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Does subsidized public health insurance for parents improve children's human capital and close achievement gaps?

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ABSTRACT

Between 2009 and 2018, many states dramatically changed income eligibility limits for parental Medicaid. We examine whether increasing parental Medicaid eligibility had spillover benefits on children's development. We study the effects of state-level changes in parental income limits for Medicaid on 3rd through 8th grade mathematics and English-language arts (ELA) achievement using county-level administrative test score data. We find that a 50-percentage point increase in parental Medicaid income limits, roughly equal to the average state increase in eligibility over this period, is associated with a 1.5% reduction in the socioeconomic achievement gap for math and a 3% reduction in the white-black math achievement gap. Math test scores improved significantly following parental Medicaid eligibility expansions among black students residing in poorer counties, with little estimated change in test scores for black students in higher income counties. We find no effect in ELA achievement gaps or white-Hispanic test score gaps. Our findings suggest that means-tested policies that improve parental and family wellbeing have important spillover benefits to children's educational achievement and can help reduce inequities in children's human capital development.

1. Introduction

Access to public health insurance for low-income parents increased in the early 2000s as a result of expansions in Medicaid eligibility and increased again under the Affordable Care Act (ACA) in 2014, which expanded Medicaid eligibility to all adults earning less than 138% of the Federal Poverty Level (FPL) in participating states. Research has shown that expanding access to Medicaid to low-income parents (1) increased parental health insurance coverage and reduced the proportion of uninsured parents (Kaestner et al., 2017; McMorrow et al., 2017); (2) increased parental healthcare utilization (McMorrow et al., 2017; Miller & Wherry, 2019); (3) improved parental mental health (McMorrow et al., 2017); (4) improved parental self-reported health (Gopalan et al., 2022); and (5) increased time parents spent on childcare (Soni & Morrissey, 2022). Other studies have shown that, among non-elderly adults, expanding Medicaid eligibility is associated with (6) reduced out-of-pocket spending (Abramowitz, 2018); and (7) reduced debt collections and improved credit scores (Caswell & Waidmann, 2017; Hu et al., 2018).

These consequences of expanding Medicaid eligibility to low-income parents may have beneficial effects to their children. Reducing financial stress is associated with improved maternal physical and mental health (Evans & Garthwaite, 2014; Boyd-Swan et al., 2016; Gangopadhyaya et al., 2020) which could improve the quality of parental investments (Propper et al., 2007; Yamauchi, 2009; Podor & Halliday, 2012; Bratti & Mendola, 2014; Mühlenweg et al., 2016). Additionally, interventions that have raised family income have been found to have beneficial effects on children's health and education development (Dubay & Kenney, 2003; Aizer & Grogger, 2003; Dahl & Lochner, 2012; Bastian & Michelmore, 2018; Braga et al., 2020; Gangopadhyaya et al., 2020; Hamersma et al., 2018; Miller & Wherry, 2019). For example, Dahl and Lochner (2012) found that children of parents who received the Earned Income Tax Credit scored higher on math and reading tests, with larger improvements experienced by lower-income children. Lastly, previous studies have shown that expanding parental access to Medicaid reduces children's uninsured rates (Hudson & Moriya, 2017; Dubay & Kenney, 2003) which, in turn, is associated with improvements in educational achievement and attainment (Levine & Schanzenbach, 2009; Cohodes et al., 2016). However, recent evidence from Gopalan et al. (2022) suggests the direct effects of children gaining coverage may be limited,

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Table 1
Change in parental Medicaid income eligibility limits (as% of FPL), by state (2009–2018).

State	Year of Change	Magnitude of Change (percentage points)	ACA Medicaid Expansion (by 2017)
States that increased parental income eligibility limits for Medicaid between 2009 and 2017			
Alabama	2014	0.05	Non-Expansion
Alaska	2014	0.54	Late Expansion
Arkansas	2014	1.22	Expansion
California	2013	0.32	Early Expansion
Colorado	2011	0.40	Expanded
Delaware	2014	0.31	Expanded
District of Columbia	2014	0.05	Early Expansion
Florida	2014	0.05	Non-Expansion
Georgia	2014	0.05	Non-Expansion
Hawaii	2013	0.33	Expansion
Indiana	2015	1.15	Late Expansion
Iowa	2014	0.83	Expansion
Kansas	2014	0.05	Non-Expansion
Kentucky	2014	1.01	Expansion
Louisiana	2017	1.14	Late-Expansion
Maryland	2009	0.84	Expansion
Massachusetts	2014	0.05	Early Expansion
Michigan	2014	0.85	Late Expansion
Mississippi	2009	0.08	Non-Expansion
Montana	2016	0.87	Late Expansion
Nebraska	2016	0.08	Non-Expansion*
Nevada	2014	1.07	Expansion
New Hampshire	2015	0.63	Late Expansion
New Jersey	2009	0.67	Early Expansion
New Mexico	2014	0.90	Expansion
North Carolina	2013	0.05	Non-Expansion
North Dakota	2014	0.84	Expansion
Ohio	2014	0.48	Expansion
Oklahoma	2011	0.06	Non-Expansion*
Oregon	2014	0.88	Expansion
Pennsylvania	2015	1.00	Late Expansion
Tennessee	2009	0.43	Non-Expansion
Texas	2014	0.05	Non-Expansion
Utah	2009	0.14	Non-Expansion*
Virginia	2014	0.18	Non-Expansion
Washington	2014	0.87	Early Expansion
West Virginia	2014	1.18	Expansion
Wyoming	2014	0.05	Non-Expansion
States that decreased parental income eligibility limits for Medicaid between 2009 and 2017			
Arizona	2010	−0.94	Expansion
Connecticut	2016	−0.46	Early Expansion
Idaho	2009	−0.13	Non-Expansion*
Illinois	2013	−0.62	Expansion
Maine	2014	−0.67	Non-Expansion*
Minnesota	2015	−0.67	Early Expansion
Missouri	2009	−0.11	Non-Expansion
New York	2014	−0.34	Expansion
Rhode Island	2014	−0.41	Expansion
South Carolina	2014	−0.07	Non-Expansion
South Dakota	2009	−0.02	Non-Expansion
Vermont	2014	−0.57	Expansion
Wisconsin	2014	−1.01	Non-Expansion

Source: Kaiser Family Foundation (https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D).
* indicates states that did not expand Medicaid during our period of analysis but that have expanded Medicaid under the ACA in later years.

as they found that although parental self-reported health improved following Medicaid expansions, they found no evidence of changes in child doctor visits or parental assessments of their child's health.

In this paper, we assess the effects of recent parental Medicaid expansions on 3rd through 8th grade mathematics and reading achievement using data from 2009 to 2018 for all counties in the United States from the Stanford Education Data Archive (SEDA). Because Medicaid is means-tested, and because race/ethnicity is correlated with income, we further examine whether the expansions diminished socioeconomic and racial/ethnic gaps in achievement. We assess the impact of expanding parental Medicaid eligibility on test scores using a difference-in-differences design exploiting changes in state Medicaid eligibility income limits for parents throughout this panel.

We find evidence that parental Medicaid eligibility expansions significantly narrowed the socioeconomic and white-black achievement gaps in math. In counties with above-median poverty rates, a 50 percentage points increase in parental eligibility income limits (roughly the size of the average expansion) is associated with reducing the socioeconomic achievement gap in math scores by 0.11σ and the white-black achievement gap in math scores by 0.029σ, representing a 1.7 and a 3.9% decrease in these respective achievement gaps relative to their means. Our evidence suggests that these gaps narrowed because of improved math scores for economically disadvantaged students and for black students; among non-disadvantaged students or white students, parental Medicaid expansions are associated with no change in achievement. We show that while socioeconomic gaps in math achievement reduced similarly regardless of county-level poverty, reductions in the white-black gap in math scores are concentrated in poorer counties. Finally, we find no evidence that parental Medicaid expansions had any association with achievement gaps in English-Language Arts (ELA) test scores during this period nor do we find any association between parental Medicaid expansion and math or ELA test scores for Hispanic children or corresponding achievement gaps. In analyses using data from the American Community Survey (ACS), we find that Hispanic parents in fact had lower Medicaid take-up effects and smaller reductions in uninsured rates following parental Medicaid expansions relative to white and black parents, the direct mechanism through which parental Medicaid is expected to affect children's education achievement. These diminished first-stage estimates may explain the absence of any association between parental Medicaid eligibility expansion and education achievement of Hispanic children.

Examining the impact of parental Medicaid eligibility on children's human capital development is critical. First, racial-ethnic and socioeconomic gaps in education achievement are large and persistent. These gaps emerge before kindergarten and persist throughout childhood (Jencks & Phillips, 1998; Reardon & Galindo, 2009), persist over time (Reardon, 2013; Hanushek et al., 2019), and are strongly correlated with adult success (Heckman et al., 2010; Chetty et al., 2011). Therefore, identifying factors that narrow these gaps, such as what we find with respect to parental Medicaid, is important to inform policies to reduce inequality and enhance human capital. Second, if Medicaid expansions to low-income parents are associated with improvements in their children's test scores, it suggests co-benefits that are important to quantify and have been previously ignored. Failure to account for these co-benefits risks undervaluing the program. Our findings complement two recent studies that explored spillover effects of Medicaid expansions on child academic achievement. Bullinger et al. (2022) use data from the Early Childhood Longitudinal Study to estimate the relationship between Medicaid expansions and find evidence of improvements in reading and mathematics scores, especially amongst Black children. Wehby (2022) finds improvements in reading scores in Iowa amongst children of mothers with a high school education or less. Our study contributes to this growing literature and, relative to Bullinger et al. (2022), evaluates education achievement among older children and, relative to Wehby (2022), reflects estimates representative of the whole nation.

2. Background and conceptual framework

Before the ACA, Medicaid eligibility for parents was limited: 33 states had Medicaid income limits set at a threshold below the poverty level in 2013; and 18 states had income limits set below the deep poverty level (50% of the poverty level). The ACA Medicaid expansions were aimed at reducing uninsured rates among low-income, non-elderly adults. By uniformly providing subsidized health insurance to non-elderly adults with incomes below 138% of FPL, the ACA Medicaid expansions were anticipated to standardize Medicaid eligibility across states for this population. A Supreme Court ruling in 2012, however, made Medicaid expansion optional to states. Consequently, in 2014, 26 states and the District of Columbia opted to expand Medicaid under the ACA.

Previous studies have shown that the ACA Medicaid expansions led to large increases in Medicaid coverage and reductions in uninsured rates for low-income parents. For example, Kaestner et al. (2017) implemented a difference-in-differences design using data from the 2010 to 2015 ACS and found that Medicaid expansion was associated with a 4.5 percentage point increase in Medicaid coverage and a 2.9 percentage point reduction in uninsured rates for parents with a high school degree or less education in states that had limited prior Medicaid eligibility for parents. The ACA Medicaid expansion is also credited with reducing racial and ethnic disparities in insurance coverage (Buchmueller et al., 2016; Chen et al., 2016). By closing the socioeconomic and racial and ethnic gaps in coverage, the ACA Medicaid expansions may also help close achievement gaps in education.

