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Social Spending and Educational Gaps in Infant Health in the United States, 1998–2017

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ABSTRACT Recent expansions of child tax, food assistance, and health insurance programs have made American families' need for a robust social safety net highly evident, while researchers and policymakers continue to debate the best way to support families via the welfare state. How much do children—and which children—benefit from social spending? Using the State-by-State Spending on Kids Dataset, linked to National Vital Statistics System birth data from 1998 to 2017, we examine how state-level child spending affects infant health across maternal education groups. We find that social spending has benefits for both low birth weight and preterm birth rates, especially among babies born to mothers with less than a high school education. The stronger benefits of social spending among lower educated families lead to meaningful declines in educational gaps in infant health as social spending increases. Our findings are consistent with the idea that a strong local welfare state benefits infant health and increases equality of opportunity, and that spending on nonhealth programs is equally beneficial for infant health as investments in health programs.

KEYWORDS Health • Social policy • Children • Inequality • Education

Introduction

Education and economic status are strong determinants of health in the United States, with large gaps in adult and child health and mortality that have persisted or grown in the last several decades (Montez et al. 2019). Among adults, the size of educational and income gaps in health varies widely across geographic areas, with pronounced differences in mortality risk and life expectancy across U.S. metropolitan areas and states (Elo et al. 2019; Fenelon and Boudreaux 2019). These patterns have led to increased attention to the role of U.S. states as key institutional actors in affecting population health and to a call for increased attention to the resources, policies, and opportunity structures they provide (Montez et al. 2019).

Social spending is a key indicator of the resources available to children in U.S. states. The recent temporary expansion of the Child Tax Credit, which implemented monthly cash payments to nearly all American families with children, is a particularly visible example of the many public investments in children and families that

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provide social supports in education, health, income support, or housing. Currently, U.S. states spend about $26,000 per child each year, on average, on income support programs, health services, public education, and investments in housing, parks, and libraries, with striking variation in spending amounts across states (Greenberg et al. 2021). A large literature within and beyond the United States has demonstrated how income support, health, and educational programs improve the outcomes of low-income children (Jackson 2015; Johnson 2015; Markowitz et al. 2017; Parolin 2021; Strully et al. 2010) and has argued that public expenditures on children may increase equality of opportunity (Bradbury et al. 2015; Corak 2013; Waldfogel 2016).

How much do children—and which children—benefit from social spending? Using annual data from the State-by-State Spending on Kids Dataset between 1997 and 2016, linked to annual birth data from the National Vital Statistics System (NVSS) from 1998 to 2017, we draw on geographic and temporal variation in the United States to examine how social spending on income support, health, and housing programs that benefit parents and children is associated with infant health. Unlike a focus on one specific program or policy, a focus on expenditures affords consideration of the relative importance of different forms of spending for reducing inequality in child health. We advance the existing literature in several ways. First, we significantly expand our portrait of public spending and its relationship with infant health by measuring both federal and state/local spending, including both direct spending programs and tax credits, and focusing on programs most relevant to parents and children. Second, we examine multiple forms of spending to understand how infant health is associated with both health and nonhealth spending. Third, we examine the effects of social spending across educational groups and consider its implications for educational gaps in infant health. Finally, we explore two primary pathways through which increased social spending may affect infant health—improved access and frequency of prenatal care, and improvements in maternal health behaviors.

Background

Educational Gaps in Child Health

Socioeconomic disadvantage and child health are tightly connected in the United States, with social conditions determining access to the resources, institutions, and networks necessary for healthy development (Case and Paxson 2006; Finch 2003; Lee and Jackson 2017; Link and Phelan 1995). Stubbornly high levels of child socioeconomic disadvantage in the United States (Brady and Parolin 2020; Chen and Corak 2008; Gornick and Jäntti 2012) and the risk of poor health go hand in hand (Finch 2003; Link and Phelan 1995), and indeed rates of infant mortality and preterm birth are much higher in the United States than in most European countries, and life expectancy is lower (Chen et al. 2016; Conley and Springer 2001; MacDorman et al. 2014; Montez et al. 2020). National statistics also mask substantial variation in child health within the United States, with wide state variation in rates of infant mortality and low birth weight (Ely and Driscoll 2021) and large and rising inequality of infant health by maternal education (Lawrence et al. 2020).

How Much Does Social Spending Affect Infant Health?

Beyond families, governments are a primary source of investment in children, and a more generous provision of social supports through the state may positively affect children by augmenting parents' access to resources both within and outside of the home. Much existing research on social spending has considered its effects on child poverty and household income. Child poverty rates vary substantially within the United States, ranging from 10% in Iowa to over 20% in California (Laird et al. 2018; Renwick and Fox 2016), and this striking variation is partly a result of state differences in public benefits (Brady and Parolin 2020; Wimer et al. 2020).

Beyond poverty, how does infant health vary with social spending in U.S. states? Much research examining the state context and infant health has focused on particular social policies or programs, or on the effects of political factors such as governance structure. For example, children exposed to the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) or generous school funding regimes experience better health than their peers (Jackson 2015; Johnson 2015). The introduction and subsequent expansion of the Medicaid program in 1965 led to improvements in child health and declines in infant mortality and hospitalizations (Currie et al. 2006; Currie and Gruber 1996; Goodman-Bacon 2018). Additionally, there are strong positive effects of the enactment of income support programs, such as the Earned Income Tax Credit (EITC) and Supplemental Nutrition Assistance Program (SNAP) (e.g., Gundersen and Kreider 2009; Hoynes et al. 2016; Markowitz et al. 2017; Strully et al. 2010), and the provision of housing assistance (Fenelon et al. 2021) on child health. In contrast, recent work documents poorer infant health in Republican-controlled states, as well as in states with punitive policies that target and restrict rights among immigrants (Torche and Rauf 2021; Torche and Sirois 2019).

A focus on individual policies is crucial and especially valuable for identifying the causal effects of a policy after its implementation or expansion. We argue that examining expenditures is also useful because it affords consideration of the relative importance of different forms of spending for child health. Although the United States represents a limited welfare state relative to other industrialized countries (Bradbury et al. 2015; Garfinkel et al. 2010), public spending on children has grown over time (Isaacs and Edelstein 2017). Federal, state, and local governments must therefore determine how to spend funding for the children and families who rely on it, making it useful to understand how different forms of spending may benefit infant health. However, it is not clear whether health or nonhealth spending should be most strongly associated with infant health. Among adults, physical health outcomes are more strongly associated with spending on social services than with spending on health (Bradley et al. 2016; Kim and Jennings 2009; Ronzio et al. 2004). The relative importance of expenditures on social services compared to spending on health and other programs is less understood for infants. Understanding these questions is critical for advancing knowledge about how policies and programs can address the social determinants of health, in addition to solely expanding access to health care, given the high cost of health care delivery and pronounced effects of income, education, and social environmental factors on health (Bradley et al. 2016; Lawrence et al. 2020). Examination of how different forms of public spending are associated with infant health is also important for policymakers, who are increasingly (and currently) charged with choosing among many possible forms of family-focused investment in a highly polarized political environment.

Which Children Benefit From Social Spending?

Most existing research has focused on how public policies and programs affect children in families with low income and low levels of education. This is a sensible approach given that maternal education and economic disadvantage strongly predict poor infant health (Currie and Moretti 2003; Kandel et al. 2009). In addition, public spending on many programs is considerably higher for lower income families than for higher income families (Vericker 2012), though the 2021 expansion of the Child Tax Credit represents a notable exception (Marr et al. 2021). Social spending should disproportionately benefit lower SES families, both by providing direct cash assistance and by providing necessities (food, health care) that parents would otherwise need to purchase or forgo (Milligan and Stabile 2009; Yeung et al. 2002). Such investments allow low-resource parents to make investments in themselves and their children that are more similar to those of higher resource families (Jackson and Schneider 2022; Leininger et al. 2010).

However, many income and health supports at the state level are available to families above 200% of the poverty threshold. The Children's Health Insurance Program (CHIP), for example, is available in many states to children between 300% and 400% of the poverty threshold. Social spending can also improve outcomes for all children, even if lower educated families benefit disproportionately. For example, public health insurance spending can yield medical improvements that benefit children across socioeconomic groups (Currie and Gruber 2001; Finkelstein 2007). Even adults with insurance are less likely to have accessible and high-quality medical services when they live in communities with low rates of insurance and, as a result, are less likely to have a place to go when they are sick and need to receive regular medical care (Pauly and Pagán 2007). Moreover, studies of the Temporary Assistance for Needy Families (TANF) and other income support programs suggest that lower levels of welfare generosity are associated with higher levels of community-level crime (Liebertz and Bunch 2018), and that SNAP expenditures have benefits that extend beyond the eligible income groups, increasing the incomes of SNAP-ineligible households as well (Hanson et al. 2002; Lewin and Weber 2020). Such evidence suggests that social spending should be most positively associated with health among infants born to low-SES mothers, with positive but less pronounced health benefits among infants born to higher SES mothers (*Hypothesis 1*). If social spending has the most positive effects among infants with low-SES mothers, then it may have an equalizing effect on pronounced gaps in infant health by SES (Corak 2013; Solon 2004) (*Hypothesis 2*). Alternatively, if higher educated mothers are better able to leverage policy opportunities and access resources (Phelan and Link 2015; Phelan et al. 2010), then educational gaps in infant health may increase (*Hypothesis 3*).

Why Should Social Spending Affect Infant Health in the United States?

The majority of health and economic social spending on children and families is on health (Medicaid; non-Medicaid public health spending) and income support/social services (TANF, SNAP, child care assistance, child welfare, and EITC). Greater expenditures on both income support and in-kind services may lead to improvements in infant health by improving maternal well-being and nutrition, as well as both the amount and quality of medical care available to mothers and babies (Currie 2008).

Increased expenditures on health programs for children should make it more likely that families will have health insurance and that a greater number of health care providers will be available to treat patients with public insurance—and hence that families will have an easier time accessing care and providers will be able to spend more time with patients (Currie et al. 1995; Goodman-Bacon 2018). Beyond spending on health care, increases in income through federal and state-level investments in cash or tax credit programs such as the EITC also improve mothers' ability to increase their prenatal care usage, or even to switch from public to private insurance (Hoynes et al. 2015; Lenhart 2019). Greater social spending on children and families may therefore improve infant health by allowing mothers to receive more and better prenatal care.

Improvements in the amount and quality of resources available to mothers, whether in the form of household resources or access to services, may also affect health behaviors associated with maternal stress and "cognitive load" (Gennetian and Shafir 2015). Research examining public benefits and "coping" health behaviors strongly associated with financial stress and maternal mental health shows that, for example, child tax benefit expansions lead to improvements in maternal health and reductions in depression and smoking (Milligan and Stabile 2011; Strully et al. 2010), and larger SNAP benefits are associated with improvements in caregiver physical health and reductions in psychological distress (Ettinger de Cuba et al. 2019; Oddo and Mabli 2015). Such evidence suggests that greater social spending on children should affect infant health by improving maternal health behaviors.

