only marginally larger than those observed among children born most well off whose families experienced an extraordinary decrease in income. It is estimated that half of the population-level variability in lifetime earnings is related to factors determined in childhood (Cunha et al., 2005; Huggett et al., 2011), and the early years are sensitive periods for acquiring and optimizing cognitive skills that scaffold health, academic engagement and achievement, employment, and income across the life course (Barnett, 1998; Cunha & Heckman, 2007, 2008). Our results suggest that low SEP may begin to influence long-term outcomes even before birth and these early influences are difficult to reverse even with exceptional improvements in socioeconomic circumstances.

### 4.1. The long arm of prenatal family socioeconomic status

In this study, overall, we did not find an association between prenatal family SEP and infant cognitive, language, and social development at 8 months of age. SEP-related changes may not yet manifest in cognitive performance at this age. Prior studies provide some support for this possibility. For example, Black et al. (2000) found that children born in families with low SEP had Bayley Mental Development Index scores similar to national norms at 12 months of age, but these scores decreased over time into toddlerhood compared to their more advantaged counterparts. The canalization theory of development suggests that there are strong protective and “self-righting” processes that buffer young infants from all but the most extreme environmental influences. Beginning in toddlerhood, however, this canalization process becomes less prominent and genetic and environmental influences play a larger role in shaping cognitive outcomes (Black et al., 2000; Conger et al., 1994; Johnson et al., 2016; Rutter, 1985).

Consistent with the predictions of the canalization theory of development, we observed that lower SEP in the prenatal period predicted poorer cognitive performance by 7 years of age, even after accounting for contemporaneous SEP. Both prenatal and 7-year family SEP were associated with 7-year cognitive performance. Every unit increase in family SEP index (range 0–5) was associated with an increase of 1.23 FSIQ points at age 7. For comparison, in a meta-analysis, Ritchie and

Tucker-Drob (2018) found that an additional year of schooling, the most robust and durable way to increase IQ at the population level, was associated with an increase of 1–5 IQ points. Our results suggest that interventions to reduce socioeconomic inequities before and during pregnancy (e.g., ensuring access to a living wage, supporting parental educational attainment), as well as those that reduce the threats of poverty on development (improved nutrition, reduced parental psychosocial distress), may generate population impacts on IQ that are of a similar or even larger magnitude to the established benefits of schooling.

#### 4.2. *Moving up but not getting ahead: the impact of extreme upward mobility*

A key benefit of the NCPP is its very large sample size, which allowed us to examine the paths of children whose families experienced extraordinary mobility. Our results demonstrate the formative role of SEP and accompanying environments very early in life in setting trajectories of child development. Regardless of their families' circumstances at age 7, children who were advantaged in pregnancy continued to demonstrate improvements in relative cognitive performance regardless of their circumstances in the intervening years. Even children born into the small group of families who ostensibly embodied the mythic American ideal of "rags to riches" fared only marginally better than their peers who were born the best off. Parents' hard work, it seems, is itself not enough. Population-level strategies to reduce income inequality and scaffold early childhood environments and child development are critical. In the US, however, family support programs (e.g., nutrition assistance, childcare subsidies) are generally means-tested rather than universal, an approach that has been shown to drive population inequality (Gornick et al., 2020).

Our finding that early advantage trumps mobility is consistent with previous studies conducted outside of the United States. Plewis and Bartley (2014) found that British children born to upwardly-mobile parents had higher educational attainment compared to those whose parents did not experience such mobility, but not as high as those born to more socioeconomically advantaged families. Feinstein (2003) found that British toddlers with the highest cognitive ability born into families with low SEP lost ground in cognitive performance in comparison to their low-performing peers born into high-income families. The current study extends this work to the US.

Today, the United States has greater disposable household income inequality than any other comparable high-income nation (Gornick et al., 2020). Despite notable policy and programmatic efforts to reduce inequality, there is still a substantial gap between the health and wealth of those in the top income brackets and those in the middle or bottom of the distribution, largely influenced by limited upward and intergenerational mobility (de Neubourg et al., 2018). Examining social mobility trajectories in the United States from the 1850s reveals a long-term decline in intergenerational mobility; though there have been social transformations since the 1960s, they have not necessarily translated into relative mobility chances for all (Song, 2020). As a result, more recent birth cohorts experience less upward mobility than their parents or grandparents, an important trend that grounds the relevance of our study findings for current demographic patterns, policy implementation, and future research. Specifically, the results of this study suggest that the population-level consequences of children failing to reap the full developmental benefits of upward mobility in early life (unequal as they may be) may be greater today than at the time these data were collected in the NCPP because fewer children experience mobility.