Although the ACA expanded Medicaid in 2014, we show in Table 1 that the expansion had heterogeneous effects on parental eligibility by state. Table 1 presents each state's largest year-over-year change in parental Medicaid eligibility income limits and ACA Medicaid expansion status between 2009 through 2018, covering our period of analysis.[1] Twenty-seven states changed parental Medicaid income limits as a percent of the Federal Poverty Level (FPL) by more than 25 percentage points over this period. These changes occurred in both directions: 20 states increased income limits for parents by more than 25 percentage points, while 7 states lowered their Medicaid eligibility thresholds by more than 25 percentage points. Moreover, while the direction of parental Medicaid eligibility is loosely related to each state's Medicaid expansion status, this relationship is weak—6 states that expanded Medicaid under the ACA in fact *reduced* Medicaid eligibility for parents (AZ, IL, MN, NY, RI, VT) during this period. Thus, comparing trends in parental outcomes in ACA Medicaid expansion and non-expansion states before and after the expansions went into effect will result in a misclassification of the change in Medicaid generosity for parents in several states. We address this by directly using the largest year-over-year state change in parental Medicaid income limits throughout the panel as our measure of treatment.

Though we attempt to isolate the impact of changes in parental Medicaid eligibility from broader changes occurring in the healthcare landscape under the ACA during this period, the ACA may have affected parental health in several ways other than through Medicaid expansion. In 2014 the ACA established individual marketplace plans that had guaranteed issue, restrictions on age-rating premiums, and were no longer allowed to price premiums based on preexisting health conditions. Depending on household income, premiums and cost-sharing for these plans can be fully or partially subsidized by the federal government. Unlike Medicaid expansion, these provisions were shared nationally; however, Marketplace exchanges were administered differently across states. In non-expansion states, individuals with incomes between 100 and 400% FPL are eligible for premium subsidies for Marketplace plans; only those with incomes between 138 and 400% of FPL are eligible for premium subsidies in expansion states, since those with incomes below 138% FPL would qualify for Medicaid in these states. Blavin et al. (2018) demonstrated that this difference in Medicaid eligibility leads to substantial increases in coverage and declines in out-of-pocket spending in expansion states for individuals in the affected income range relative to non-expansion states. There is also a strong correlation between states that chose to expand Medicaid and states that chose to operate state-based health insurance exchanges rather than federally facilitated marketplace plans—state-based exchanges have more flexibility in managing individual Marketplaces (allowing them to interact with state Medicaid websites, for example) and have spent more resources for advertising and on in-person navigators (who can also help direct individuals to Medicaid coverage) than states adopting federally facilitated marketplace plans.[2] Finally, evidence finds that states that expanded Medicaid also experienced distinct trends in physician labor supply (Neprash et al., 2021) and hospital closure rates (Lindrooth et al., 2018) relative to non-expansion states, and these differences in capacity constraints could have differential effects on parental healthcare access, use, and wellbeing.

As we highlight in Table 1, Medicaid eligibility rates for parents varied extensively within state ACA expansion status. This is an important fact in our research design, since our preferred model exploits variation in parental Medicaid eligibility while controlling for states that have or have not implemented a Medicaid expansion under the ACA, which allows us to adjust for features of ACA implementation that were shared by state expansion status discussed above.

The primary mechanism by which parental Medicaid expansion influences achievement is through increased parental insurance coverage. As noted, current evidence indicates that increased parental coverage from Medicaid expansion is associated with improved healthcare access and utilization (McMorrow et al., 2017), children's insurance coverage (Hudson & Moriya, 2017), improved family finances in the form of reduced out-of-pocket spending (Abramowitz, 2018), reductions in debt collections (medical and total) and improvements in credit score and access to credit (Argys et al., 2020; Hu et al., 2018; Brevoort et al., 2017; Caswell & Waidmann, 2017).

The impact of parental Medicaid eligibility expansions on Medicaid take-up are expected to be most immediate – most event studies assessing dynamic effects of Medicaid take-up following Medicaid expansion under the ACA indicate that changes in insurance coverage are greatest in the first year of expansion, but further increases in coverage rates are observed 2–3 years after implementation (e.g., Kaestner et al. 2017; Simon et al., 2017). Further, impacts of Medicaid expansion on healthcare access and use have been typically found to occur in relative lockstep with changes in insurance coverage, so we anticipate these effects to occur relatively immediately following policy implementation as well. There is little evidence supporting immediate changes in non-elderly adult health and wellbeing in the initial years following Medicaid eligibility expansions. Evidence from the Oregon Medicaid lottery demonstrated that depression diagnosis and treatment were some of the more immediate clinically measured improvements in health among this population (Baicker et al., 2014), and so we may similarly expect parental mental health to be one of the first domains of health to be affected by Medicaid parental eligibility expansions. We predict financial effects such as reductions in out-of-pocket healthcare spending and debt collections to occur over a longer time horizon, allowing for costly adverse health conditions to arise in the population. However, for parents and/or children transitioning from private coverage to public coverage, Medicaid expansion could result in

[1] Parental eligibility limits are from Kaiser Family Foundation (https://www.kff.org/medicaid/state-indicator/medicaid-income-eligibility-limits-for-parents/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D) last accessed July 27,2020. Income limits in 2014 and later are reported following MAGI reporting requirements. To streamline Medicaid eligibility determination, the ACA removed income disregards for expenditures and implemented a standardized measure Modified Adjusted Gross Income (MAGI) in 2014. To keep our measure of Medicaid eligibility generosity consistent from before and after 2014, we use an estimate, developed in Palmer (2020), of pre-2014 MAGI limits constructed by taking the average amount of disregards for people around the threshold in each state, determined based on state filings submitted to the Centers for Medicare and Medicaid Services, and adding them to the income eligibility threshold.

[2] See: https://www.kff.org/private-insurance/issue-brief/data-note-further-reductions-in-navigator-funding-for-federal-marketplace-states/

Table 2
Sample summary statistics overall and by county poverty.

	All Counties	Counties with poverty rates above median	Counties with poverty rates below median
Math Test Scores and Achievement Gaps			
Math test scores: Economically Disadvantaged	−0.323	−0.365	−0.292
Math test scores: Non-Economically Disadvantaged	0.355	0.298	0.395
Math test scores: Non-Hispanic white students	0.269	0.218	0.305
Math test scores: Non-Hispanic black students	−0.472	−0.550	−0.420
Math test scores: Hispanic students	−0.268	−0.312	−0.240
Math: Socioeconomic Achievement Gap	0.677	0.661	0.688
Math: White-Black Achievement Gap	0.731	0.748	0.720
Math: White-Hispanic Achievement Gap	0.533	0.522	0.540
Reading Test Scores and Achievement Gaps			
Reading test scores: Economically Disadvantaged	−0.333	−0.387	−0.294
Reading test scores: Non-Economically Disadvantaged	0.363	0.303	0.407
Reading test scores: Non-Hispanic white students	0.286	0.228	0.326
Reading test scores: Non-Hispanic black students	−0.399	−0.488	−0.338
Reading test scores: Hispanic students	−0.292	−0.353	−0.252
Reading: Socioeconomic Achievement Gap	0.696	0.689	0.701
Reading: White-Black Achievement Gap	0.675	0.697	0.660
Reading: White-Hispanic Achievement Gap	0.569	0.566	0.571
County Characteristics			
Area: Urban	0.300	0.378	0.246
Area: Suburban	0.404	0.301	0.475
Area: Township	0.116	0.140	0.099
Area: Rural	0.180	0.181	0.179
Median Income (log)	10.9	10.7	11.0
Percent of students economically disadvantaged	0.532	0.632	0.463
Percent of students Native American	0.011	0.015	0.008
Percent of students non-Hispanic Asian	0.050	0.038	0.058
Percent of students Hispanic	0.244	0.306	0.201
Percent of students non-Hispanic Black	0.165	0.195	0.144
Percent of students non-Hispanic White	0.530	0.446	0.588
Number of students tested	13,127	19,408	8786
Unemployment rate	0.147	0.186	0.121
School expenditures per student	$12,360	$12,690	$12,131
Number of community health centers	16	27	8
Number of primary care physicians	851	1212	602
Observations	327,329	166,108	161,032

Sources: SEDA 2009–2018. Test scores are in standard deviation units.

relatively immediate impacts on household income by immediately eliminating monthly premiums payments, deductibles, and copayments. We hypothesize the combined influence of these improvements in parental wellbeing may improve the quantity and quality of parental investments in their children. Furthermore, increased coverage rates for children is predicted to improve child health and healthcare access (Currie & Gruber, 1996). Improved family-level financial outcomes resulting from Medicaid expansion may have a positive spillover effect on child health as well. In whole, these spillover effects of parental Medicaid eligibility expansions are all anticipated to have positive effects on children's cognitive achievement, with several of the proposed mechanisms (i.e., coverage, healthcare access, routine healthcare expenses, parental mental health) affected within the first year of implementation and others (i.e., large out-of-pocket healthcare expenditures, household finances, parental health, children's coverage) ultimately affected after a longer period of time.

3. Data

Our primary dataset for assessing changes in education achievement is the Stanford Education Data Archive (SEDA) (Reardon et al., 2021). The SEDA data contain aggregate 3rd through 8th grade achievement in mathematics and English/language arts (ELA) from 2008 to 09 to 2017–18 for nearly every county in the United States.[3] These data also contain test information separately by racial (non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic students of other racial backgrounds) and socioeconomic groups (economically disadvantaged students and non-disadvantaged students) ,[4] which we use to explore changes over time in achievement gaps. However, there is no test information for racial/ethnic groups *by* socioeconomic status. The SEDA also contain a rich set of covariates that characterize the schooling and county environment, which we use as time-varying county level controls in our model described below. Note that qualifying for free or reduced lunch typically means students are in families with incomes below 130% and 185% FPL, respectively—we expect that parents of such students are more likely to be targeted by changes in Medicaid income limits.

Information on state parental Medicaid income limits comes from the Kaiser Family Foundation. Each data year in the SEDA corresponds to the spring of the year in which a test is taken. For each year in the SEDA, we merge the state parental Medicaid eligibility limit from the previous calendar year, which would have been applicable to students in the fall and thus at the beginning of each school year. Our income limits prior to 2013 have been adjusted using information from state filings on Modified Adjusted Gross Income (MAGI) adjustments, adding in the income disregards for each state and allowing income eligibility limits to be comparable within a state over the entire panel.[5]

Summary statistics for our analytic sample are described in Table 2. We present sample means for all counties and by counties above and below the median poverty rate. The overall sample consists of 327,329

[3] For the remainder of this study, individual years refer to the fall of each school year.

[4] "Economic disadvantage" is a state-defined measure states that typically identifies students eligible for free school lunch. See page 43 of: https://edopportunity.org/papers/SEDA_documentation_v30_DRAFT09212019.pdf

[5] We thank Makayla Palmer for sharing these MAGI calculations with us. For more information on how these are derived, see Appendix B. of Palmer (2020).

county-by-grade-by-year observations over the period 2009 to 2018. Test scores are standardized in the SEDA, and we find that economically disadvantaged students score about 0.32 standard deviations lower on math relative to all students and about 0.68 standard deviations lower than non-disadvantaged students. For math test scores, white students scored about 0.27 standard deviations higher relative to average students while black students and Hispanic students score about −0.47 and −0.27 standard deviations lower relative to the average student, respectively. Accordingly, the white-black math achievement gap is wide at 0.73 standard deviations while the white-Hispanic gap is slightly narrower at 0.53 standard deviations. Performance on ELA tests on Table 2 show approximately similar achievement patterns and gaps observed for math.

Table 2 shows that achievement is lower on average in counties with above-median poverty rates and higher in counties with below-median poverty rates. Economically disadvantaged students in poorer counties achieved about −0.37 and −0.39 standard deviations worse than average students in math and ELA students in poorer counties, compared to −0.29 standard deviations in counties with below-median poverty rates. Though economically disadvantaged students, black students and Hispanic students all have better math and ELA achievement in less poor counties, so too do non-disadvantaged students and white students. As a result, there is very little difference in socioeconomic, white-black, or white-Hispanic achievement gaps across areas that have higher or lower poverty rates.