Data, Measures, and Analytic Approach

By leveraging variation in spending across states and over time, we test whether infant health is stronger, and educational gaps in infant health are narrower, when states spend more on programs that benefit mothers and children, and how this relationship varies across different forms of spending and different educational groups. To accomplish this, we use a new annual state-level comprehensive database of public spending on children from 1997 to 2016 (Isaacs et al. 2020), linked to annual National Vital Statistics System birth data, aggregated to the state level by maternal education. We merge NVSS birth data for 1998–2017 to spending data one year earlier (1997–2016) to allow spending to influence maternal context before, during, and after pregnancy. Importantly, the data we use afford the measurement of both federal and state spending, direct spending programs and tax credits, and many variables that typically confound cross-national findings regarding the welfare state and population health.

Table 1 Social spending on children and families, by spending category

Spending	Source
Income Security	
TANF cash assistance	TANF Expenditure Reports
Other cash assistance and social services	SLGF and TANF Expenditure Reports
SNAP	Characteristics of SNAP Households Recipients Reports
Social Security	Urban Institute estimates using data from the Social Security Bulletin Annual Statistical Supplement
Federal SSI	Urban Institute estimates using data from the Social Security Bulletin Annual Statistical Supplement and SSI Annual Statistics Report
Federal EITC	IRS SOI Tax Statistics Historic Tables
Child Tax Credit	IRS SOI Tax Statistics Historic Tables
Additional Tax Credit	IRS SOI Tax Statistics Historic Tables
State EITC	Urban Institute estimates using data from the Rockefeller Institute of Government and the University of Kentucky Center for Poverty Research National Welfare Database
Unemployment compensation	SLGF
Workers compensation	SLGF
Health	
Children's Medicaid (<21) and CHIP	Urban Institute estimates using data from RAND, MACPAC (Medicaid and CHIP Payment and Access Commission), and Rockefeller Institute of Government
Public health	SLGF
Residual health spending	SLGF
Housing and Community Development	SLGF

Notes: TANF = Temporary Assistance for Needy Families. SLGF = State and Local Government Finance. SNAP = Supplemental Nutrition Assistance Program. SSI = Supplemental Security Income. EITC = Earned Income Tax Credit. SOI = Statistics of Income. CHIP = Children's Health Insurance Program.

Data: State-Level Public Spending

We use the Urban Institute State-by-State Spending on Kids Dataset, a state-by-year database of public spending from federal, state, and local sources that spans 1997–2016, aiming to cover the longest period feasible with existing administrative data (Isaacs et al. 2020). The data include all 50 states and the District of Columbia, drawing on data from the U.S. Census State and Local Government Finance Survey (SLGF), federal agency websites, the State Funding for Children Database compiled by the Rockefeller Institute of Government, and other sources. The data contain per-child spending at the state–year level in the domains of income support, health, education, and other spending. Table 1 lists the relevant programs included in the state-level database, as well as the data sources for each spending program.

Data: National Vital Statistics System

Infant health is a useful marker of population health to examine not only because pronounced gaps exist by social class, but because childhood health strongly affects educational and economic attainment over the life course (Bleakley 2007; Conley et al. 2003; Currie 2008). NVSS administrative records data provide the most complete and accurate information about births in the United States and include multiple measures of infant health. We use the NVSS restricted birth data from 1998–2017, which include maternal state of residence. We limit the sample to singleton births because infant health measures are often lower for multiple births, the rate of multiple births has increased over time, and the likelihood of multiple births is not randomly distributed (Kulkarni et al. 2013; Luke and Martin 2004; Matthews et al. 2015; Russell et al. 2003; Saavedra 2020). Using 73,536,080 singleton birth records in the years 1998–2017 with information on maternal residence and education, we calculate annual, aggregate measures of infant health separately by maternal state of residence and education category. We examine state–year–education observations ($N=51$ states $\times$ 20 years $\times$ 4 education categories = 4,080) to measure both infant health and spending at the same level as state spending policy (Abadie et al. 2010; Kenny 1996). Sensitivity analyses predicting individual-level infant health outcomes (using a 10% random sample of births in each year) yield similar results.

NVSS birth data have low rates of missing information. Online appendix Table A1 shows the percentage of births in years 1998–2017 missing information for each measure used in our analyses. Overall rates for key measures are low: the state–year mean rate of missing infant health information is 0.11% for birth weight measures and 0.22% for gestational length measures. Missing rates for birth weight never exceed 3%, and missing rates for gestational length rarely exceed 3% (10 state–year observations have missing rates of 3–10% and sensitivity analyses excluding these observations yield consistent results). Missing rates are higher for paternal age (16%) and for maternal behaviors (ranging from 2% for prenatal care to 25% for tobacco use), but these measures are not central to our analyses. Because states adopted new birth certificate formats after 1997 and 2008, maternal education is not included on a substantial subset of birth certificates in certain state–years. In these cases, maternal education is not selectively unreported by mothers, but is excluded from certain birth certificates. We conduct sensitivity analyses excluding state–years with high missing rates for maternal education (84 state–years above 10%), and the results are consistent.

Measures

Infant Health

We examine two key measures of infant health aggregated to the state level: the percentage of children who are low birth weight (less than 2,500 grams) and the percentage of children who are born preterm (before 37 weeks). Low birth weight and preterm birth are thresholds that identify infants at high risk for poor health in childhood and later life (Conley et al. 2003; Institute of Medicine 2003a; Johnson and Schoeni 2011).[1]

[1] In additional analyses we also measure rates of intrauterine growth restriction (<10th percentile of birth weight for gestational age), given evidence that there have been downward trends in birth weight over time (Oken et al. 2003). The results are consistent.

Social Spending on Children and Families

We measure state-level real spending per child in 2016 dollars in several domains. We focus on types of spending that are most likely to be related to infant health in the short term. Specifically, we focus on forms of *cash support* (TANF, other cash assistance, SNAP, Federal Supplemental Security Insurance (SSI), Social Security, unemployment compensation, worker's compensation); income support in the form of *tax credits* (federal EITC, state EITC, Child Tax Credit, Additional Tax Credit); *health* spending (children's Medicaid and CHIP, public health, and residual health spending); and *housing and community development* spending.[2] Importantly, our measures of state spending capture both spending on programs that are relevant to parents and children and spending on the specific "kids' share" of Medicaid, a large program serving many populations. Spending on EITC programs, for example, is relevant for both children and families, including pregnant women. Thus, while the spending measures capture "per-child" spending based on the number of children in a state–year, they capture the bundle of resources available to families that are most relevant for infant health.[3]

The Medicaid health insurance program, jointly financed by the federal government and the states, represents the second largest form of investment in children, after K–12 education (Isaacs and Edelstein 2017). Many states have expanded Medicaid beyond federal minimums for benefits and coverage, leading to wide variation in eligibility levels, service coverage, payment mechanisms, and spending per enrollee. Children also benefit from spending on CHIP and public health systems. Medicaid and other health programs often target low- and moderate-income families. Income support programs also support families with children. Some of these programs are explicitly limited to families with children (e.g., the Child Tax Credit), and other programs that serve the low-income population have a disproportionate share of child recipients. For example, two thirds of SNAP benefits go to households with children and, during the Great Recession, SNAP was a primary form of support for children with unemployed parents (Isaacs and Healy 2014). Most of these programs are federal or joint federal–state programs, and many target lower income families. While both cash and tax-based programs provide income support to families, we separate them in our analyses given important differences in the way they are administered, as well as evidence that, prior to 2021, tax-based programs excluded a large percentage of low-income families (Goldin and Michelmore 2020).

Maternal Education

We use maternal education as our measure of family socioeconomic status, comparing those with less than a high school degree, a high school diploma, some college,

[2] Our results are consistent when using log-transformed spending measures.

[3] Our measure of Medicaid spending does not focus on pregnant women specifically, but includes spending on children ages 0–21. However, because infants born to mothers covered with Medicaid are automatically covered for one year from the time of birth, the measure is highly relevant to pregnant women.

or a four-year college degree or more. We calculate annual aggregate infant health measures by maternal education and state of residence. NVSS records do not include a measure of family income. Relative to other core indicators of socioeconomic status, education (including maternal education) strongly predicts health (Harding et al. 2015; Montez et al. 2019).

Demographic and State-Level Controls

We include time-varying NVSS controls, measured at the state–education category level, in an effort to account for factors that co-occur with socioeconomic status and state-level public investments: maternal age, paternal age, proportion of births to married parents, and the total number of births. Prior literature has connected demographic composition with spending generosity (i.e., Alesina et al. 2001; Preuhs 2007; Rodgers and Tedin 2006; Soss et al. 2011). We therefore control for the distribution of births by maternal race or ethnicity, based on self-reports. Within each level of maternal education, we control for the proportion of births to Black, American Indian or Alaska Native, Asian, and Hispanic mothers.

We include additional state–year controls using data from the University of Kentucky Poverty Center's State Welfare database, the Current Population Survey, and the Bureau of Labor Statistics. Because state-level spending increases with economic need during periods of economic downturn (Brown and Best 2017; Edelstein et al. 2016; Rodgers and Tedin 2006), we also control for the unemployment rate and poverty rate. As an indicator of state generosity, we control for the prevailing minimum wage. We measure states' governance structures with a variable indicating whether the governor is a Democrat, as prior research has shown that Republican control is negatively associated with safety net generosity (i.e., Brown and Best 2017; Scruggs and Hayes 2017; Soss et al. 2011).

Analytic Approach

We predict infant health measures in models that include state and year fixed effects to control for time-constant state differences correlated with spending and infant health (e.g., labor market structure, level of economic need) and for variation over time shared across states (e.g., recession effects). Variation across states in the strength of the labor market and the demographic composition of the population could produce a positive relationship between spending and economic need that does not reflect true variation in states' investment in children and families. Including state fixed effects helps to control for these fixed differences across states. In addition, increased economic need during periods of economic downtown is correlated with increases in spending, particularly from federal sources, to support state and local governments working to provide assistance to families (Edelstein et al. 2016). Increased spending during recessions may also be correlated with worse infant health, despite the generally positive relationship between spending and children's development (Isaacs and Edelstein 2017). Including year fixed effects helps to separate the effects of state investments from the effects of economic need. To examine the association between public investment and infant health by maternal education, we use the following ordinary least-squares regression model:

$$Y_{rst+1} = \beta_0 + \beta_1 Educ_{rst} + \beta_2 Spend_{s,t} + \beta_3 Educ_{rst} Spend_{s,t} + \beta_4 X_{rst} + \mu_s + \theta_t + \delta_{rs} + \varepsilon_{rst+1}. \tag{1}$$

For each state s in year t and maternal education category r, Eq. (1) predicts infant health (Y) as a function of maternal education category; state spending (*Spend*) in the previous year; the interaction between education and state spending; time-varying state–education-level controls (X); state and year fixed effects; and state–education category fixed effects.[4] We weight analyses by the number of births in each state–education–year to prevent states with a small number of births from having a disproportionate influence on the pattern of results. Standard errors are robust. Finally, we predict infant health one year after the measure of state spending to capture the state spending environment to which mothers were exposed during pregnancy, since this is the environment that would determine their access to state-provided resources relevant to a healthy pregnancy. We begin by measuring total state spending, then disaggregate spending into cash income support, tax credits, health, and housing spending.