#### 4.3. *Differences by race*

Enrollment in the NCPP took place during the US Civil Rights movement, a time when injustices imposed by long-entrenched racism, white supremacy, segregation, and Jim Crow laws took on new socio-political prominence. The experiences of white and Black families in this

study with similar socioeconomic resources were undoubtedly different. In sensitivity analyses exploring differences by race, prenatal SEP was significantly inversely associated with 8-month cognitive performance among white but not Black infants. However, the magnitude of this association was so small as to be negligible and is likely due to the large sample size. Nonetheless, it is important to note that some studies have found that the Bayley MDI has poorer predictive validity among some groups of Black children (Hack et al., 2005). In contrast, prenatal SEP was positively associated with cognitive performance at age 7 among both white and Black children, although the magnitude of this relationship was about one-third smaller for Black children. These differences likely capture the otherwise unmeasured impact of racialized stressors as well as interpersonal and systemic racism for Black families, conditions that likely defined their experience regardless of their socioeconomic status (Farley & Hermalin, 1972).

#### 4.4. *Limitations*

The results of this study should be considered in the context of several limitations. First, many aspects of family life have changed significantly since the 1960s. However, the proportion of children in poverty (17%) is similar to 1965 (US Census Bureau, 2016) and social mobility has declined (Chetty et al., 2017). In the US, datasets with sufficient sample size and SEP diversity to examine cognitive performance in the context of marked mobility are rare; thus, despite the use of a historical sample, the current dataset provides much-needed insight into how mobility is associated with changes in child outcomes. Furthermore, how early environmental and family contexts shape children's development over time and how economic disadvantages and inequities transmit from one generation to the next are still central policy questions today, even if the context of family life has shifted.

We excluded infants with perinatal risks such as low birth weight, preterm birth, and low Apgar scores, which biased our sample toward healthier infants. This selection could lead us to underestimate the relation between prenatal SEP and cognitive outcomes. In sensitivity analyses, however, we included preterm infants in the analysis and the results were consistent with those presented.

The measures of cognitive performance used in the NCPP have limitations. First, the Bayley MDI combined language and cognition, yields a broad and blunt measure of development (Duncan & Magnuson, 2012). Some previous studies have demonstrated racial/ethnic differences in assessment scores that cannot be explained by SEP (Lowe et al., 2009). Moreover, the potential for cultural biases in assessments is documented (Poortinga, 1995). The results also likely illustrate the role of sustained interpersonal and systemic racism operating on Black families that reduced their ability to fully benefit from improved economic circumstances, however, racism, bias, and discrimination were not measured.

Families in the NCPP likely differ on unobserved characteristics that might be related both to their risk of poverty and child cognitive outcomes. There is the potential for unmeasured confounding by factors such as genetics, cultural and parenting practices, access to childcare, and exposure to chemical and non-chemical stressors. There are also limitations introduced by available SEP measures. Occupational class, for example, is a less than ideal indicator of SEP and our summary score weights either component of SEP equally. By examining only infancy and 7 years, we may have missed some changes in SEP that would influence child outcomes. We may also have missed informative variations in the relationship between prenatal SEP and development in the intervening years.

## 5. *Conclusions*

Cognitive performance is a key contributor to health, educational achievement and attainment, and productivity across the life course. The results of this study highlight the long arm of prenatal family

socioeconomic resources and the need to consider the intensity and timing of anti-poverty investments to optimize cognitive development. Cognitive development may be malleable in response to mobility, but for children born into poverty, even extreme upward mobility may not erase socioeconomic disparities. A multi-tiered approach to preventive interventions (i.e., increasing family economic security and mitigating adverse social conditions) is necessary given the pervasive impact of poverty. Three-generation approaches focus on promoting educational attainment and job readiness before adults become parents, thereby optimizing the socioeconomic resources available to young families and protecting human potential at the population level (Cheng et al., 2016). Efforts to support adolescents' and young adults' educational and occupational attainment could enhance human capital formation for future parents and their children (Cunha & Heckman, 2007).

Social mobility remains more of an ideal than a reality for many families in the US. Even children in families who realize the American dream of "rags to riches," elusive as it may be, did not reap the full developmental benefits of this mobility in this study. Our findings provide support for directing policy resources to optimize family health before and during pregnancy and for broader policy efforts to reduce population income inequality given accumulating evidence for negative impacts on cognitive development.

#### Author statement

**S. Johnson:** Funding acquisition, conceptualization, writing- original draft. **R. Raghunathan:** Writing-review and editing. **M. Li:** Formal analysis, writing, reviewing. **D. Nair:** Formal analysis, writing, reviewing and editing. **P. Matson:** Conceptualization, writing, review and editing.

#### Ethical statement

This research was reviewed and determined to be exempt by the Johns Hopkins Medicine IRB.

#### Declaration of competing interest

None.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2022.101064>.

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