We use the Census Bureau's American Community Survey (ACS) to assess the impact of changes in parental Medicaid eligibility during our panel period on parental coverage and children's coverage. To do so, we restrict the analysis to parents with children between the ages 8–14 (which aligns with grades 3 through 8). For these households, we estimate the impact of changes in parental Medicaid eligibility on parental coverage type (Medicaid coverage, uninsured, or private insurance coverage). We similarly assess coverage types of children to investigate a potential spillover mechanism of parental coverage. Although the impact of parental Medicaid eligibility expansions on parental insurance coverage is well documented (McMorrow et al., 2017 and Kaestner et al., 2017, for example), we attempt to reassess those findings in our context given that our approach to estimating the impact of changes in parental eligibility expansions differs from the research designs used by others (the research design is described below).

One complicating factor during this period is state variation in adoption of common core testing introduced in 2014–15. We collect data on each state's common core test used in 2014. This information was collected from Achieve's annual 50-state survey.[6] Information for individual dates was cross-validated from each state's department of education historical records where available. Each state's test type in 2014–15 are documented in Appendix Table 1. In Appendix Fig. 1, we plot math and reading test scores for state groups that either adopted one of the two major common core test types (PARCC test or Smarter Balanced Test), implemented their own state test type, or chose not to follow common core curriculum altogether. Appendix Fig. 1 clearly shows that common core tests affected state test scores when implemented in 2014, that some test score types were more difficult than others, and states that did not adopt common core standards have relatively smooth progression in test scores throughout the panel. We address and adjust for the impact of common core test type adoption in our research design, described in detail below (Appendix Tables 3 and 4).

Finally, our models include several time-varying county-level contextual controls from various data sources. From the SEDA, we use information on the urbanicity, percent of students economically disadvantaged, the percent of students Native American, Asian, Hispanic, Black, or white, and the number of students tested. The SEDA also contains data on local area unemployment rates and the log of median household income in the county, information collected from the American Community Survey. From the Area Health Resource Files, we collect information on the number of community health centers and the number of primary care physicians. From the National Center for Education Statistics, we collect district-level measures of education expenditures from the Local Education Agency Finance Surveys – we use a district-to-county crosswalk mapping to aggregate these data to the county-level.

4. Methods

We estimate the intent-to-treat effect of increasing parental Medicaid income limits by comparing the change in trends in test scores and achievement gaps in states that had greater changes in Medicaid parental eligibility thresholds relative to states implementing smaller or no change in parental eligibility limits. Our specifications, described in more detail below, control for year and county fixed effects, thus controlling for time-invariant county-level factors as well as shared secular trends in outcomes that may contaminate findings in a standard descriptive comparison.

Although parents generally experienced increased Medicaid eligibility in expansion states relative to non-expansion states, there was substantial heterogeneity in income eligibility limits for parents within expansion states (as noted in Table 1) over this period – comparing states that expanded Medicaid under the ACA to those that did not will lead to substantial misclassification in the change in Medicaid eligibility facing parents. Another option is to directly use the income eligibility limits for parents that vary at the state-year level as continuous measurement of Medicaid program generosity. One disadvantage of this approach is that it does not delineate a post-treatment period from a pre-treatment period. The absence of a clearly defined pre-/post treatment period makes it difficult to investigate whether trends in test scores and achievement gaps in states that had more generous changes in parental Medicaid eligibility thresholds were similar to trends in other states in the pre-treatment period, an analysis that helps assess the validity of parallel trends assumption in the difference-in-differences designs. With these considerations in mind, we identify each state's single largest year-over-year change in parental Medicaid eligibility between 2009 and 2018 (reported in Table 1) as well as the magnitude of the change. We designate all periods before this change occurs as pre-treatment periods and all periods after as the post-treatment periods. Delineating pre- and post- treatment periods does not come at a major loss of information in this continuous measure: most states had a single major change in parental Medicaid eligibly during this period and only 4 states had more than a 15-pp change in eligibility twice during the period.

We use the following difference-in-differences specification:

$$Y_{gcst} = \phi_g + \theta_c + \lambda_t + \beta_1(POST_{st} \times Change_{st}) + \gamma Expansion_{st} + \omega_1 PARCC_{st} + \omega_2 SMART_{st} + \omega_3 OWN_{st} + \Gamma' Z_{ct} + \varepsilon_{gcst} \tag{1}$$

where Y_{gcst} is the test-score outcome (math or ELA scores or achievement gaps) among students in grade g, county c, state s, at time t. The parameter of interest is β_1, the coefficient on an interaction term of the state-specific year in which parental Medicaid limits were changed in the panel ($POST_{st}$) and the size and direction of that state-specific change specified in units of percentage points as a percent of the poverty level

[6] See Appendix C of: http://achieve.org/files/Achieve50state2013Nov18EMBARGOEDlow-res.pdf

Table 3
Impact of parental Medicaid eligibility expansions on parents' health insurance coverage, by income group and parental racial-ethnic background.

Medicaid	Full Sample	Below Median Household Income	Above Median Household Income	Household Income < 185% FPL	Household Income > 185% FPL
All Parents	0.022**	0.050**	0.003	0.070**	0.004
	(0.007)	(0.012)	(0.003)	(0.013)	(0.004)
Pre-ACA mean	0.113	0.215	0.022	0.276	0.035
White, non-Hispanic	0.028**	0.063**	0.005	0.091**	0.008**
	(0.006)	(0.015)	(0.002)	(0.017)	(0.003)
Pre-ACA mean	0.084	0.199	0.018	0.285	0.028
Share of White parents in income range	1.00	0.36	0.64	0.22	0.78
Black, non-Hispanic	0.035**	0.053**	0.002	0.069**	0.002
	(0.011)	(0.014)	(0.006)	(0.017)	(0.005)
Pre-ACA mean	0.206	0.305	0.039	0.37	0.06
Share of Black parents in income range	1.00	0.62	0.38	0.47	0.53
Hispanic	0.009	0.015	<0.01	0.023	−0.004
	(0.010)	(0.016)	(0.008)	(0.017)	(0.008)
Pre-ACA mean	0.142	0.187	0.037	0.213	0.054
Share of Hispanic parents in income range	1.00	0.69	0.31	0.54	0.46

Uninsured	Full Sample	Below Median Household Income	Above Median Household Income	Household Income < 185% FPL	Household Income > 185% FPL
All Parents	−0.021**	−0.043**	−0.004	−0.061**	−0.004
	(0.007)	(0.012)	(0.003)	(0.013)	(0.004)
Pre-ACA mean	0.193	0.332	0.069	0.398	0.094
White, non-Hispanic	−0.025**	−0.052**	−0.005*	−0.073**	−0.006**
	(0.006)	(0.012)	(0.002)	(0.014)	(0.002)
Pre-ACA mean	0.117	0.238	0.048	0.309	0.063
Share of White parents in income range	1.00	0.36	0.64	0.22	0.78
Black, non-Hispanic	−0.037**	−0.051**	−0.008	−0.064**	−0.008
	(0.013)	(0.016)	(0.007)	(0.017)	(0.007)
Pre-ACA mean	0.193	0.259	0.081	0.294	0.102
Share of Black parents in income range	1.00	0.62	0.38	0.47	0.53
Hispanic	−0.018	−0.021	−0.009	−0.028	−0.004
	(0.013)	(0.018)	(0.007)	(0.017)	(0.010)
Pre-ACA mean	0.413	0.511	0.186	0.556	0.236
Share of Hispanic parents in income range	1.00	0.69	0.31	0.54	0.46

Private Insurance Coverage	Full Sample	Below Median Household Income	Above Median Household Income	Household Income < 185% FPL	Household Income > 185% FPL
All Parents	0.002	<0.001	0.001	−0.002	0.001
	(0.005)	(0.009)	(0.003)	(0.010)	(0.003)
Pre-ACA mean	0.708	0.475	0.916	0.35	0.881
White, non-Hispanic	<0.001	−0.004	0.001	−0.007	<0.001
	(0.004)	(0.010)	(0.002)	(0.012)	(0.002)
Pre-ACA mean	0.812	0.587	0.942	0.435	0.919
Share of White parents in income range	1.00	0.36	0.64	0.22	0.78
Black, non-Hispanic	0.010	0.010	0.006	0.007	0.010
	(0.010)	(0.013)	(0.009)	(0.014)	(0.008)
Pre-ACA mean	0.624	0.464	0.892	0.367	0.852
Share of Black parents in income range	1.00	0.62	0.38	0.47	0.53
Hispanic	0.009	0.007	0.009	0.006	0.008
	(0.008)	(0.010)	(0.005)	(0.010)	(0.009)
Pre-ACA mean	0.457	0.316	0.785	0.246	0.719
Share of Hispanic parents in income range	1.00	0.69	0.31	0.54	0.46

Sources: ACS 2008–2017. Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2017 and the magnitude of the change (see Table 1). Sample limited to parents with at least one child in school grades 3 through 8. Regressions include year fixed effects, state fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following parent-level characteristics: indicators for age-group, sex, race/ethnicity, education, marital status, and the number of own children. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

Table 4
Impact of parental Medicaid eligibility expansions on children's health insurance coverage, by income group and parent racial-ethnic background.

Medicaid	Full Sample	Below Median Household Income	Above Median Household Income	Household Income < 185% FPL	Household Income > 185% FPL
All Parents	0.006	0.009	0.004	0.010	0.004
	(0.006)	(0.009)	(0.004)	(0.009)	(0.004)
Pre-ACA mean	0.317	0.529	0.073	0.634	0.112
White, non-Hispanic	0.005	0.005	0.004	0.004	0.005
	(0.006)	(0.011)	(0.003)	(0.012)	(0.004)
Pre-ACA mean	0.21	0.432	0.052	0.566	0.078
Share of White parents in income range	1.00	0.42	0.58	0.27	0.73
Black, non-Hispanic	0.012	0.009	0.015	0.004	0.016*
	(0.008)	(0.010)	(0.009)	(0.012)	(0.008)
Pre-ACA mean	0.506	0.646	0.134	0.724	0.191
Share of Black parents in income range	1.00	0.73	0.27	0.60	0.40
Hispanic	0.024*	0.028*	0.015**	0.034*	0.016
	(0.012)	(0.015)	(0.007)	(0.017)	(0.009)
Pre-ACA mean	0.473	0.599	0.146	0.656	0.21
Share of Hispanic parents in income range	1.00	0.71	0.28	0.58	0.42
Uninsured	**Full Sample**	**Below Median Household Income**	**Above Median Household Income**	**Household Income < 185% FPL**	**Household Income > 185% FPL**
All Parents	−0.002	−0.003	−0.001	−0.005	<0.001
	(0.005)	(0.008)	(0.003)	(0.008)	(0.003)
Pre-ACA mean	0.082	0.116	0.044	0.125	0.054
White, non-Hispanic	−0.002	<0.001	−0.002	−0.001	−0.002
	(0.003)	(0.006)	(0.002)	(0.006)	(0.003)
Pre-ACA mean	0.056	0.089	0.032	0.1	0.039
Share of White parents in income range	1.00	0.42	0.58	0.27	0.73
Black, non-Hispanic	−0.002	−0.002	−0.002	−0.005	<0.001
	(0.003)	(0.005)	(0.006)	(0.005)	(0.005)
Pre-ACA mean	0.07	0.078	0.05	0.079	0.057
Share of Black parents in income range	1.00	0.73	0.27	0.60	0.40
Hispanic	−0.026**	−0.030**	−0.012	−0.037**	−0.009
	(0.010)	(0.013)	(0.007)	(0.014)	(0.007)
Pre-ACA mean	0.155	0.175	0.101	0.182	0.115
Share of Hispanic parents in income range	1.00	0.71	0.28	0.58	0.42
Private Insurance Coverage	**Full Sample**	**Below Median Household Income**	**Above Median Household Income**	**Household Income < 185% FPL**	**Household Income > 185% FPL**
All Parents	−0.005*	−0.009**	−0.002	−0.008*	−0.004
	(0.002)	(0.004)	(0.003)	(0.004)	(0.003)
Pre-ACA mean	0.635	0.402	0.902	0.291	0.857
White, non-Hispanic	−0.003	−0.006	−0.001	−0.004	−0.003
	(0.003)	(0.005)	(0.002)	(0.006)	(0.003)
Pre-ACA mean	0.767	0.535	0.934	0.399	0.904
Share of White parents in income range	1.00	0.42	0.58	0.27	0.73
Black, non-Hispanic	−0.014	−0.011	−0.016	−0.006	−0.017
	(0.008)	(0.009)	(0.012)	(0.011)	(0.01)
Pre-ACA mean	0.464	0.322	0.843	0.242	0.785
Share of Black parents in income range	1.00	0.73	0.27	0.60	0.40
Hispanic	−0.002	−0.004	−0.002	−0.005	−0.005
	(0.007)	(0.008)	(0.011)	(0.009)	(0.012)
Pre-ACA mean	0.404	0.261	0.777	0.197	0.702
Share of Hispanic parents in income range	1.00	0.71	0.28	0.58	0.42