The inclusion of state and year fixed effects means that model identification is based on within-state variation in public spending across years, as well as across-state differences in public spending in a given year. While understanding the predictors of spending variation within and across states is beyond the scope of this article, this variation could be driven by a number of factors, including ideological variation and policy choices at the state level about how much to invest in child and family policies. For example, expanding Medicaid to extend coverage to more children would result in increased health spending in states that prioritized this expansion, such as many states in the Northeast. These decisions at the state level are correlated with indicators such as governance structure (Democrat/Republican) but imperfectly so, given the wide variation in spending even among states with the same structure (e.g., New York vs. California, or Arkansas vs. Utah). In some cases, spending variation could reflect idiosyncratic differences in bargaining among legislators and political interest groups.

Coefficients for education (β_1) test whether infant health differs by maternal education category compared with mothers with less than a high school education (the omitted category). The coefficient for spending (β_2) tests whether infant health varies with state spending in the lowest education category (births to mothers with less than high school). β_3 provides a test of Hypothesis 1, that social spending is most positively associated with infant health among those born to lower educated mothers as compared with higher educated mothers.

To consider the implications of these findings for educational gaps in infant health, we compute predicted rates of low birth weight and preterm birth by maternal

[4] In supplementary analyses, we also estimate separate models by maternal education category to account for possibly different distributions of our observed covariates by maternal education. The results are consistent.

education across the distribution of state spending. To test Hypotheses 2 and 3, we examine whether gaps in infant health between lower and higher educated mothers converge, diverge, or remain stable as state spending increases.

Results

Table 2 shows descriptive statistics of outcome and predictor variables among the analytic sample (weighted by the number of births in each state), for both the total sample and by maternal education. The mean proportion of low birth weight and preterm births during our study period is 6% and 10%, respectively. Consistent with prior research, this pattern varies strikingly by maternal education: the rate of low birth weight is twice as high among mothers with less than a high school education (8%) than among mothers with a college degree or more (4%), with a decreasing gradient for the educational groups in between. There is also consistent variation across educational groups in maternal characteristics. The highest educated mothers are more likely than the lowest educated mothers to be older at the time of a child's birth (32 vs. 24 years), and births to the highest educated mothers are more likely to occur to married parents (92% vs. 37%) and to non-Hispanic White mothers (73% vs. 30%).

Turning to state-level characteristics, the mean social spending per year on children and families between 1997 and 2016 on the forms of state spending we consider was $6,970 per child. The majority of this spending takes the form of cash or tax-based income support ($4,140), with a smaller but sizable share on health spending ($2,330) and the smallest amount on housing ($500). During the study period, the average unemployment rate was 5.9%, the poverty rate was 13.3%, and the minimum wage was $6.29 per hour. About 12% of state residents are Black, 16% are Hispanic, and 28% have a college degree in an average state–year, with 42% of state–years having a Democratic governor.

Figure 1 shows the amount of variation across states in per-child spending during our study period. Per-child spending on both cash and tax credit income support programs jumped sharply in 2010 owing to the increased economic need (and corresponding increased government investment) during the Great Recession. While cash income support steadily declined after 2010, tax credit spending stayed at higher levels after 2010 than in previous years. Spending on both types of programs varies widely across states, as shown by the variation within particular years. Per-child spending on health increased more gradually than spending on income support programs over this roughly 20-year period, nonetheless producing ample variation over the study period. Finally, increases and decreases in spending on housing and community development are more modest during the period, also showing considerable variation in spending across states.

Figure A1 in the online appendix presents the bivariate relationship between social spending and infant health, by maternal education. Panel a shows that when social spending is higher, the proportion of low birth weight births declines among mothers with less than a high school education, while remaining fairly flat among other educational groups. The proportion of preterm births declines among all educational groups

Table 2 Descriptive statistics of outcome and predictor variables

Variable	Full Sample		Less Than High School		High School		Some College		College Degree+	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Percentage of Low Birth Weight Births	.06	.02	.08	.02	.07	.01	.06	.01	.04	.01
Percentage of Preterm Births	.10	.02	.13	.02	.11	.02	.10	.01	.08	.01
Total Number of Births	48,236	41,240	52,030	51,191	51,495	42,189	43,272	35,315	46,696	36,469
Average Maternal Age	27.60	2.85	24.28	1.51	25.86	0.80	27.92	0.69	31.55	0.72
Average Paternal Age	30.43	2.33	28.04	1.37	28.95	0.89	30.55	0.77	33.62	0.86
Percentage of Births										
To married parents	.62	.22	.37	.08	.49	.09	.64	.09	.92	.03
To Black mothers	.14	.11	.16	.12	.19	.12	.16	.10	.07	.05
To AI/AN mothers	.01	.03	.01	.04	.01	.03	.01	.02	.00	.01
To Asian mothers	.06	.07	.03	.04	.04	.04	.04	.05	.11	.08
To Hispanic mothers	.24	.23	.50	.26	.25	.20	.18	.15	.09	.07
To White mothers	.55	.23	.30	.19	.51	.19	.60	.17	.73	.13
State-Level Variables										
Total per-child spending[a]	6.97	2.16								
Per-child spending on cash income support[a]	2.88	1.11								
Per-child spending on tax credits[a]	1.26	0.38								
Per-child spending on health[a]	2.33	0.87								
Per-child spending on housing[a]	0.50	0.30								
Unemployment rate (%)	5.88	1.96								
Poverty rate (%)	13.27	2.95								
Minimum wage ($)	6.29	1.39								
Proportion of Black residents	.12	.08								
Proportion of Hispanic residents	.16	.13								
Proportion of residents with a college degree	.28	.05								
Proportion of states with a Democratic governor	.42	.50								

Note: The following state–year observations were excluded: Alaska, 2008 less than high school; Rhode Island, 2008 less than high school and high school, and 2009 less than high school; Washington, D.C., 1997–2016 all education categories when controlling for Democratic governor. AI = American Indian. AN = Alaska Native.

[a] Spending is reported in $1,000s.

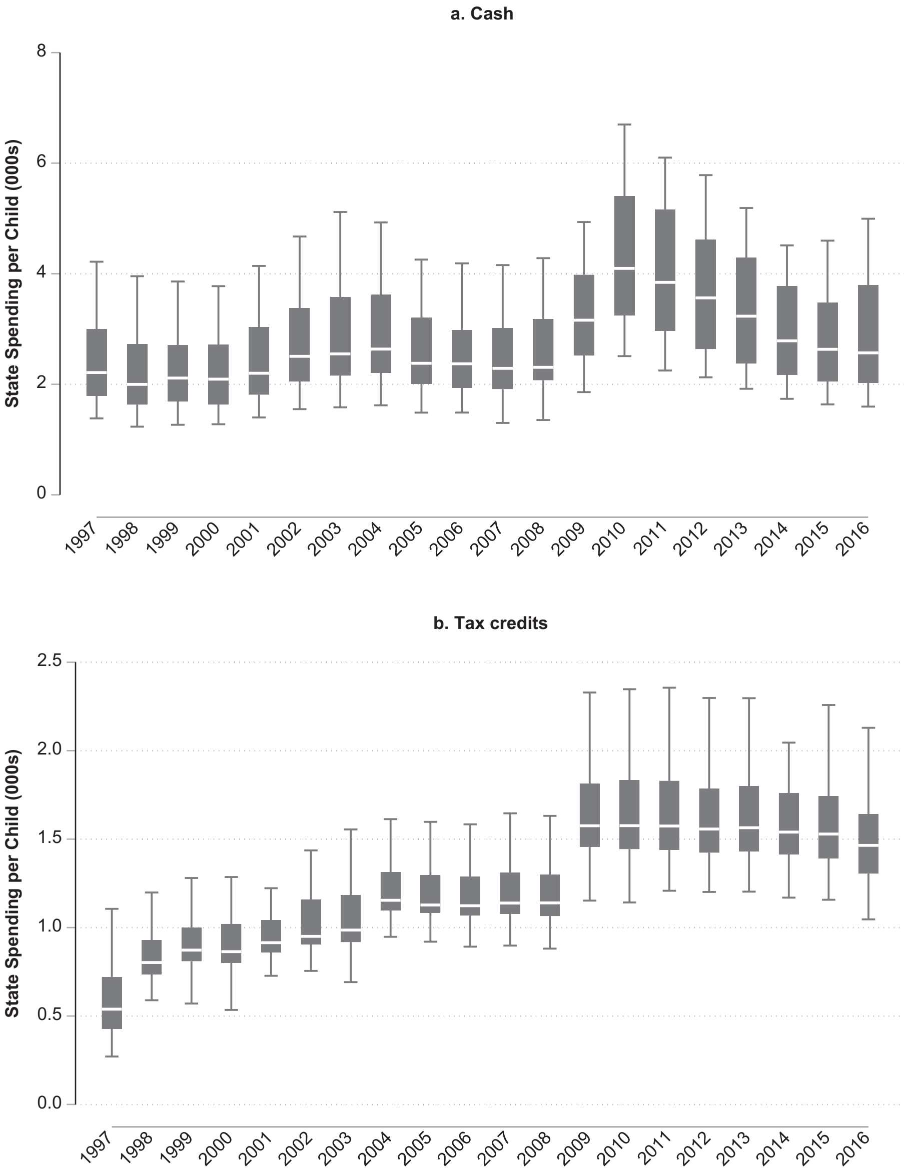


Fig. 1 Box plots of state spending by category, 1997–2016. Plots indicate the median, interquartile range, and maximum and minimum values.

as total social spending increases (panel b). These descriptive patterns suggest that social spending provides benefits to infant health, but does not control for potentially important confounders at the state level. The next section describes the results from multivariate analyses that more rigorously account for correlates of social spending and infant health.

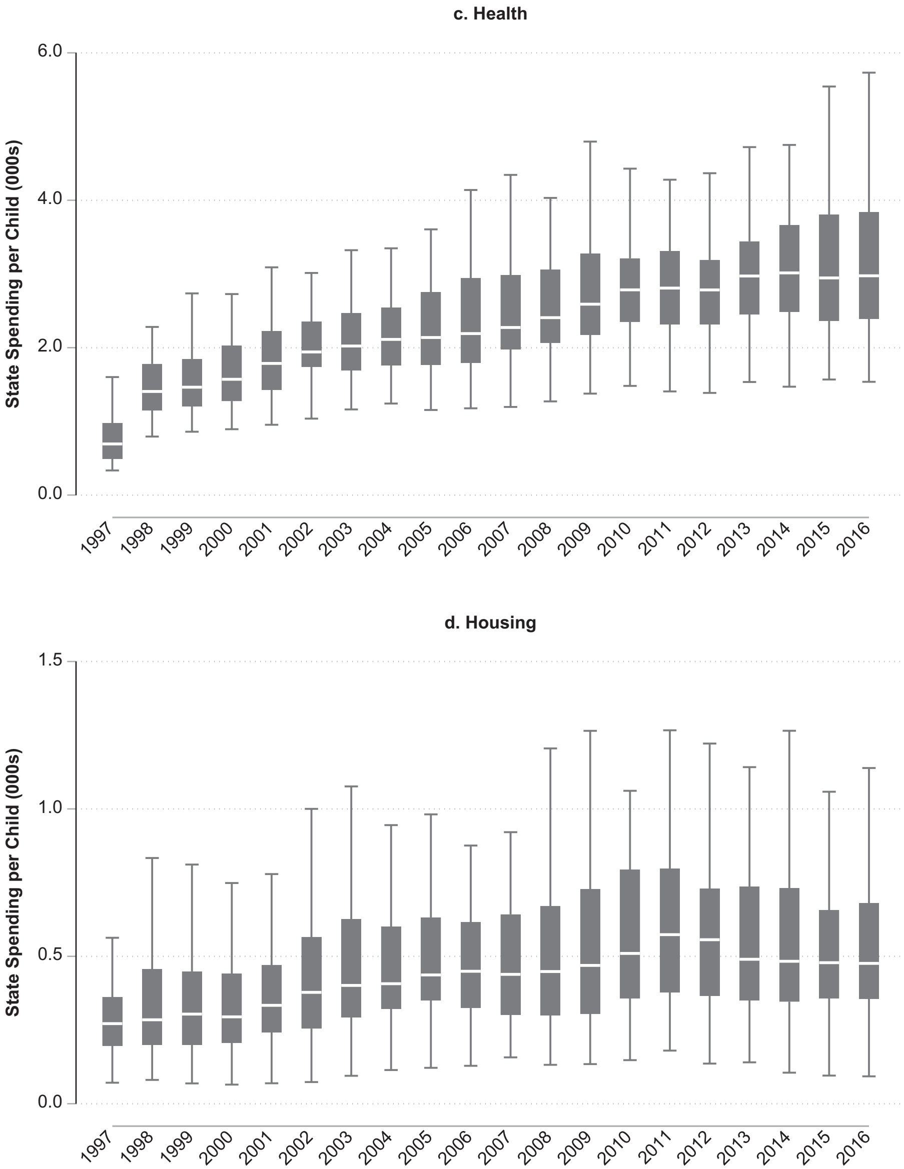


Fig. 1 (continued)

How Much Does Social Spending Affect Infant Health, and for Whom?

Tables 3 and 4 present coefficient estimates from multivariate models of the association between social spending and the share of low birth weight and preterm births, respectively. We present separate coefficient estimates for our measures of total social spending on children, two forms of income support spending (cash and tax credits), health spending, and housing/community development spending. Model 1 predicts infant health from state-level social spending and time-varying controls within state–education categories, while Model 2 adds additional time-varying control variables at the state level.

These findings provide consistent support for Hypothesis 1: social spending is most positively associated with health among infants born to less-educated mothers, with less pronounced health benefits of social spending among infants born to higher educated mothers. Model 1 in Table 3 shows that a $1,000 increase in total state spending on children decreases the rate of a low birth weight birth by about .08 percentage points among infants born to the lowest educated mothers. Model 2 shows that the addition of time-varying controls at the state level does not alter this coefficient. Figure 2 puts these findings into context for a realistic amount of spending variation. A standard deviation of total state spending is $2,150, and the range of state spending among the observed state–years is very dramatic, at about 8 SD. A 1-SD increase in total state spending, therefore, decreases the rate of low birth weight by 0.17 (.08×2.15) percentage points (panel a). One standard deviation is a realistic amount of variation in social spending. Consider, for example, that Alabama spent $3,800 per child in 1997 and $6,600 in 2006—a change of about 1 SD during that nine-year period. The difference between the 2010 spending environment for children in Massachusetts (a high-spending state at $12,900 per child) and Utah (a low-spending state at $5,800 per child) is $6,600, or 3 SD. A 1-SD change in social spending is therefore a commonly observed amount of spending variation both within and across states.

Torche and Rauf (2021) provided a useful way to think about the population-level significance of this effect size: with 493,397 births to mothers with less than high school in the United States in 2017, a 1-SD increase in total social spending on children would potentially lead to 838 (493,397 × .0017) fewer low birth weight infants among mothers with less than a high school education in that year. One underweight hospital birth is estimated to cost about $27,200, $24,000 more than a normal-weight birth (America's Health Rankings 2021), suggesting a short-term savings of over $20 million (839 × $24,000).

Among infants born to higher educated mothers, the benefits of social spending are less pronounced, as shown in Table 3 and Figure 2. Among infants born to the highest educated mothers (those with a four-year degree or more), a 1-SD increase in total social spending decreases the probability of a low birth weight infant by .06 percentage points [(–.0008 + .0005) ×2.15], compared with .17 percentage points among mothers with less than a high school degree. The benefits of total social spending decrease as maternal education increases.

Table 3 and panels b–e of Figure 2 show the coefficient estimates for cash income support, tax credits, health, and housing/community development spending on children. Coefficient equality tests (shown in Table 3) demonstrate that the coefficients for specific forms of state spending are significantly different from one another. Similar to the case of total state spending, the benefits of each of these forms of social spending decrease as maternal education increases. Similar to the results for total social spending, results are extremely similar across Models 1 and 2, demonstrating that the addition of correlated state-level changes other than state spending only very slightly reduces the coefficients for social spending. The rate of low birth weight among infants born to the lowest educated mothers decreases by .13 percentage points for a $1,000 increase in cash income support

Table 3 Regression of low birth weight on social spending and maternal education

	Total		Cash		Tax Credits		Health		Housing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Spending Type										
Total spending	–.0008**	–.0008**								
	(.0001)	(.0001)								
Cash			–.0015** [b,c,d]	–.0014** [b,c,d]						
			(.0002)	(.0002)						
Tax credits					.001[a,d]	.0019† [a,c,d]				
					(.001)	(.0011)				
Health							–.0004† [a,d]	–.0006* [a,b,d]		
							(.0003)	(.0003)		
Housing									–.0033** [a,b,c]	–.003** [a,b,c]
									(.0006)	(.0006)
Maternal Education (ref. = less than high school)										
High school	–.0067**	–.0069**	–.0066**	–.0067**	–.0045**	–.0048**	–.0076**	–.0078**	–.0067**	–.0068**
	(.0008)	(.0008)	(.0006)	(.0006)	(.0009)	(.0009)	(.0008)	(.0008)	(.0005)	(.0005)
Some college	–.0128**	–.0131**	–.0124**	–.0126**	–.0071**	–.0075**	–.013**	–.0134**	–.0112**	–.0114**
	(.0011)	(.0011)	(.0009)	(.0009)	(.0012)	(.0012)	(.0011)	(.0011)	(.0008)	(.0008)
BA or higher	–.0155**	–.0159**	–.016**	–.0163**	–.0063**	–.0066**	–.0142**	–.0146**	–.0136**	–.0137**
	(.0015)	(.0014)	(.0012)	(.0012)	(.0016)	(.0016)	(.0015)	(.0015)	(.0012)	(.0012)
Interactions										
High school × spending	0	0	0[b]	0[b]	–.0016** [a,c]	–.0015** [a,c]	.0001[b]	.0002[b]	–.0002	–.0001
	(.0001)	(.0001)	(.0001)	(.0001)	(.0005)	(.0005)	(.0002)	(.0002)	(.0005)	(.0005)
Some college × spending	.0003**	.0004**	.0008** [b]	.0008** [b]	–.0021** [a,c,d]	–.002** [a,c,d]	.0007** [b]	.0007** [b]	.0018** [b]	.0018** [b]
	(.0001)	(.0001)	(.0001)	(.0001)	(.0005)	(.0005)	(.0002)	(.0002)	(.0006)	(.0006)
BA or higher × spending	.0005**	.0005**	.0016** [b,c,d]	.0016** [b,c,d]	–.0037** [a,c,d]	–.0038** [a,c,d]	.0001[a,b,d]	.0001[a,b,d]	.0035** [a,b,c]	.0035** [a,b,c]
	(.0001)	(.0001)	(.0002)	(.0002)	(.0005)	(.0005)	(.0002)	(.0002)	(.0005)	(.0005)

Table 3 (continued)

	Total		Cash		Tax Credits		Health		Housing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Main Controls										
Average maternal age	–.002**	–.0021**	–.0024**	–.0025**	–.0033**	–.0035**	–.0023**	–.0024**	–.0022**	–.0023**
	(.0004)	(.0004)	(.0003)	(.0003)	(.0004)	(.0004)	(.0004)	(.0004)	(.0003)	(.0003)
Average paternal age	.001**	.001**	.0013**	.0014**	.0016**	.0017**	.0011**	.0011**	.001**	.0011**
	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)	(.0003)
Proportion of births to married couples	–.0386**	–.0372**	–.0376**	–.0363**	–.03**	–.0281**	–.0336**	–.0322**	–.0366**	–.0355**
	(.0019)	(.0019)	(.0018)	(.0018)	(.002)	(.0021)	(.002)	(.002)	(.0018)	(.0018)
Total number of births	0**	0**	0**	0**	0	0[†]	0**	0**	0**	0**
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Proportion of births to Black mothers	.042**	.0423**	.0422**	.0423**	.0424**	.0426**	.0426**	.0427**	.0447**	.0449**
	(.0021)	(.0021)	(.0021)	(.0021)	(.0021)	(.0021)	(.0021)	(.0021)	(.0021)	(.0021)
Proportion of births to AI/AN mothers	–.0353**	–.0348**	–.035**	–.0345**	–.0327**	–.0323**	–.0351**	–.0347**	–.0353**	–.0353**
	(.0043)	(.0043)	(.0042)	(.0042)	(.0043)	(.0043)	(.0043)	(.0043)	(.0043)	(.0043)
Proportion of births to Asian mothers	.0284**	.0274**	.0243**	.0233**	.0286**	.0277**	.0306**	.0298**	.0291**	.0284**
	(.0027)	(.0027)	(.0026)	(.0026)	(.0026)	(.0026)	(.0027)	(.0027)	(.0026)	(.0027)
Proportion of births to Hispanic mothers	–.0251**	–.0254**	–.0252**	–.0256**	–.0248**	–.0251**	–.0256**	–.0259**	–.0244**	–.0247**
	(.0012)	(.0012)	(.0012)	(.0012)	(.0012)	(.0012)	(.0012)	(.0012)	(.0012)	(.0012)
State-Level Controls										
Unemployment rate		–.0003**		–.0003**		–.0003**		–.0003**		–.0003**
		(.0001)		(.0001)		(.0001)		(.0001)		(.0001)
Poverty rate		.0001		.0001		.0001		.0001		.0001[†]
		(.0001)		(.0001)		(.0001)		(.0001)		(.0001)