Sources: ACS 2008–2017. Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2017 and the magnitude of the change (see Table 1). Sample limited to children in school grades 3 through 8. Regressions include year fixed effects, state fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the highest level of education attained by a parent in the household, older parent's age indicators and the following child-level indicators: indicators for age, sex, race/ethnicity, and grade attending, and family size. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

Table 5
Impact of parental Medicaid eligibility expansion on mathematics achievement.

Mathematics Achievement	(1)	(2)	(3)
Economically Disadvantaged	0.040**	0.035**	0.033**
	(0.014)	(0.013)	(0.014)
Non-Economically Disadvantaged	0.023	0.016	0.013
	(0.018)	(0.018)	(0.018)
Socioeconomic Achievement Gap	−0.017*	−0.019**	−0.020**
	(0.009)	(0.009)	(0.009)
Black	0.041	0.046	0.046
	(0.029)	(0.030)	(0.029)
White	0.004	<0.001	0.001
	(0.028)	(0.028)	(0.027)
White-Black Gap	−0.037	−0.045*	−0.044*
	(0.028)	(0.025)	(0.024)
Hispanic	0.009	0.003	0.006
	(0.018)	(0.016)	(0.017)
White	0.008	0.002	0.004
	(0.019)	(0.017)	(0.017)
White-Hispanic Gap	−0.002	−0.002	−0.002
	(0.009)	(0.008)	(0.008)
Common Core Test Type Indicators	No	Yes	Yes
County-Year Covariates	No	No	Yes

Sources: SEDA 2009–2018. Notes: Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2017 and the magnitude of the change (see Table 1). All regressions include county fixed effects, year fixed effects, grade fixed effects, and an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect. Columns (2) and (3) further include an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment). Column (3) further includes the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

($Change_{st}$).[7] β_1 is the intent-to-treat estimate of changes in parental Medicaid eligibility limits on math or reading test scores.

Eq. (1) also includes grade fixed effects (ϕ_g), county fixed effects (θ_c), and year fixed effects (λ_t). Note that Table 1 showed substantial heterogeneity in parental eligibility limits by Medicaid expansion status. Since expansion status controls for other factors surrounding ACA implementation, Eq. (1) further includes a state-by-year varying indicator for whether a state has expanded Medicaid to all low-income adults under the ACA ($\gamma Expansion_{st}$). Indicators for whether a state is taking the PARCC common core test ($PARCC_{st}$), the Smarter Balanced ($SMART_{st}$) common core test, or a state's own common core test (OWN_{st}) are included to control for differences in trends attributable to changes in state curriculum and assessment standards.[8] As noted in the previous section, we include county-by-year contextual controls (Z_{ct}), including indicators for whether the county is urban, suburban, a township, or rural, the log of the county's median income, percent of students in the county that are Native American, non-Hispanic Asian, Hispanic, non-Hispanic Black, and non-Hispanic white, the county's unemployment rate, the share of students that are economically disadvantaged, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level to adjust for serial correlation in error terms at the state level, which is the unit of treatment (Bertrand et al., 2004).

[7] SEDA tests are administered in the spring. We assign $POST_{st}$ and $Change_{st}$ to the fall of school year (occurring in the previous calendar year). For example, if a state's largest change in year-over-year parental Medicaid eligibility occurred in 2014, then it is assigned to apply in the fall of 2014 and to first potentially affect assessments taken in the spring of 2015.

[8] States with no changes in common core test type are designated as the omitted reference group.

Table 6
Impact of parental Medicaid eligibility expansion and mathematics achievement, by county poverty at baseline.

	All counties	Counties with poverty rates > median	Counties with poverty rates < median
Economically Disadvantaged Students	0.033**	0.035**	0.030**
	(0.014)	(0.015)	(0.014)
Non-Economically Disadvantaged	0.013	0.014	0.012
	(0.018)	(0.020)	(0.018)
Socioeconomic Achievement Gap	−0.020**	−0.022**	−0.019*
	(0.009)	(0.010)	(0.009)
Black	0.046	0.052*	0.036
	(0.030)	(0.029)	(0.035)
White	0.001	−0.007	0.006
	(0.027)	(0.034)	(0.022)
White-Black Gap	−0.044*	−0.058**	−0.030
	(0.024)	(0.021)	(0.029)
Hispanic	0.006	0.002	0.007
	(0.017)	(0.023)	(0.015)
White	0.004	−0.005	0.009
	(0.017)	(0.019)	(0.016)
White-Hispanic Gap	−0.002	−0.008	0.002
	(0.008)	(0.011)	(0.010)
Common Core Test Type Indicators	Yes	Yes	Yes
County-Year Covariates	Yes	Yes	Yes

Sources: SEDA 2009–2018. Notes: Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2018 and the magnitude of the change (see Table 1). Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

We estimate specification (1) among all counties and separately by counties with baseline (2008–2010) poverty rates above and below median. We assess math and ELA test scores among economically disadvantaged students, white students, black students, and Hispanic students. As a falsification exercise, we also investigate the impact of changes in parental Medicaid income limits on the test scores of non-economically disadvantaged students (we expect no change).

We also implement the following event-study regression model:

$$Y_{gcst} = \phi_g + \theta_c + \lambda_t + \Gamma' Z_{ct} + \sum_{k=-6}^{3} \beta_k (\eta_k \times Change_{st}) + \gamma Expansion_{st} + \omega_1 PARCC_{st} + \omega_2 SMART_{st} + \omega_3 OWN_{st} + \varepsilon_{gcst} \quad (2)$$

Eq. (2) is the same as Eq. (1), except here we replace the post-period indicator with indicators for the periods leading up to and following the policy change. In Eq. (2), the parameters of interest (β_k) are the coefficients on the interaction terms between indicators representing the year relative to each state's year of change in parental Medicaid eligibility (η_k) and the variable measuring the state-specific magnitude of change imposed by the state which ranges from −100 percentage points in Wisconsin to 122 percentage points in Arkansas ($Change_{st}$). Most, though not all, states change Medicaid parental limits in 2014, so for most states there are six pre-treatment periods (i.e. k=−6 to −1, where

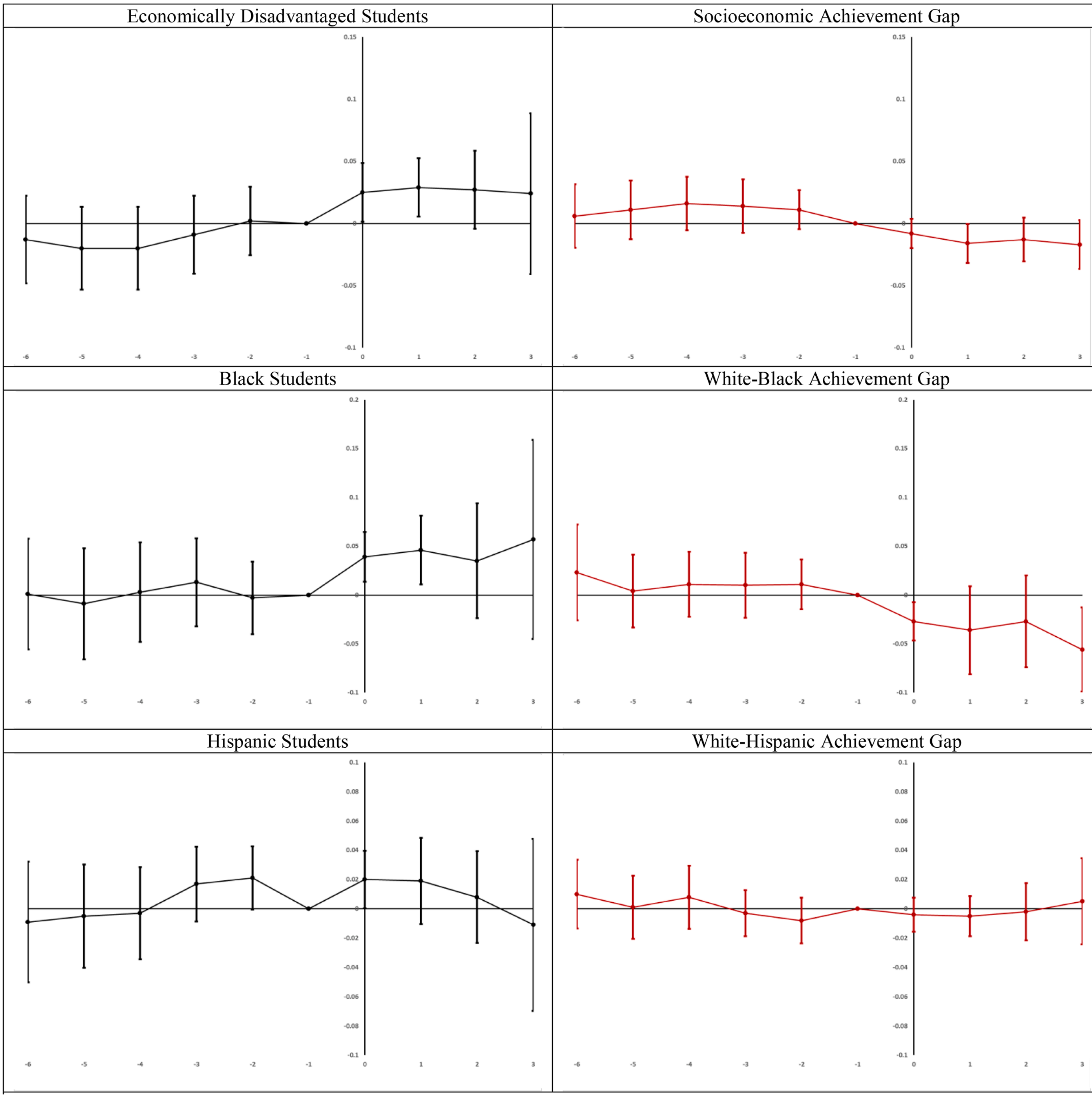

Fig. 1. Event-Study Analysis of Impact of Parental Medicaid Eligibility Expansions on Math Achievement for Disadvantaged Student Groups and Corresponding Achievement Gaps. Sources: SEDA 2009–2018. Coefficients represent interaction between an indicator for the relative period and the magnitude of the change in eligibility that will occur in the state in period 0. Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state‘s common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, and the county unemployment rate. Standard errors are clustered at the state-level. Standard errors are clustered at the state-level and are reported in parenthesis. P-values from F-test of joint significance of pre-treatment estimates.

Table 7
Event study analysis of impact of parental eligibility on mathematics achievement.

Mathematics Achievement	Economically Disadvantaged	Non-Economically Disadvantaged	Non-ECD vs ECD Gap	Black	White	White-Black Gap	Hispanic Students	White Students	White-Hispanic Gap
(t-6)	−0.013	−0.007	0.006	0.001	0.024	0.023	−0.009	<0.001	0.010
	(0.018)	(0.018)	(0.013)	(0.029)	(0.021)	(0.025)	(0.021)	(0.018)	(0.012)
(t-5)	−0.020	−0.009	0.011	−0.009	−0.004	0.004	−0.005	−0.006	0.001
	(0.017)	(0.017)	(0.012)	(0.029)	(0.018)	(0.019)	(0.018)	(0.016)	(0.011)
(t-4)	−0.009	0.006	0.016	0.003	0.015	0.011	−0.003	0.004	0.008
	(0.017)	(0.015)	(0.011)	(0.026)	(0.016)	(0.017)	(0.016)	(0.013)	(0.011)
(t-3)	0.002	0.016	0.014	0.013	0.023	0.010	0.017	0.013	−0.003
	(0.016)	(0.015)	(0.011)	(0.023)	(0.014)	(0.017)	(0.013)	(0.011)	(0.008)
(t-2)	−0.001	0.010	0.011	−0.003	0.008	0.011	0.021*	0.012	−0.008
	(0.014)	(0.013)	(0.008)	(0.019)	(0.012)	(0.013)	(0.011)	(0.010)	(0.008)
($t = 0$)	0.025**	0.017	−0.008	0.039**	0.012	−0.027**	0.020*	0.017	−0.004
	(0.012)	(0.010)	(0.006)	(0.013)	(0.012)	(0.010)	(0.010)	(0.010)	(0.006)
($t + 1$)	0.029**	0.013	−0.016**	0.046**	0.010	−0.036	0.019	0.014	−0.005
	(0.012)	(0.013)	(0.008)	(0.018)	(0.023)	(0.023)	(0.015)	(0.013)	(0.007)
($t + 2$)	0.027*	0.014	−0.013	0.035	0.007	−0.027	0.008	0.006	−0.002
	(0.016)	(0.015)	(0.009)	(0.030)	(0.031)	(0.024)	(0.016)	(0.017)	(0.010)
($t + 3$)	0.024	0.008	−0.017	0.057	<0.001	−0.056**	−0.011	−0.007	0.005
	(0.033)	(0.029)	(0.010)	(0.052)	(0.044)	(0.022)	(0.030)	(0.026)	(0.015)
F-Test (p-value)	0.498	0.064	0.196	0.257	0.002	0.548	0.231	0.279	0.142

Sources: SEDA 2009–2018. Coefficients represent interaction between an indicator for the relative period and the magnitude of the change in eligibility that will occur in the state in period 0. Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. Standard errors are clustered at the state-level and are reported in parenthesis. P-values from F-test of joint significance of pre-treatment estimates. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

Table 8
Impact of parental Medicaid eligibility expansion on english-language arts achievement.

Reading Achievement	(1)	(2)	(3)
Economically Disadvantaged	0.017	0.016	0.013
	(0.012)	(0.012)	(0.012)
Non-Economically Disadvantaged	0.022	0.017	0.013
	(0.014)	(0.014)	(0.014)
Socioeconomic Achievement Gap	0.005	0.001	<0.001
	(0.007)	(0.007)	(0.007)
Black	0.017	0.019	0.020
	(0.024)	(0.027)	(0.026)
White	0.013	0.010	0.011
	(0.017)	(0.017)	(0.017)
White-Black Gap	−0.004	−0.009	−0.009
	(0.026)	(0.025)	(0.026)
Hispanic	−0.001	−0.008	−0.007
	(0.019)	(0.017)	(0.017)
White	0.009	0.008	0.009
	(0.015)	(0.015)	(0.015)
White-Hispanic Gap	0.010	0.016**	0.016**
	(0.008)	(0.007)	(0.006)
Common Core Test Type Indicators	No	Yes	Yes
County-Year Covariates	No	No	Yes

Sources: SEDA 2009–2018. Notes: Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2018 and the magnitude of the change (see Table 1). All regressions include state fixed effects, year fixed effects, grade fixed effects, and an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect. Columns (2) and (3) further include an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment). Column (3) further includes the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

$k=-6$ corresponds to 2009 for a state expanding in 2014) and two post-period coefficients ($k = 0$ and $k = 1$). We set period $k= -1$ as the reference period. The internal validity of the difference-in-differences design depends on the assumption that test score outcomes in states that differentially changed parental Medicaid eligibility limits would have trended similarly in the absence of the decision to expand the limits. Though this is never directly observable, the common trends assumption can be supported by examining the statistical significance of the pre-period coefficients ($\beta_{-6}, \beta_{-5}, \beta_{-4}, \beta_{-3}, \beta_{-2}$) — if treated and control states trended similarly prior to the expansion, it is more likely they would have trended similarly after had there been no change in parental Medicaid income limits. We test for the significance of each of these pre-treatment estimates individually and jointly using an F-test. Later we show that common pre-trends appear to be satisfied in all

Table 9
Impact of parental Medicaid eligibility expansion and english-language arts achievement, by county poverty at baseline.

	All counties	Counties with poverty rates > median	Counties with poverty rates < median
Economically Disadvantaged Students	0.013	0.015	0.011
	(0.012)	(0.011)	(0.014)
Non-Economically Disadvantaged	0.013	0.014	0.011
	(0.014)	(0.014)	(0.015)
Socioeconomic Achievement Gap	<0.001	−0.001	<0.001
	(0.007)	(0.008)	(0.007)
Black	0.020	0.022	0.016
	(0.026)	(0.025)	(0.032)
White	0.011	0.011	0.011
	(0.017)	(0.021)	(0.014)
White-Black Gap	−0.009	−0.011	−0.005
	(0.026)	(0.019)	(0.033)
Hispanic	−0.007	−0.008	−0.008
	(0.017)	(0.018)	(0.018)
White	0.009	0.007	0.010
	(0.015)	(0.016)	(0.015)
White-Hispanic Gap	0.016**	0.014*	0.018**
	(0.006)	(0.008)	(0.008)
Common Core Test Type Indicators	Yes	Yes	Yes
County-Year Covariates	Yes	Yes	Yes

Sources: SEDA 2009–2018. Notes: Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2018 and the magnitude of the change (see Table 1). Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

specifications for mathematics and ELA, given the fact that all pre-period estimates are statistically indistinguishable from zero and that nearly all joint F-tests of pre-treatment differences are insignificant as well.

5. Results

5.1. Impact of parental medicaid eligibility on parental and child health insurance coverage

We first assess the impact of expanding parental Medicaid eligibility on parental insurance coverage and children's health insurance coverage. Although this has been previously investigated by others (e.g. McMorrow et al. 2017; Hudson & Moriya, 2017; Dubay & Kenney 2003), we repeat the analysis here given that our difference-in-differences approach is distinct from the conventional analysis since we evaluate a dose response in the change of parental Medicaid eligibility limits and because our inclusion of an ACA expansion indicator and indicators for common core test types draws comparisons within expansion states and within state common core test type. These distinctions in our research design are intended to better isolate the impact of parental Medicaid eligibility expansion on student test scores, but it is also important that we verify that they detect impacts of eligibility expansions on parental coverage in our context, the first-stage outcome through which all subsequent mechanisms between parental Medicaid and children's test scores are predicted to occur.

Table 3 presents difference-in-differences estimates of the association between parental Medicaid eligibility expansions and parental health insurance coverage overall, in households with above and below median household income, in households with incomes above and below 185% of the Federal Poverty Level (a rough approximate for reduced school lunch eligibility and economic disadvantage in the SEDA data), and by race/ethnicity. We investigate the impact of a 100 percentage-point increase in parental Medicaid eligibility on parental Medicaid coverage, uninsured rates, and rates of private coverage.

Evidence from Table 3 clearly indicates that parents in low-income families benefitted from expansions in parental Medicaid eligibility relative to higher-income parents. A 100 percentage-point increase in parental Medicaid eligibility limits resulted in about a 2.2 percentage point increase in Medicaid coverage in the full sample, a 5-percentage point increase among households with incomes below the median, and a 7 percentage point increase among households with incomes below 185% of the poverty level. For each of these groups, there were corresponding and significant declines in uninsured rates. For parents in households with incomes above the median or in households with incomes above 185% of poverty, there is no estimated change in Medicaid coverage or in uninsured rates following expansion of parental Medicaid eligibility. We observe little relationship between parental Medicaid eligibility thresholds and rates of private coverage among parents across all samples. Clearly, our estimation strategy successfully detects the impact of parental Medicaid eligibility expansions on parental Medicaid enrollment and uninsured rates.

Table 3 further assesses differences in parental coverage by race/ethnicity. A 100 percentage-point increase in Medicaid eligibility limits for parents is associated with a 2.8 and 3.5 percentage point increase in Medicaid coverage for non-Hispanic white parents and non-Hispanic black parents overall – analyses stratified by income group show that these effects are concentrated among low-income samples. Similarly,

Table 10
Event study analysis of impact of parental Medicaid eligibility on english-language arts achievement.

English-Language Arts Achievement	Economically Disadvantaged	Non-Economically Disadvantaged	Non-ECD vs ECD Gap	Black	White	White-Black Gap	Hispanic Students	White Students	White-Hispanic Gap
(t-6)	−0.005	−0.015	−0.009	0.010	−0.009	−0.020	−0.005	−0.012	−0.006
	(0.018)	(0.016)	(0.012)	(0.017)	(0.014)	(0.018)	(0.019)	(0.017)	(0.011)
(t-5)	−0.011	−0.012	<0.001	−0.008	−0.018	−0.011	<0.001	−0.010	−0.010
	(0.015)	(0.016)	(0.010)	(0.019)	(0.017)	(0.020)	(0.018)	(0.018)	(0.010)
(t-4)	−0.011	−0.012	<0.001	−0.001	−0.016	−0.016	<0.001	−0.013	−0.012
	(0.013)	(0.013)	(0.009)	(0.016)	(0.014)	(0.016)	(0.016)	(0.016)	(0.011)
(t-3)	−0.003	0.003	0.007	0.003	0.006	0.002	0.010	−0.002	−0.011
	(0.013)	(0.012)	(0.010)	(0.015)	(0.012)	(0.015)	(0.014)	(0.014)	(0.007)
(t-2)	0.006	0.004	−0.001	<0.001	−0.001	−0.001	0.014	0.005	−0.008
	(0.011)	(0.010)	(0.009)	(0.012)	(0.011)	(0.013)	(0.011)	(0.011)	(0.006)
($t = 0$)	0.008	0.007	<0.001	0.005	0.001	−0.005	−0.002	0.004	0.006
	(0.010)	(0.009)	(0.004)	(0.015)	(0.009)	(0.012)	(0.010)	(0.009)	(0.006)
($t + 1$)	0.010	0.006	−0.004	0.014	0.001	−0.013	−0.002	0.008	0.010
	(0.009)	(0.011)	(0.006)	(0.020)	(0.016)	(0.018)	(0.016)	(0.012)	(0.007)
($t + 2$)	0.007	0.002	−0.004	0.010	−0.008	−0.019	−0.004	0.003	0.007
	(0.012)	(0.011)	(0.009)	(0.030)	(0.019)	(0.023)	(0.016)	(0.014)	(0.009)
($t + 3$)	0.012	0.008	−0.004	0.041	0.002	−0.039	−0.015	0.003	0.016
	(0.022)	(0.018)	(0.010)	(0.043)	(0.022)	(0.030)	(0.018)	(0.015)	(0.011)
F-Test (p-value)	0.249	0.302	0.410	0.172	0.169	0.117	0.706	0.544	0.716