Table 3 (continued)

	Total		Cash		Tax Credits		Health		Housing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Minimum wage		0		0		0		0		0
		(.0001)		(.0001)		(.0001)		(.0001)		(.0001)
Proportion of Black residents		–.0072		–.0038		–.0071		–.0069		–.0087
		(.0061)		(.0061)		(.0062)		(.0062)		(.0062)
Proportion of Hispanic residents		.0185**		.0207**		.0205**		.0199**		.0176**
		(.0044)		(.0044)		(.0044)		(.0045)		(.0044)
Proportion of residents with a college degree		–.01*		–.0101*		–.011**		–.0109**		–.0085*
		(.0041)		(.0041)		(.0041)		(.0042)		(.0042)
Constant	.1272**	.1317**	.1255**	.1294**	.1301**	.1341**	.1247**	.1298**	.1251**	.1299**
	(.0032)	(.0038)	(.0031)	(.0037)	(.0033)	(.0039)	(.0032)	(.0038)	(.0031)	(.0037)
Number of Observations	4,076	4,076	4,076	4,076	4,076	4,076	4,076	4,076	4,076	4,076

Notes: Standard errors are shown in parentheses. Coefficient testing compares main effects and interactions with maternal education for each spending type. BA = bachelor's. AI = American Indian. AN = Alaska Native.

[a] Indicates that the coefficient differs significantly from that of cash spending at $p < .05$.

[b] Indicates that the coefficient differs significantly from that of tax credit spending at $p < .05$.

[c] Indicates that the coefficient differs significantly from that of health spending at $p < .05$.

[d] Indicates that the coefficient differs significantly from that of housing spending at $p < .05$.

$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$

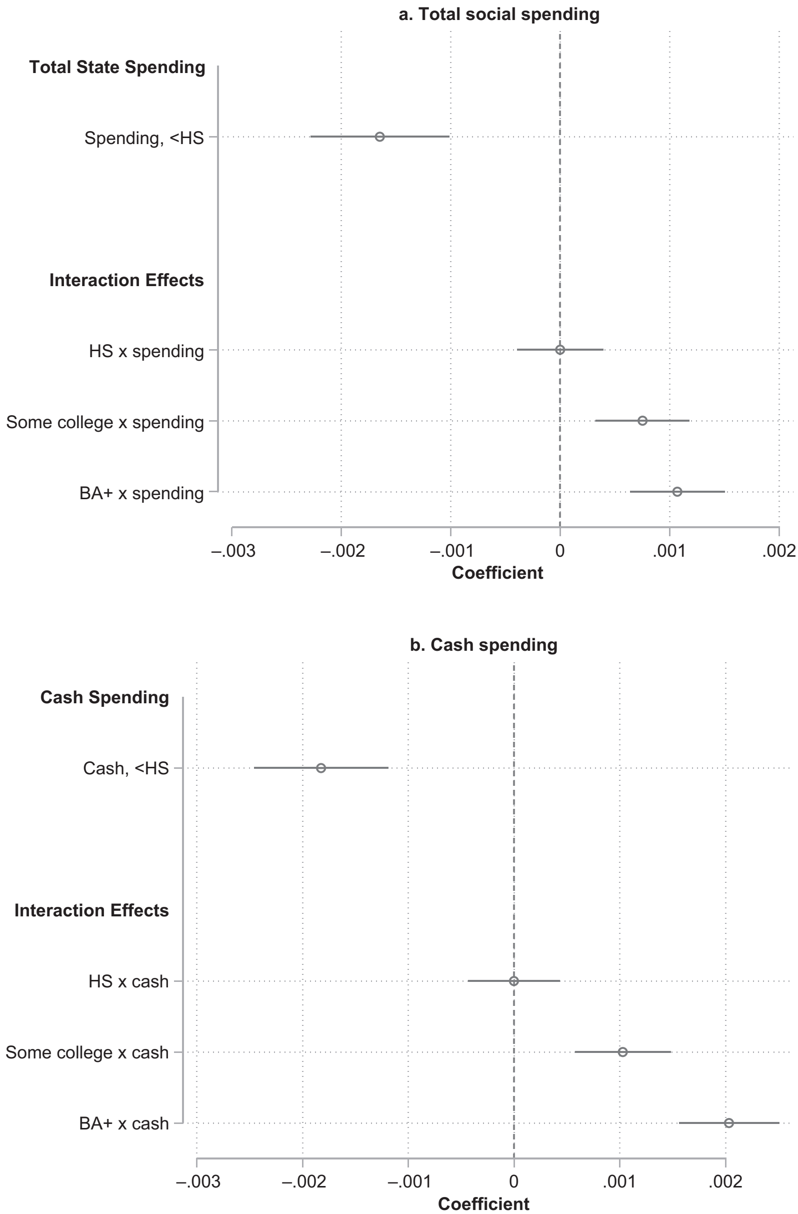
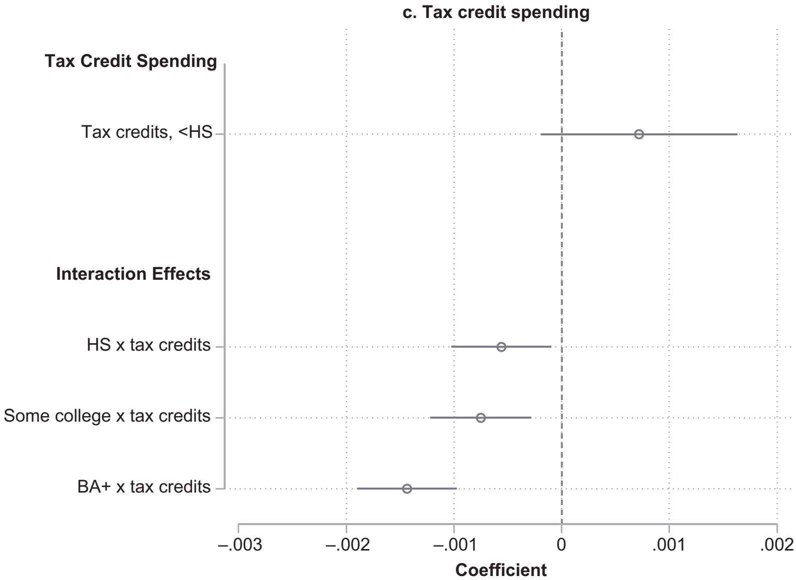


Fig. 2 Estimates of the effect of a 1-SD increase in social spending on low birth weight, 1998–2017. Coefficients are from Model 2 in Table 3. HS = high school. BA = bachelor's.

spending (or .14 for a 1-SD increase; panel b of Figure 2), by .04 percentage points for a 1-SD increase in health spending (panel d), and by .09 percentage points for a 1-SD increase in spending on housing and community development (panel e). Because variation across state–years in spending on housing is smaller (SD = 0.30) than variation in other forms of spending (e.g., SD = 1.11 for cash spending), the



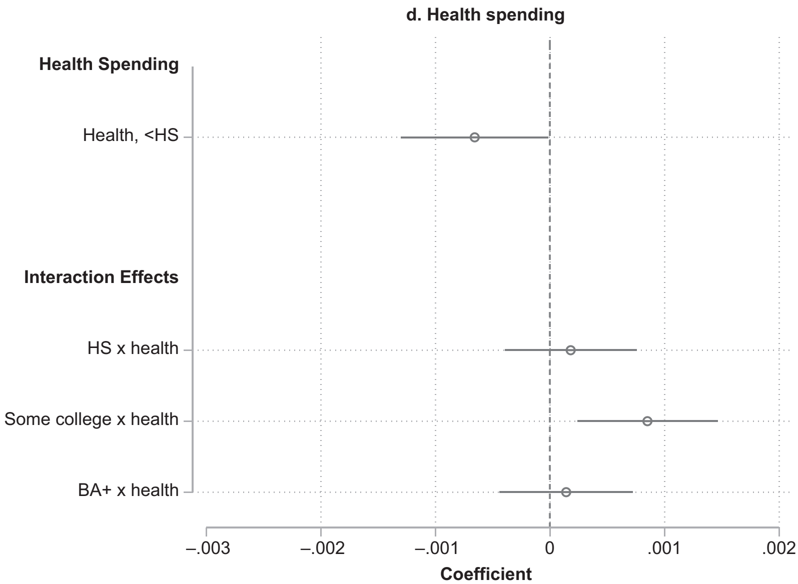


Fig. 2 (continued)

importance of housing spending is minimized within the framework of standard deviation comparisons. However, it is notable that, dollar for dollar, state spending on housing and community development is associated with significantly greater improvements in low birth weight than spending on cash support or other forms of investment.

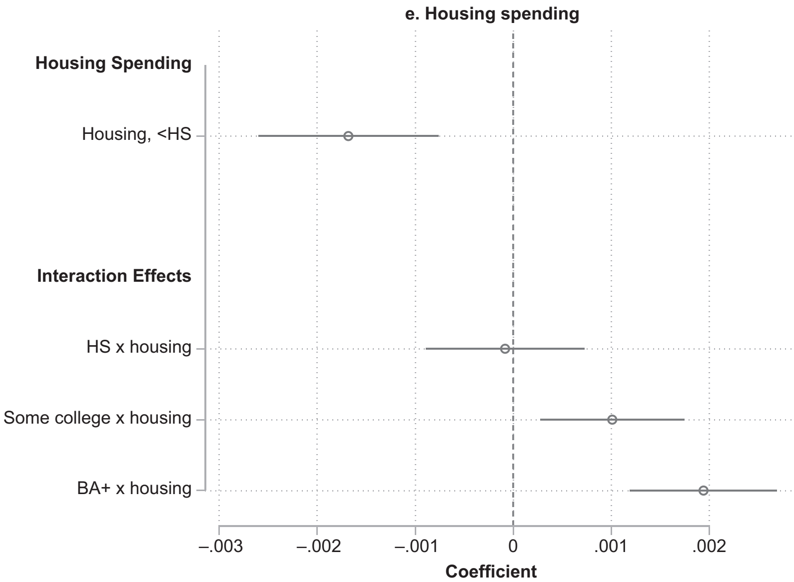


Fig. 2 (continued)

Interestingly, the pattern of results is in the opposite direction for the case of tax credits (which include EITC and the Child Tax Credit), where the benefits of such investments increase as maternal education increases (panel c of Figure 2). Supplementary analyses, shown in online appendix Table A2, show that this result is fairly consistent across both programs and especially pronounced for the case of the Child Tax Credit, which during the period of our study excluded millions of low-income families by design (Goldin and Michelmore 2020).