Sources: SEDA 2009–2018. Coefficients plot interaction between an indicator for the relative period and the magnitude of the change in eligibility that will occur in the state in period 0. Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. Standard errors are clustered at the state-level and are reported in parenthesis. P-values from F-test of joint significance of pre-treatment estimates. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

non-Hispanic white and non-Hispanic black parents have qualitatively similar estimates of reductions in rates of uninsurance. Although these impact estimates of Medicaid take-up and reduction in uninsured rates are similar across both black and white parents, Table 3 also highlights that a far larger share of black parents are represented in the low-income categories relative to white parents. For example, where less than a quarter (22%) of white parent have incomes below 185% FPL, nearly half (47%) of black parents are in this income range. Thus, we should predict that Medicaid parental eligibility expansion affect a larger share of black families relative to white families. Somewhat surprisingly, in our design we observe no change in Medicaid coverage following parental Medicaid eligibility expansions for Hispanic parents across all income groups. Given that other studies have documented that Medicaid expansion under the ACA resulted in substantial take-up effects for low-income Hispanic adults overall (e.g., Lee et al., 2021), we conclude that our absence of findings under our approach indicates that, *within* expansion and non-expansion states, Hispanic parents had similar outcomes independent of changes in parental Medicaid eligibility limits.

In Appendix Table 2, we assess whether increase in coverage results in improved healthcare access and use among parent with a high school degree or less education in the 2009–2018 Behavioral Risk Factors Surveillance System (BRFSS). We use a difference-in-differences model analogous to our main approach and find that parental Medicaid eligibility expansions are associated with increasing insurance coverage increased significantly among white parents (3.8 percentage points), black parents (4.5 percentage points), and, insignificantly, among Hispanic parents (2.6 percentage points). We find little evidence that these increased rates of coverage for parents translated to higher rates of checkups in the past 12 months. However, following parental Medicaid eligibility expansions, non-Hispanic white parents and non-Hispanic black parents both report significantly lower rates of delaying care due to cost in the past year, by 2.2 and 3.9 percentage points, respectively. There is no estimated effect for Hispanic parents. Finally, we find little evidence that parental Medicaid eligibility is associated with improving rates of self-reported health. Altogether, this evidence suggests that parental Medicaid eligibility may improve children's education achievement through bolstering household resources, i.e., the types of resources that prevent parents from receiving care due to cost-related barriers.

In Table 4, we further assess whether parental Medicaid eligibility expansions during this period are associated with any changes in coverage directly for children in grades 3 through 8, an additional potential mechanism through which parental Medicaid expansions could affect children's cognitive achievement. We find little-to-no effect of parental Medicaid eligibility expansions on children's Medicaid coverage, and observe little difference in Medicaid take-up-rates across groups by income. That child Medicaid coverage does not change with income is not surprising, since Medicaid eligibility limits for children were high and unchanged during this period of time (e.g. 70% of children in the first quartile of income are covered by Medicaid). Our analysis indicates that spillover effects on children's coverage is unlikely to be a major mechanism through which parental Medicaid may affect children's education achievement. We find no evidence that parental Medicaid eligibility expansions affected Medicaid coverage, uninsured rates, or private coverage amongst non-Hispanic white children or non-Hispanic black children. However, we find small increases in Medicaid coverage among Hispanic children (2.4 percentage points, marginally significant at the $p < 0.10$ level) following parental Medicaid eligibility expansions, that is slightly larger in magnitude among lower income groups. For Hispanic children, we observe movement from uninsured (2.6 percentage point reduction) to Medicaid (2.4 percentage point increase), although we note these findings may be spurious as we found no estimated direct first stage effects on parental coverage for Hispanic parents. Table 4 indicates that if parental Medicaid eligibility expansions are associated with any improvements in children's education achievement, for white and black children, it is unlikely through spillover effects in children's own coverage and therefore unlikely to be related to changes in children's healthcare access, use, and wellbeing. Ultimately, Table 4 raises the possibility of a direct effect operating through child coverage for Hispanic children. Yet, a recent study by Gopalan et al. (2022) explored the child health effects of Medicaid expansions and found no changes in children visiting the doctor or parents reporting improvements in their child's health, even after child coverage increased. For these reasons, we do not feel that changes in children's coverage rates represent a strong mechanism for the changes in education achievement in this analysis.

5.2. Estimates of parental Medicaid eligibility expansions on children's education achievement

We assess the impact of parental Medicaid eligibility expansions on math achievement and achievement gaps in Tables 5 through 7 and ELA achievement and achievement gaps in Tables 8 through 10. Estimates represent the intent-to-treat effect of parental Medicaid eligibility expansion on children's achievement overall and for each student subgroup. For each subject, we begin by presenting results from 3 models: first a basic difference-in-differences model that only includes county, year, and grade fixed effects and an indicator for whether a state-year had an ACA Medicaid expansion in effect; our second model adds indicators for the state's common core assessment type; and our third (preferred) model, adds county-year covariates described in the previous section. Next, we present results for each subject stratified by county poverty. Our county poverty measure are county poverty rates, provided directly in the SEDA data but ultimately derived from the ACS, and we separate counties with poverty rates above and below the state-specific median baseline (2008–2010) poverty rate. We predict that any effects of parental Medicaid expansions on children's education achievement to be concentrated in poorer counties, as families in these counties are more likely to become eligible and benefit from this policy. Finally, we present event-study estimates for each subject, which speak to concerns over common-trends assumptions.

Focusing on the math achievement among economically disadvantaged students (row 1 of Table 5), we find that a 100-percentage point increase in parental Medicaid income limits is associated with a 4.0% of a standard deviation increase in test scores in our baseline model (column 1), which diminishes slightly to 3.3% of a standard deviation (10.2% increase relative to the mean, $p < 0.05$) after including common core test type indicators and county-year covariates (columns 3). Among non-Hispanic Black students, we find a roughly 4.6% of a standard deviation improvement, although the estimate is statistically insignificant (9.8% increase relative to the mean; $p>0.1$). Among non-economically disadvantaged, Hispanic, and non-Hispanic white students, we find small and statistically insignificant changes in math achievement.

The subgroup findings in Table 5 raise the possibility that parental Medicaid eligibility expansions reduced socioeconomic and white-black achievement gaps. Our preferred model (column 3 of Table 5) suggests that parental Medicaid eligibility indeed narrowed both gaps. The socioeconomic achievement gap narrowed by 2% of a standard deviation (2.95% reduction relative to the mean; $p < 0.05$) while the white-black achievement gap narrowed by 4.4% of a standard deviation (6% reduction relative to the mean; $p < 0.1$).

To contextualize these results, consider that the average change in parental Medicaid eligibility income limits was 50 percentage points among states that increased parental eligibility during this period. Our estimates indicate that a 50 percentage point increase in parental eligibility implies a reduction in the socioeconomic achievement math gap by roughly 1.5% and the white-black achievement math gap by 3%, relative to their respective means. Both achievement gaps have remained large for decades, so although the magnitude of the impact of parental Medicaid eligibility expansion on math achievement gaps is small, even minor changes in these gaps may be meaningful in the context of historically persistent inequities in education achievement. We find no evidence of any narrowing of the white-Hispanic achievement gap in math.

Since parental Medicaid eligibility expansions depend on household income, effects of eligibility expansions are predicted to directly benefit economically disadvantaged students, irrespective of where they live and attend school. However, for effects by race and ethnicity, we should expect that poorer white, Black, and Hispanic kids benefit *more* from parental Medicaid expansions relative to less-poor students. Similarly, while we may suspect that socioeconomic achievement gaps in education achievement narrow relatively uniformly across regions, we suspect that white-Black and white-Hispanic education achievement gaps are more likely to narrow in areas where larger shares of parents become eligible for Medicaid, under the assumption that white children are relatively less poor than non-white children living in the same neighborhood.[9] To test these predictions, Table 6 presents results stratified by county poverty (above and below the median county poverty rate). Results for economically disadvantaged students are just slightly larger in counties with poverty rates above the median—a 100-percentage point increase in parental Medicaid income limits is associated with a 3.5% of a standard deviation ($p < 0.05$) increase in test scores in our poorer counties and a 3% of a standard deviation ($p < 0.05$) increase in wealthier counties – again, this is consistent with the expectation that parental Medicaid eligibility should benefit this group of students irrespective of where they attend school. We find no change in performance for non-economically disadvantaged students, as such, the socioeconomic achievement gap narrowed by 2.2% of a standard deviation in poorer counties and 1.9% of a standard deviation in higher income counties. For non-Hispanic black students, we find that test-score improvements were concentrated in poorer counties, with estimates pointing to a 5.2% of a standard deviation improvement ($p < 0.1$) compared to a 3.6 percentage of a standard deviation improvement in wealthier counties ($p>0.1$). Given that achievement amongst white students did not change, we also find a reduction in the white-black achievement gap of 5.8% of a standard deviation that is concentrated in counties with above median poverty rates. These results are also not surprising and support our hypothesized direction, since the only way in which race/ethnicity is expected to be correlated with Medicaid eligibility is through income. Again, we find no change in Hispanic performance following Medicaid expansions (Fig. 1).

In Table 7 we present event study versions of the difference-in-differences models for math achievement, overall and for each subgroup and achievement gap. Across the 9 regressions, *all* coefficients in the pre-treatment period (i.e. 45 total estimates) are small and statistically indistinguishable from zero, meaning that they are not significantly different from outcomes in the omitted reference year ($t=-1$). This finding is supportive of the parallel trends assumption and again supports the internal validity of the difference-in-differences research design suggesting that, in the absence of treatment, states that had larger changes in parental Medicaid eligibility expansions would have trended similar in math test scores as those with lesser changes in parental Medicaid eligibility over this period. Although no individual pre-treatment coefficient is statistically significant, results from tests of

[9] We predict that white students in poorer neighborhoods are more likely to be non-poor than black students. We cannot test this directly in the SEDA data, but we constructed a similar analysis using public-use microdata areas (PUMAs) in the ACS. Using 185% FPL as a threshold for economic disadvantage, we find that the share of white students in families with incomes below 185% FPL increases less rapidly with PUMA-level poverty (i.e. from 15% in the richest quartile to 47% in the poorest quartile) than the share of black students in families with incomes below 185% FPL (from 31% to 73%).

joint significance among pre-treatment coefficients for non-economically disadvantaged students ($p < 0.1$) and white students ($p < 0.01$) are statistically significant. Qualitatively, we note that the 95% confidence intervals of nearly all pre-treatment estimates overlap with all other pre-treatment estimates, demonstrating that the lack of significance in pre-treatment periods is not driven by the choice of the reference year, further supporting the validity of the research design. Event study results for math achievement among students residing in poorer counties are presented in Appendix Table 2.

Focusing on estimates for economically disadvantaged students, the estimates point to a 2.5, 2.9, and 2.7% of a standard deviation increase in math achievement during the first three years following the expansion ($t = 0$, $t + 1$, and $t + 2$). In year four following Medicaid expansions, the magnitudes of the estimate is qualitatively similar to those in the first three years, but the estimate becomes statistically insignificant. A similar pattern emerges for non-Hispanic Black students, with math achievement improving in the first two or three years following Medicaid expansions, consistent with the hypothesized dynamics in our conceptual framework and suggesting that some of the proposed mechanisms predicted to be immediately affected by parental Medicaid expansions (parental coverage, healthcare access, routine healthcare expenses, parental mental health) may, in turn, produce relatively immediate spillover effects to children's education achievement.[10]

Appendix Table 5 evaluates whether effects of parental Medicaid eligibility expansions on children's mathematics achievement varied by grade. Younger children may have younger parents, and this may increase the likelihood that their parents are Medicaid eligible, since age is positively related with income. Also, the education production function for math may alter with age, and the returns to cognitive investments at different grades may vary as well. Our analysis in Appendix Table 5 reveals very similar effects of parental Medicaid eligibility expansions on math achievement across these grades, suggesting limited evidence of heterogeneous effects by child grade or age.

In Tables 8 through 10, we replicate the results for math achievement focusing on ELA achievement. Throughout, we find little evidence that Medicaid expansions are associated with changes in ELA scores for any of the student subgroups. Indeed, all the ELA estimates in Table 8 are smaller in magnitude than the corresponding estimates for math (Table 5) and all are statistically insignificant. The one exception is the white-Hispanic ELA achievement gap (Table 9). Here we find a modest *increase* in the gap, driven by small and statistically insignificant reductions in Hispanic achievement and increases in non-Hispanic white achievement. However, event-study estimates in Table 10 reveal no statistically significant change following the expansion for any group or gap. We note that the event-study estimates for ELA achievement reported in Table 10 do suggest common pre trends and therefore our null findings for the effects of parental Medicaid expansions on ELA test scores appear internally valid. Lastly, analysis in Appendix Table 6 finds little evidence of differences in effects of parental Medicaid eligibility expansions on ELA achievement by child age or grade.

6. Conclusions

Our study demonstrates that expansions to state parental Medicaid programs can have positive spillover effects to children's human capital development and education achievement. Parental Medicaid eligibility expansions were associated with improvements in math achievement for economically disadvantaged students and non-Hispanic Black students that reside in poorer counties. The improvements in test performance also narrowed socioeconomic and white-black achievement gaps. Though the achievement gap reductions were not large in magnitude, they are nevertheless notable given the historic persistence of these gaps over many decades, despite various education interventions and reforms that have attempted to remedy these gaps more directly. One limitation of our study is that we only observe education outcomes 2–4 years after most states changed parental Medicaid eligibility limits. Skills may beget skills so that improving education among children may result in higher achievement in later grades, particularly in math, where more challenging concepts in later grades build on the understanding of foundational concepts taught in earlier grades. An area of future research remains to assess the longer-term effect of parental Medicaid eligibility expansion on children's education achievement and attainment.

We observe no changes in achievement for Hispanic children. Our analysis using ACS data, which exploits variation in parental Medicaid eligibility coverage after adjusting for state expansion status and common core test trends, suggests very little effect of parental Medicaid expansion on Medicaid take-up or uninsurance rates among Hispanic parents. This is somewhat inconsistent with the larger literature surrounding the ACA Medicaid expansions and the insurance coverage of disadvantaged minorities, although note that findings surrounding the relative coverage effects among Hispanic adults are not conclusive. For example, Wehby and Lyu (2018) found no association between Medicaid expansion and uninsured rates for Hispanic adults while Buchmueller et al. (2016) found that uninsured rates for Hispanic adults fell by 4.2 percentage points in expansion states relative to nonexpansion states. The lack of a strong first stage effect for Hispanic parents may explain the absence of any estimated effect of parental Medicaid eligibility expansion on the education achievement of Hispanic children. Additionally, rates of private coverage did not fall for Hispanic children following parental Medicaid eligibility expansions as they do for black children. Since Hispanic children are mostly coming to Medicaid from the margin of being previously uninsured, Hispanic families are not seeing any immediate savings from expenditures on premiums for private coverage as some black families are. While insurance coverage improves access to care and may improve child health, these benefits are likely less immediate to the education production function, while reductions in expenditures for premium payments may benefit black children immediately. Finally, heterogenous treatment effects of parental and child health insurance coverage could result in different observations as well – unfortunately we have no ex ante predictions for such heterogenous effects and it remains an area of future research.

Data availability

Data are available through the Stanford Education Data Archive (SEDA).

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Appendix Figures and Tables

[10] Corresponding event-study study figures appear in Figure 1, where each panel presents event-study results specific to either the level of achievement (left panels) for economically disadvantaged students, black students, and Hispanic students, or the associated achievement gaps (right panels). The figure highlights the fact that pre-trends appear similar between more or less generous expansion settings. In Appendix Tables 3 and 4, we also present event-study tables for mathematics and reading among counties with poverty above the median. The results are similar to the estimates from the overall sample.

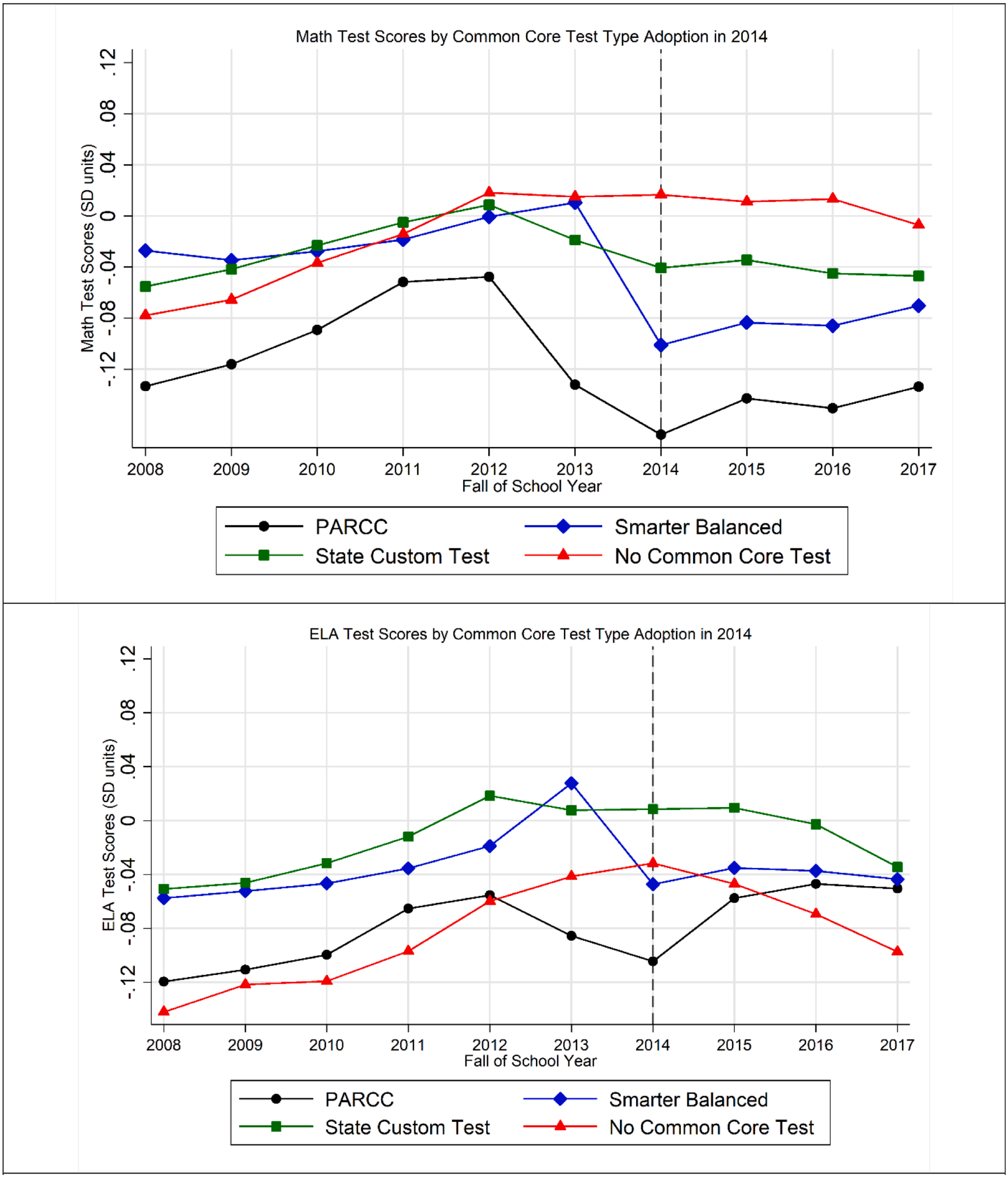

Fig. 1.A. Math and English-Language Arts Test Scores by Common Core Test Type Adoption in 2014. Notes: SEDA 2009–2018.

Table 1.A
Common core test type, by state (2014–2015).

State	Common Core Test Type used in (2014–2015)
Alabama	Own state assessment
Alaska	Did not adopt Common Core
Arkansas	PARCC
California	Smarter Balanced
Colorado	PARCC
Connecticut	Smarter Balanced
Delaware	Smarter Balanced
District of Columbia	PARCC
Florida	Own state assessment
Georgia	Own state assessment
Hawaii	Smarter Balanced
Indiana	Did not adopt Common Core
Iowa	Own state assessment
Kansas	Own state assessment
Kentucky	Own state assessment
Louisiana	PARCC
Maryland	PARCC
Massachusetts	PARCC
Michigan	Smarter Balanced
Mississippi	PARCC
Montana	Smarter Balanced
Nebraska	Did not adopt Common Core
Nevada	Smarter Balanced
New Hampshire	Smarter Balanced
New Jersey	PARCC
New Mexico	PARCC
North Carolina	Own state assessment
North Dakota	Smarter Balanced
Ohio	PARCC
Oklahoma	Did not adopt Common Core
Oregon	Smarter Balanced
Pennsylvania	Own state assessment
Tennessee	Own state assessment
Texas	Did not adopt Common Core
Utah	Own state assessment
Virginia	Did not adopt Common Core
Washington	Smarter Balanced
West Virginia	Own state assessment
Wyoming	Own state assessment
Arizona	Own state assessment
Idaho	Smarter Balanced
Illinois	Smarter Balanced
Maine	Smarter Balanced
Minnesota	Own state assessment
Missouri	Own state assessment
New York	Own state assessment
Rhode Island	PARCC
South Carolina	Did not adopt Common Core
South Dakota	Smarter Balanced
Vermont	Smarter Balanced
Wisconsin	Smarter Balanced

Table 2.A
Impact of Medicaid parental eligibility on coverage, access, and health, by education and parent racial-ethnic background.