Table 4 presents coefficient estimates for our other measure of infant health: the share of preterm births. Results are similar in direction to those for low birth weight, and slightly larger in magnitude. Model 2 of Table 4 shows that a $1,000 increase in total social spending leads to a decrease in the rate of preterm birth of .16 of a percentage point—in other words, a 1-SD increase in total social spending decreases the rate of preterm birth by over a third of a percentage point (.366). Following the same logic as earlier, at the population level this amount of increase in total social spending on children would lead to 1,805 (493,397 × .00366) fewer preterm births among the lowest educated mothers. Figure A2 in the online appendix displays similar results for preterm birth for most specific forms of social spending, with significantly higher benefits of spending on cash income support programs compared with other forms of spending. A 1-SD increase in spending on cash support decreases the rate of preterm birth by .27 of a percentage point (where 1 SD of income support spending is $1,110), compared with decreases of .17 and .02 of a percentage point in preterm birth rates for each 1 SD of health and housing spending, respectively. Cash spending has the largest association with preterm birth in both standard deviation units and in terms of the dollar-for-dollar impact. This is partially inconsistent with the results for low birth weight, where housing spending had the largest per-dollar association. Similar

Table 4 Regression of preterm birth on social spending and maternal education

	Total		Cash		Tax Credits		Health		Housing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Spending Type										
Total spending	–.0017**	–.0016**								
	(.0002)	(.0002)								
Cash			–.0031** [b,c,d]	–.0031** [b,c,d]						
			(.0003)	(.0003)						
Tax credits					.0131** [a,c,d]	.0118** [a,c,d]				
					(.0015)	(.0016)				
Health							–.002** [a,b]	–.0019** [a,b]		
							(.0004)	(.0004)		
Housing									–.0004 [a,b]	–.0008 [a,b]
									(.0009)	(.0009)
Maternal Education (ref. = less than high school)										
High school	–.0133**	–.0128**	–.0147**	–.0145**	–.008**	–.0073**	–.0132**	–.0127**	–.0135**	–.0132**
	(.0013)	(.0013)	(.001)	(.001)	(.0014)	(.0014)	(.0012)	(.0012)	(.0008)	(.0008)
Some college	–.0214**	–.0206**	–.0242**	–.0238**	–.0105**	–.0097**	–.02**	–.0193**	–.0212**	–.0208**
	(.0018)	(.0018)	(.0014)	(.0014)	(.0019)	(.0019)	(.0017)	(.0017)	(.0013)	(.0013)
BA or higher	–.0354**	–.0347**	–.0391**	–.0388**	–.0188**	–.018**	–.0317**	–.031**	–.0343**	–.0339**
	(.0023)	(.0023)	(.0019)	(.0019)	(.0025)	(.0024)	(.0023)	(.0023)	(.0018)	(.0018)
Interactions										
High school × spending	0	–.0001	.0003[b]	.0003[b]	–.0038** [a,c]	–.0041** [a,c,d]	–.0003[b]	–.0004[b]	–.001	–.0011[b]
	(.0001)	(.0001)	(.0002)	(.0002)	(.0008)	(.0008)	(.0003)	(.0003)	(.0008)	(.0008)
Some college × spending	.0001	.0001	.0011** [b,c]	.001** [b,c]	–.0063** [a,c,d]	–.0065** [a,c,d]	–.0003[a,b]	–.0004[a,b]	.0006[b]	.0005[b]
	(.0001)	(.0001)	(.0002)	(.0002)	(.0008)	(.0008)	(.0004)	(.0004)	(.0009)	(.0009)
BA or higher × spending	.0005**	.0005**	.0022** [b,c]	.0022** [b,c]	–.0076** [a,c,d]	–.0076** [a,c,d]	–.0004[a,b,d]	–.0004[a,b,d]	.0038** [b,c]	.0039** [b,c]
	(.0001)	(.0001)	(.0002)	(.0002)	(.0008)	(.0008)	(.0003)	(.0003)	(.0009)	(.0009)

Table 4 (continued)

	Total		Cash		Tax Credits		Health		Housing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Main Controls										
Average maternal age	.0019**	.002**	.0017**	.0019**	–.0003	–.0002	.0014*	.0016**	.002**	.0021**
	(.0006)	(.0006)	(.0005)	(.0005)	(.0006)	(.0006)	(.0006)	(.0006)	(.0005)	(.0005)
Average paternal age	–.0007	–.0008	–.0005	–.0006	.0003	.0002	–.0006	–.0006	–.0008	–.0009†
	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)	(.0005)
Proportion of births to married couples	–.0421**	–.0442**	–.0398**	–.0415**	–.0285**	–.0309**	–.0375**	–.0394**	–.0402**	–.0418**
	(.003)	(.003)	(.0028)	(.0028)	(.0032)	(.0032)	(.0031)	(.0031)	(.0028)	(.0028)
Total number of births	0	0	0**	0**	0**	0**	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Proportion of births to Black mothers	.0609**	.0605**	.0629**	.0623**	.0646**	.064**	.061**	.0608**	.0659**	.0654**
	(.0033)	(.0032)	(.0033)	(.0032)	(.0032)	(.0032)	(.0033)	(.0033)	(.0033)	(.0033)
Proportion of births to AI/AN mothers	.0116†	.0108	.0133*	.0124†	.0186**	.018**	.0114†	.0108	.0129†	.012†
	(.0067)	(.0067)	(.0067)	(.0066)	(.0067)	(.0067)	(.0068)	(.0067)	(.0068)	(.0067)
Proportion of births to Asian mothers	.0213**	.0236**	.016**	.0181**	.0209**	.0232**	.0247**	.0271**	.021**	.0235**
	(.0042)	(.0041)	(.0041)	(.0041)	(.0041)	(.0041)	(.0042)	(.0041)	(.0041)	(.0041)
Proportion of births to Hispanic mothers	–.003	–.0022	–.0033†	–.0026	–.0009	–.0001	–.0034†	–.0024	–.0025	–.0016
	(.0019)	(.0019)	(.0019)	(.0019)	(.0019)	(.0019)	(.0019)	(.0019)	(.0019)	(.0019)
Unemployment rate		.0001		.0002		–.0001		–.0001		0
		(.0001)		(.0001)		(.0001)		(.0001)		(.0001)
Poverty rate		.0003**		.0003**		.0003**		.0003**		.0004**
		(.0001)		(.0001)		(.0001)		(.0001)		(.0001)

Table 4 (continued)

	Total		Cash		Tax Credits		Health		Housing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Minimum wage		–.0001		–.0002		–.0003[†]		–.0001		–.0002
		(.0002)		(.0002)		(.0002)		(.0002)		(.0002)
Proportion of Black residents		–.0063		.0025		.0012		–.0074		–.0012
		(.0096)		(.0095)		(.0096)		(.0096)		(.0097)
Proportion of Hispanic residents		–.0389**		–.0326**		–.0335**		–.0393**		–.0362**
		(.0069)		(.0068)		(.0069)		(.007)		(.007)
Proportion of residents with a college degree		.0088		.0086		.0052		.0042		.0065
		(.0064)		(.0064)		(.0064)		(.0065)		(.0065)
Constant	.1388**	.1331**	.134**	.126**	.1326**	.1292**	.1364**	.1326**	.1301**	.1236**
	(.005)	(.006)	(.0048)	(.0058)	(.0051)	(.006)	(.005)	(.006)	(.0049)	(.0058)
Number of Observations	4,076	4,076	4,076	4,076	4,076	4,076	4,076	4,076	4,076	4,076

Notes: Standard errors are shown in parentheses. Coefficient testing compares main effects and interactions with maternal education for each spending type. BA = bachelor's. AI = American Indian. AN = Alaska Native.

[a] Indicates that the coefficient differs significantly from that of cash spending at $p < .05$.

[b] Indicates that the coefficient differs significantly from that of tax credit spending at $p < .05$.

[c] Indicates that the coefficient differs significantly from that of health spending at $p < .05$.

[d] Indicates that the coefficient differs significantly from that of housing spending at $p < .05$.

[†]$p < .10$; *$p < .05$; **$p < .01$

to the case for low birth weight, the positive effects of social spending on preterm birth rates are less pronounced among infants born to higher educated mothers, with the exception of tax credit spending.

Education Gaps in Infant Health

To consider the implications of these findings for educational gaps in infant health, we visualize marginal relationships between state spending and infant health by maternal education category from the results shown in Tables 3 and 4. We show predictions for low birth weight in Figure 3 (the overall pattern is similar for preterm birth). The results are more consistent with Hypothesis 2 (that a stronger local welfare state for children and families reduces gaps in infant health across educational groups) than Hypothesis 3. Panel a of Figure 3 shows that as state spending increases, there is a decrease in the gap in low birth weight between those with less than a high school education and those with a college degree. When total state spending is less than 2 SD below the mean (e.g., Utah in the late 1990s), the gap in low birth weight is 20%, with 7.4% versus 5.9% of babies predicted to be low birth weight in the lowest and highest educated families, respectively. In the highest spending state contexts, this gap decreases by almost 30%. The predicted percentage of low birth weight infants declines by .7 of a percentage point among the lowest educated mothers, and by .2 of a percentage point among the highest educated mothers.

Panels b–e of Figure 3 show the same predictions for cash income support, tax credits, health, and housing spending, respectively. With the important exception of tax credit spending, the pattern of convergence is similar across spending domains and is most pronounced for cash income support and housing spending, where convergence in the percentage of low birth weight infants—a reduction in the gap between the highest and lowest educated mothers—declines by about 40% and is driven entirely by declines in the rate of low birth weight among the lowest educated mothers. Educational convergence in low birth weight is less pronounced for the case of health spending, where the rate of low birth weight is predicted to decline among both the lowest and highest educated mothers. This pattern may be driven by the relative generosity of state health insurance programs, which cover families up to 300–400% of the poverty threshold and are therefore more likely to include higher educated mothers. While higher educated mothers may be more likely to take advantage of state health insurance programs when they qualify, less-educated mothers are more likely to qualify, resulting in infant health benefits at both high and low levels of education. Overall, these results suggest that, while inequality in infant health remains even in high-spending state contexts, the gap is substantially smaller when states invest in a strong welfare state for children and families.

Sensitivity Analyses

The analyses presented in the foregoing carefully control for both fixed and time-varying characteristics of states and state–education groups in a theoretically driven way, and should account for many of the key correlates of both states' social spending

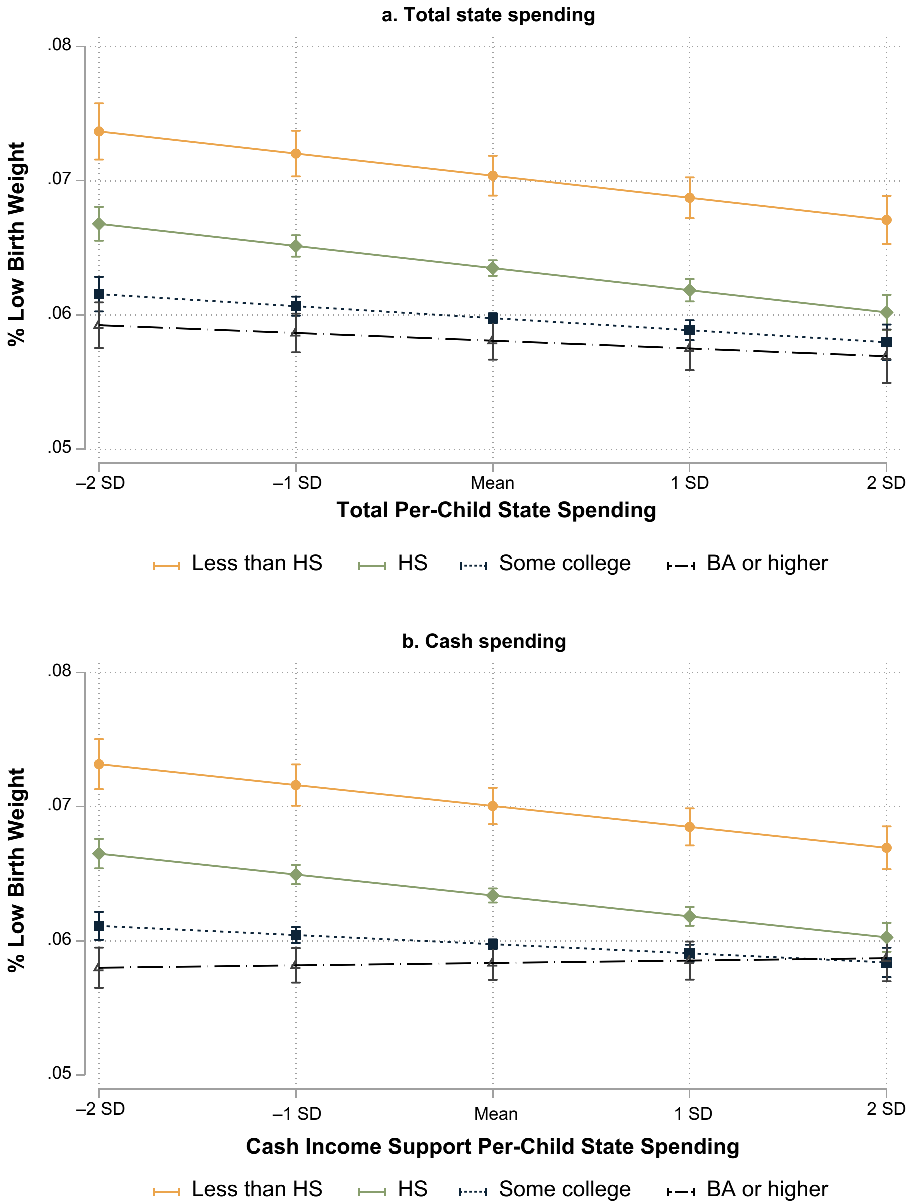


Fig. 3 Predicted percentage of low birth weight births by social spending and maternal education, 1998–2017. HS = high school. BA = bachelor's.

and infant health. Nonetheless, states with more generous social spending may be those that spend more on all programs, not just services for children and families. We conduct a placebo test that uses the same modeling framework to regress infant health on measures of state spending that should not be plausibly related to child health, using data from the U.S. Census Survey of State and Local Government Finances.

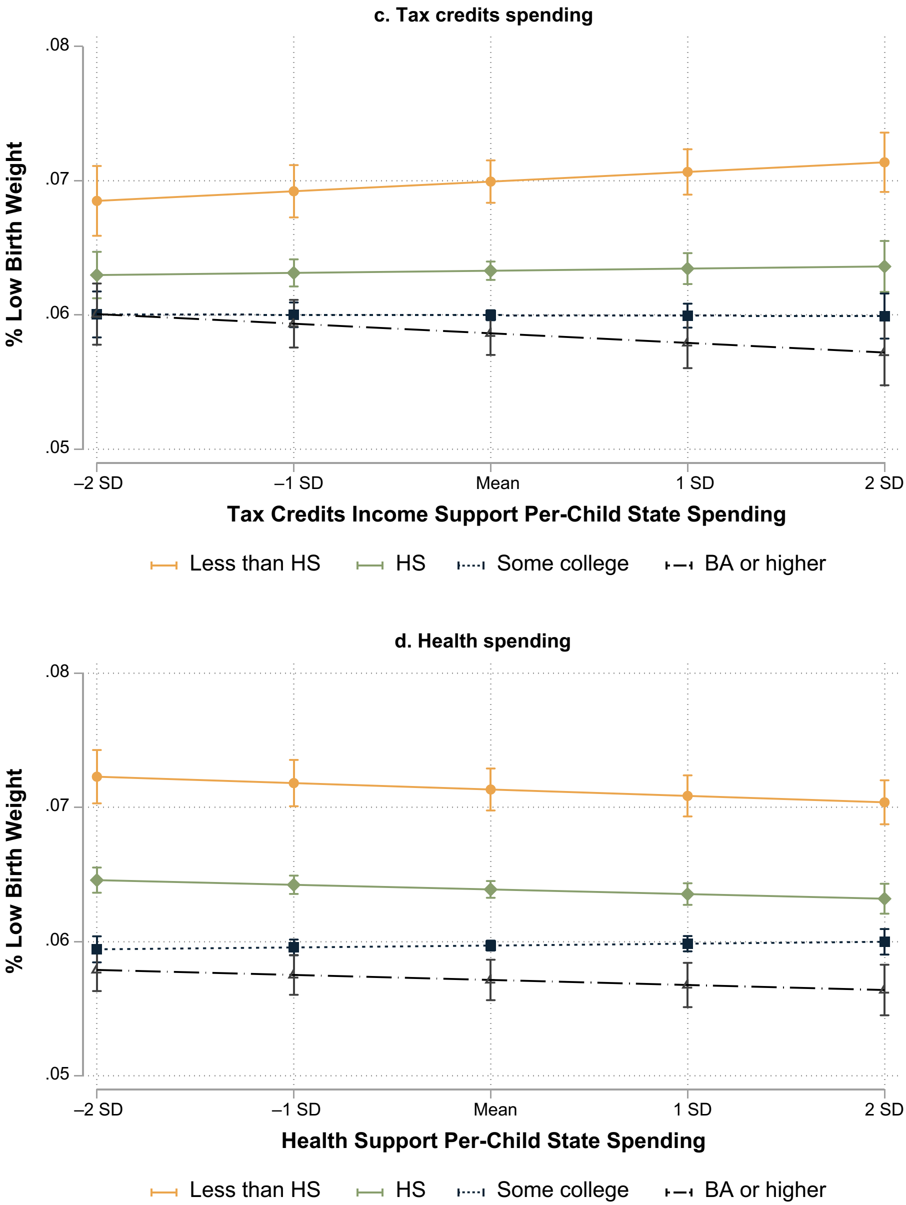


Fig. 3 (continued)

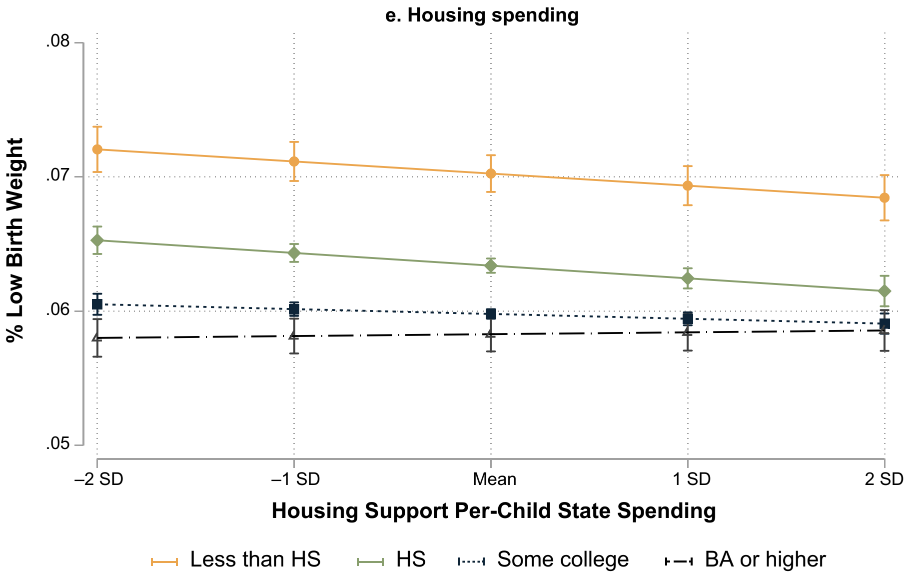


Fig. 3 (continued)

We focus on total expenditures on utilities and natural resources, important indicators of states' infrastructure that have a weaker theoretical connection to infant health.[5] Online appendix Table A3 shows that these forms of state spending are not significantly related to infant health.

We repeat the main analyses when including state-specific time trends (both linear and quadratic) to address the possibility that infant health would have changed in certain states regardless of child spending. We also estimate models over a shorter time period (2011–2017, after the Great Recession). In addition, we repeat analyses when excluding state–year observations with high missing rates for gestational length or maternal education in NVSS data. Finally, we repeat analyses when predicting individual-level (rather than state-level) infant health outcomes, using a 10% random sample of births in each year. Results using each of these approaches yield consistent findings.

While our measure of state Medicaid spending on children ages 0–12 is highly relevant to pregnant women (because infants are automatically covered for one year from the time of birth), it does not strictly cover the prenatal period. For this reason, we estimate models restricted to second-order births and higher. The results are highly similar and slightly larger in magnitude in some cases, consistent with the possibility that state spending on Medicaid for children is related to eventual birth outcomes. In addition, we estimate models among only non-Latino White births, given substantial

[5] Expenditures on utilities include water supply, electric, gas, and public mass transit services. Expenditures on natural resources encompass the conservation, promotion, and development of natural resources, including services such as irrigation, drainage, flood control, soil conservation and reclamation (including prevention of soil erosion), and surveying, development, and regulation of water resources.

racial/ethnic variation in birth outcomes over time. The findings are slightly smaller in magnitude but highly consistent in statistical and substantive significance.