Coverage	
All parents	0.038**
	(0.011)
Non-Hispanic white parents	0.038**
	(0.016)
Non-Hispanic Black parents	0.045**
	(0.026)
Hispanic Parents	0.026*
	(0.013)
Sample average	0.691
Checkup in Last 12 Months	
All parents	0.011
	(0.009)
Non-Hispanic white parents	0.017
	(0.01)
Non-Hispanic Black parents	−0.004
	(0.024)
Hispanic Parents	0.013
	(0.011)
Sample average	0.600
Delayed Care Due to Cost in Last 12 Months	
All parents	−0.017*
	(0.009)
Non-Hispanic white parents	−0.022**
	(0.009)
Non-Hispanic Black parents	−0.039**
	(0.015)
Hispanic Parents	−0.007
	(0.02)
Sample average	0.240
Excellent or very good self reported health	
All parents	−0.007
	(0.008)
Non-Hispanic white parents	0.002
	(0.007)
Non-Hispanic Black parents	−0.022
	(0.018)
Hispanic Parents	−0.024**
	(0.01)
Sample average	0.416

Source: BRFSS 2009–2018. Sample restricted to non-elderly adults with a high school degree or less education reporting a child in their household. Coefficients plot interaction between an indicator for the relative period and the magnitude of the change in eligibility that will occur in the state in period 0. Regressions include state fixed effects, year fixed effects, indicators for age, sex, racial and ethnic background, and indicators for whether a state Medicaid expansion under the Affordable Care Act is in effect, and indicators for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment). Standard errors are clustered at the state-level.

Table 3.A
Event study analysis of impact of parental Medicaid eligibility on mathematics achievement, counties with poverty rates > Median.

Mathematics Achievement	Economically Disadvantaged	Non-Economically Disadvantaged	Non-ECD vs ECD Gap	Black	White	White-Black Gap	Hispanic Students	White Students	White-Hispanic Gap
(t-6)	−0.016	−0.002	0.015	−0.007	0.026	0.032	−0.009	−0.003	0.006
	(0.019)	(0.022)	(0.016)	(0.032)	(0.023)	(0.023)	(0.023)	(0.020)	(0.013)
(t-5)	−0.024	<0.001	0.024	−0.036	−0.017	0.017	−0.015	−0.014	0.003
	(0.019)	(0.021)	(0.013)	(0.035)	(0.022)	(0.023)	(0.022)	(0.018)	(0.011)
(t-4)	−0.011	0.015	0.026**	−0.020	0.010	0.028	−0.014	−0.005	0.010
	(0.019)	(0.017)	(0.012)	(0.029)	(0.018)	(0.017)	(0.018)	(0.014)	(0.012)
(t-3)	0.002	0.024	0.023*	0.004	0.021	0.017	0.012	0.004	−0.008
	(0.017)	(0.016)	(0.013)	(0.026)	(0.015)	(0.020)	(0.017)	(0.012)	(0.011)
(t-2)	−0.001	0.018	0.019**	−0.012	0.005	0.017	0.018	0.008	−0.010
	(0.014)	(0.015)	(0.009)	(0.021)	(0.013)	(0.015)	(0.016)	(0.011)	(0.011)
($t = 0$)	0.026**	0.024**	−0.002	0.043**	0.010	−0.033**	0.013	0.013	−0.001
	(0.011)	(0.010)	(0.007)	(0.016)	(0.016)	(0.013)	(0.014)	(0.011)	(0.010)
($t + 1$)	0.028**	0.015	−0.013	0.046**	0.003	−0.043*	0.014	0.007	−0.008
	(0.012)	(0.013)	(0.009)	(0.016)	(0.030)	(0.025)	(0.019)	(0.015)	(0.009)
($t + 2$)	0.029	0.017	−0.010	0.031	−0.007	−0.038	0.003	−0.011	−0.014
	(0.018)	(0.016)	(0.009)	(0.030)	(0.040)	(0.024)	(0.021)	(0.020)	(0.012)
($t + 3$)	0.029	0.017	−0.012	0.047	−0.021	−0.066**	−0.021	−0.030	−0.010
	(0.036)	(0.031)	(0.012)	(0.060)	(0.055)	(0.021)	(0.036)	(0.028)	(0.024)
F-Test (p-value)	0.575	0.185	0.062	0.220	0.002	0.223	0.497	0.657	0.038

Sources: SEDA 2009–2018. Coefficients plot interaction between an indicator for the relative period and the magnitude of the change in eligibility that will occur in the state in period 0. Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. Standard errors are clustered at the state-level and are reported in parenthesis. P-values from F-test of joint significance of pre-treatment estimates.

Table 4.A
Event study analysis of impact of parental Medicaid eligibility on english-language arts achievement, counties with poverty rates > Median.

Reading Achievement	Economically Disadvantaged	Non-Economically Disadvantaged	Non-ECD vs ECD Gap	Black	White	White-Black Gap	Hispanic Students	White Students	White-Hispanic Gap
(t-6)	−0.007	−0.012	−0.004	0.014	−0.010	−0.025	0.007	−0.008	−0.016
	(0.020)	(0.017)	(0.015)	(0.025)	(0.017)	(0.026)	(0.023)	(0.017)	(0.014)
(t-5)	−0.015	−0.004	0.011	−0.027	−0.029	−0.004	0.005	−0.006	−0.011
	(0.015)	(0.018)	(0.012)	(0.025)	(0.021)	(0.024)	(0.023)	(0.020)	(0.011)
(t-4)	−0.015	−0.006	0.010	−0.019	−0.026	−0.008	−0.009	−0.013	−0.005
	(0.012)	(0.013)	(0.011)	(0.020)	(0.016)	(0.015)	(0.018)	(0.017)	(0.012)
(t-3)	−0.002	0.011	0.014	0.002	<0.001	−0.003	0.017	−0.002	−0.018
	(0.014)	(0.012)	(0.012)	(0.019)	(0.015)	(0.016)	(0.015)	(0.015)	(0.011)
(t-2)	0.007	0.009	0.003	−0.005	−0.010	−0.008	0.013	0.007	−0.005
	(0.011)	(0.009)	(0.010)	(0.015)	(0.011)	(0.013)	(0.012)	(0.012)	(0.009)
($t = 0$)	0.005	0.010	0.006	0.006	−0.005	−0.013	−0.008	0.001	0.009
	(0.008)	(0.009)	(0.005)	(0.019)	(0.010)	(0.011)	(0.013)	(0.009)	(0.011)
($t + 1$)	0.009	0.006	−0.003	0.009	−0.002	−0.011	−0.004	0.009	0.012
	(0.009)	(0.011)	(0.007)	(0.021)	(0.020)	(0.014)	(0.020)	(0.013)	(0.011)
($t + 2$)	0.007	0.007	<0.001	0.006	−0.013	−0.019	−0.010	−0.003	0.007
	(0.013)	(0.011)	(0.010)	(0.029)	(0.024)	(0.018)	(0.017)	(0.016)	(0.013)
($t + 3$)	0.024	0.023	<0.001	0.045	0.003	−0.041	0.007	0.006	−0.003
	(0.023)	(0.018)	(0.012)	(0.048)	(0.028)	(0.026)	(0.021)	(0.016)	(0.019)
F-Test (p-value)	0.091	0.289	0.400	0.007	0.047	0.054	0.138	0.672	0.180

Sources: SEDA 2009–2018. Coefficients plot interaction between an indicator for the relative period and the magnitude of the change in eligibility that will occur in the state in period 0. Regressions include county fixed effects, year fixed effects, grade fixed effects, an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect, an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment), and the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level and are reported in parenthesis. P-values from F-test of joint significance of pre-treatment estimates.

Table 5.A
Impact of parental Medicaid eligibility expansion on mathematics achievement, by grade.

Mathematics Achievement	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Economically Disadvantaged	0.044	0.042	0.049	0.038	0.020	0.032
	(0.040)	(0.032)	(0.032)	(0.023)	(0.018)	(0.023)
Non-Economically Disadvantaged	0.031	0.040	0.028	0.017	0.008	0.022
	(0.039)	(0.031)	(0.028)	(0.025)	(0.026)	(0.026)
Socioeconomic Achievement Gap	−0.013	−0.003	−0.022	−0.021	−0.012	−0.011
	(0.012)	(0.012)	(0.014)	(0.011)	(0.015)	(0.015)
Black	0.036	0.052	0.047	0.025	0.022	0.007
	(0.051)	(0.041)	(0.035)	(0.035)	(0.031)	(0.020)
White	0.006	0.009	0.016	−0.003	−0.003	0.011
	(0.057)	(0.046)	(0.034)	(0.025)	(0.021)	(0.019)
White-Black Gap	−0.032	−0.043	−0.029	−0.028	−0.024	0.005
	(0.021)	(0.023)	(0.021)	(0.025)	(0.02)	(0.019)
Hispanic	0.002	−0.017	0.001	0.005	−0.019	0.011
	(0.035)	(0.04)	(0.038)	(0.023)	(0.025)	(0.029)
White	0.007	−0.003	0.008	0.005	−0.007	−0.005
	(0.038)	(0.034)	(0.030)	(0.024)	(0.021)	(0.026)
White-Hispanic Gap	0.006	0.013	0.005	0.002	0.007	−0.017
	(0.014)	(0.014)	(0.020)	(0.010)	(0.009)	(0.013)

Sources: SEDA 2009–2018. Notes: Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2017 and the magnitude of the change (see Table 1). All regressions include county fixed effects, year fixed effects, grade fixed effects, and an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect. Columns (2) and (3) further include an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment). Column (3) further includes the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

Table 6.A
Impact of parental Medicaid eligibility expansion on english and language arts achievement, by grade.

English-Language Arts Achievement	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Economically Disadvantaged	0.026	0.027	0.036	0.010	0.017	0.027
	(0.024)	(0.019)	(0.025)	(0.020)	(0.017)	(0.021)
Non-Economically Disadvantaged	0.042*	0.028	0.034	0.005	0.018	−0.009
	(0.023)	(0.024)	(0.022)	(0.019)	(0.016)	(0.019)
Socioeconomic Achievement Gap	0.015	0.003	<0.001	−0.004	0.003	−0.037**
	(0.011)	(0.014)	(0.012)	(0.01)	(0.009)	(0.018)
Black	0.004	0.015	0.017	0.005	0.009	0.017
	(0.033)	(0.027)	(0.034)	(0.025)	(0.025)	(0.025)
White	0.016	0.020	0.028	0.009	0.013	0.004
	(0.03)	(0.023)	(0.027)	(0.021)	(0.015)	(0.02)
White-Black Gap	0.013	0.004	0.011	0.003	0.003	−0.016
	(0.027)	(0.019)	(0.027)	(0.024)	(0.014)	(0.018)
Hispanic	−0.016	−0.020	0.012	−0.001	−0.002	0.019
	(0.028)	(0.019)	(0.017)	(0.019)	(0.025)	(0.024)
White	0.017	0.006	0.021	<0.001	0.011	−0.007
	(0.022)	(0.017)	(0.024)	(0.019)	(0.013)	(0.016)
White-Hispanic Gap	0.031	0.023	0.008	0.003	0.009	−0.026*
	(0.021)	(0.018)	(0.017)	(0.016)	(0.015)	(0.013)

Sources: SEDA 2009–2018. Notes: Estimates report coefficient of an interaction between indicator identifying periods after the state-specific change in parental eligibility limits 2008–2017 and the magnitude of the change (see Table 1). All regressions include county fixed effects, year fixed effects, grade fixed effects, and an indicator for whether a state Medicaid expansion under the Affordable Care Act is in effect. Columns (2) and (3) further include an indicator for state's common core test type (PARCC, Smarter Balanced, own state assessment, or no change in assessment). Column (3) further includes the following county-level characteristics: urbanicity, log of median income, unemployment rate, and the percent of students economically disadvantaged, Native American, Asian, Hispanic, Black, white, number of students tested, school expenditures per student, number of community health centers, and the number of primary care physicians. Standard errors are clustered at the state-level. ** and * indicate statistical significance at the $p < 0.10$ and $p < 0.05$ level, respectively.

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