Finally, we conduct exploratory mediation analyses to understand how service access and health behaviors associated with maternal stress mediate the effects of social spending on infant health. Using Eq. (1), we estimate effects of spending on measures of prenatal health care (percentage receiving prenatal care, percentage with first-trimester care, length of prenatal care, and number of prenatal visits) and prenatal health behavior (percentage smoking during pregnancy, percentage drinking alcohol during pregnancy, number of daily cigarettes during pregnancy, number of weekly drinks during pregnancy, and weight gain during pregnancy). Under the assumption of sequential ignorability (Imai et al. 2011), we estimate the proportion of the spending effect mediated through each potential mechanism and the sensitivity of those mediation estimates to violation of the sequential ignorability assumption (Hicks and Tingley 2011).[6]

Panel A of the online appendix Table A4 shows that, consistent with the main analyses, interaction terms indicate generally smaller benefits at higher levels of maternal education. Panel B in Table A4 shows the proportion of the effect of total spending on low birth weight (shown in Table 3) that is mediated by service access and health behaviors associated with prenatal stress. Among mothers with less than high school, the number of prenatal visits mediates about 16% of the effect of total spending on low birth weight, while any prenatal care and care in the first trimester account for 2% and 4%, respectively, of the total effect. Tobacco use, alcohol use, weekly drinks, and weight gain during pregnancy account for less than 1% of the total spending effect, while average daily cigarettes during pregnancy accounts for about 14%. Results are consistent for preterm birth, shown in panel C. While mediation results should be interpreted with caution (see sensitivity estimates in panels A and B), these results are consistent with the possibility that mothers' ability to receive more and better prenatal care—especially more frequent care—and to avoid prenatal smoking partially explains the positive effect of social spending on infant health. Mediation analyses for income support, health, and housing spending are in line with analyses for total spending.

Discussion

Strikingly large and durable effects of education on health among American adults and children (Montez et al. 2019), combined with pronounced differences in the size of educational gaps across geographic areas (Fenelon and Boudreaux 2019), have led to an increasing focus on the role of U.S. states as institutional actors that determine access to resources, policies, and opportunity structures for their residents (Montez et al. 2019). State-level social spending is a key indicator of the resources

[6] Because this strong assumption is often violated, we put our mediation estimates in context with three estimates of the extent of violation of sequential ignorability required to make each mediation estimate zero: the correlation between error terms from the models predicting the mediator and the outcome measure; the percentage of residual variance an omitted confounder must explain; and the percentage of total variance an omitted confounder must explain (using *medsens*; Imai et al. 2011).

available to children and families across states and affords analysis of how different forms of spending are related to infant well-being. Understanding these questions is critical for advancing knowledge about whether and which investments in children may yield large dividends for the health of the next generation. Using annual data from the State-by-State Spending on Kids Dataset between 1997 and 2016, linked to annual birth data from the National Vital Statistics System from 1998 to 2017, we draw on geographic and temporal variation in the United States to ask how much children—and which children—benefit from different forms of state-level social spending.

Our analyses reveal that, first, social spending has especially positive benefits for rates of both low birth weight and preterm birth among babies born to mothers with less than a high school education. These benefits are meaningful at the population level, such that a commonly observed amount of variation in social spending results in a decrease in the rate of low birth weight by .17 percentage points, or over 800 fewer low birth weight births among the lowest educated mothers in a given year. This pattern is broadly consistent across the several types of social spending we examine, with the most pronounced health benefits resulting from investments in cash income supports for families.

There is also evidence that investments in housing have the largest dollar-for-dollar association with low birth weight. One hypothesis for the greater association between housing spending and low birth weight (vs. preterm birth) is that investments in housing and community development—which include rental assistance, neighborhood revitalization, and public housing construction—are especially valuable for freeing up resources that better enable adequate nutrition and weight gain throughout pregnancy, both of which are strong determinants of low birth weight. For example, during the temporary reform of the Child Tax Credit in 2021 that expanded eligibility to the poorest low-income families, recipients of this cash assistance were better able to pay regular expenses, including food expenses (Lens et al. 2022). Maternal stress is another potential reason for the stronger association between housing spending and low birth weight. Housing inadequacy is an important and persistent source of stress (Campagna 2016), which increases the likelihood of low birth weight (Torche 2011). Gaining a better understanding of these and other reasons why certain forms of spending are more important for some birth outcomes is a valuable area for future inquiry.

Income support in the form of tax credits provides an important exception to this pattern, as no infant health benefits were observed among the lowest educated mothers. These unique results for tax credit spending may be driven by the fact that, during our study period, both tax programs excluded the lowest income families, resulting in the majority of families in the bottom 30% of the income distribution receiving a partial or no credit (Goldin and Michelmore 2020). For example, children who were eligible for the full Child Tax Credit until 2021 were much more affluent than the overall population, while ineligible children had substantially lower family incomes (Goldin and Michelmore 2020). While tax credits positively affect individuals who receive them (Hoynes et al. 2015), those with less than a high school education are most likely to be in the lowest earnings group. Therefore, it stands to reason that investments in tax credit spending may disproportionately affect and benefit higher educated mothers. The recent temporary expansion of both the EITC and Child Tax Credit in the American Rescue Plan eliminated many of these exclusions, making the credits much more widely available to the lowest SES families and suggesting that this finding could change in the aftermath of these expansions.

A second major finding is that the benefits of social spending are generally less pronounced among children born to higher educated mothers and, because of this pattern, educational gaps in infant health decline as social spending increases. When spending is high, the predicted percentage of low birth weight infants declines by nearly a full percentage point among low-educated mothers while remaining stable among higher educated mothers, resulting in a 30% decline in the educational gap in infant health. It is notable that this pattern of convergence across educational groups is less pronounced for health spending than for other forms of social spending, perhaps because state health insurance programs are more likely to cover families further above the poverty threshold than other social services. While sample sizes limit the ability to examine racial variation within maternal education groups by state and year, a priority for future research is to consider racial inequality in the effects of social spending. Beyond socioeconomic status, racial inequality in infant health is also substantial, with particularly large Black–White gaps in birth weight, preterm delivery, and infant mortality (Conley et al. 2003; Cramer 1995; Schoendorf et al. 1992). Even among the lowest educated families, White mothers may benefit more from some forms of social spending, such as Medicaid, because of unequal access to quality health care (Institute of Medicine 2003b), and the psychological and physiological embodiment of racism and discrimination is more likely to be experienced by non-White families in their interactions with social services and the state (Rosenthal and Lobel 2011). Alternatively, non-White families may benefit from state investments because of the greater likelihood of economic disadvantage among Black and Hispanic mothers (Aizer and Currie 2014). Sensitivity analyses suggest that the patterns observed for the total population persist but are less pronounced among non-Latino White births, suggesting the importance of future research that considers racial/ethnic variation in the effects of social spending in greater depth.

We conducted a number of sensitivity analyses to assess the robustness of our results to possible threats, including analyses of placebo effects, inclusion of state-specific linear and quadratic time trends, a truncated time period following the Great Recession, examination of missing data and individual-level findings, and sample restrictions to higher order births and non-Latino White births. The results were highly consistent across many different samples and specifications. Nonetheless, we cannot rule out confounding from state-level economic or political factors, and so it is important to emphasize that we have not identified causal estimates of public spending on educational gaps in infant health. Families are not randomly distributed in states, but instead choose their location on the basis of a number of factors, including job opportunities, political climates, and a desire to maximize their children's development. It is possible that high public-sector investment partially reflects the presence of families who prioritize child investment, both in their own behavior and in their support for state policies and programs. Our results should be interpreted as providing a descriptive portrait of how the state context of children's policy environments may be an important contributor to population-level infant health. In addition, while we considered spending on the largest programs serving U.S. children and families—Medicaid, SNAP, TANF, EITC, Child Tax Credit, public health spending (Edelstein et al. 2016)—other types of state investment provide crucial support to children and families that is relevant for infant health (e.g., paid parental leave) and are worthy of investigation. Of course, while we examine state investments in key programs affecting families, eligibility and access to public benefits and programs vary substantially by race, geography, immigration status, and education, among other factors. Understanding how state investments work in combination with group differences in program access and use is an important area for future research.

Finally, while we conducted exploratory mediation analyses to consider mothers' access to prenatal services and health-related behaviors correlated with financial stress, our data do not permit us to consider other potentially important mechanisms for understanding the benefits of social spending, including mental health and economic stability. While they should be interpreted with caution, analyses of the mechanisms that we observed are consistent with the possibility that social spending benefits infant health through mothers' increased access to prenatal services (especially increases in the number of prenatal visits), as well as improvements in some "coping" health behaviors related to financial stress (e.g., reductions in smoking during pregnancy). Future research could usefully examine these measures in combination with other indicators of maternal stress, mental health, and economic stability, together with the state context of public investment and infant health outcomes.

By looking beyond child poverty to direct measures of child well-being, we are able to demonstrate that a strong welfare state for children at the relatively local level of the state benefits the health of the next generation. Our findings complement a large cross-national literature documenting how welfare state spending affects children by providing a detailed assessment of how change over time in different forms of safety net spending in different U.S. states shapes inequalities in infant health. These findings bring a focus on children into the growing body of research demonstrating how states regulate behavior and policy (Robertson 2012) and the effects of policy decisions at this level for health, psychosocial resources, and even mortality (Montez et al. 2017; Strully et al. 2010; Torche and Rauf 2021). Considering multiple forms of social spending complements existing research on individual programs and usefully demonstrates that nonhealth spending can be equally or more beneficial for child health than spending on health services. An ongoing research and policy debate centers on the best way to support low-income families via the state, with some evidence suggesting that cash income support programs—cash for kids—are the most effective way to allow families to enable healthy development for their children and to make the same types of developmental investments as higher resource families (Shaefer et al. 2018; Smeeding 2016). Our findings are consistent with the possibility that providing mothers with additional resources at a critical period of development may increase equality of opportunity for children as well as improve maternal well-being.

Our findings are also relevant in light of the renewed policy focus on the importance of comprehensive, multidimensional public investments in children, as evidenced by the temporary dramatic expansions of the Child Tax Credit, food assistance (SNAP and WIC), and health insurance (Medicaid) programs in response to the COVID-19 pandemic. Many forms of government investment are beneficial for children, and strong state investment in children and families not only improves infant well-being, but reduces costs in the short term and durably predicts life chances throughout childhood and beyond. ■

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