The Impact of Preschool Entry Age on Low-Income Children's Use of Health and Social Services*

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Abstract

We find that public preschools are a gateway to health and social services. Low-income children born shortly before their state's school entry cutoff date are more likely to receive speech-language pathology, occupational or physical therapy, hearing or vision services, and dental care at ages three and four, compared to children born after the cutoff. There is also suggestive evidence that they are more likely to receive financial support through Supplemental Security Income at the same ages. These findings suggest that preschool enrollment connects low-income children to the health and social service system in ways that extend beyond the classroom.

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1 Introduction

A large body of evidence documents lasting benefits of early childhood education on children's long-term outcomes, especially among disadvantaged populations (Campbell et al., 2014; Hahn and Barnett, 2023). As mechanisms, the literature points to early education curricula promoting the development of cognitive and non-cognitive skills, and improvements in parent–child interactions (Heckman and Mosso, 2014; García and Heckman, 2023). However, preschools may also connect children to health and social services. Access to these services may play an important role in shaping children's long-term trajectories given that many developmental and behavioral health conditions benefit from early intervention (Shonkoff and Phillips, 2000; Nelson, Sullivan, and Engelstad, 2024).

This paper uses administrative Medicaid data to study how earlier access to public preschool impacts the receipt of health and social services. We focus on children born in 2008-2009 and 2013-2014, whom we can observe at ages three and four in the data.[1] We use variation from public school entry cutoff dates to compare the outcomes of children with birth dates just before and after the cutoff in their state in a regression discontinuity design.[2] These children are born just days apart, but face an almost one-year gap in the age at which they can enroll in a public preschool: those born before the cutoff can enroll shortly after turning three, while those born after the cutoff must wait until they are nearly four.[3] This additional year of waiting is most often spent in informal or family-based care.[4]

We find that children born just before the school entry cutoff date are 0.9 percentage points (10.5 percent) more likely to receive speech-language pathology services, 0.4 percentage points (11.9 percent) more likely to receive occupational or physical therapy, 0.4 percentage points (9.8 percent) more likely to receive hearing or vision services, and 1.1 percentage points (1.7 percent) more likely to receive dental care. These additional services are received both inside and outside of schools: services delivered by schools are 1.1 percentage points (22.3 percent) higher among children born

[1] We select these two cohorts because we can observe them at ages three and four entirely within the same Medicaid data format. Medicaid transitioned from the Medicaid Analytic eXtract to the Transformed Medicaid Statistical Information System Analytic Files format in 2015, and there are known data quality problems around the transition period (Schpero et al., 2025). See Section 2 for more details.

[2] According to American Community Survey (ACS) data covering years 2011–2019 in the 31 states and Washington, DC used in our analysis, about 18 percent of children aged three and 40 percent of children aged four are enrolled in public preschools. The ACS considers public preschool to be a nursery school or preschool that is operated by and/or supported primarily by any level of government. This includes federal programs like Head Start, as well as state-level universal and targeted preschool and pre-Kindergarten (pre-K) programs.

[3] Public preschool programs like Head Start and universal pre-K use the same cutoff dates as the public elementary schools in their districts (NIEER, 2026).

[4] Less than eight percent of Medicaid-covered children attend private preschools that do not necessarily adhere to these cut-off dates. The percent of Medicaid-covered children attending private preschools comes from the authors' calculations using ACS data for Medicaid-covered children in 2011–2019 in the 31 states and Washington, DC used in the main analysis.

before the cutoff,[5] while services delivered elsewhere are 1.2 percentage points (2.0 percent) higher. Moreover, access to services appears to extend beyond the school and healthcare systems—children born before the cutoff are 0.2 percentage points (6.6 percent, marginally significant at the 10 percent level) more likely to receive Supplemental Security Income at ages three and four than those born after the cutoff.

While we cannot observe public preschool enrollment directly in the Medicaid data, the increase in services delivered by schools strongly suggests enrollment is a key driver. Moreover, we find that diagnoses of behavioral and developmental health conditions, including speech and language disorders, hearing or vision conditions, and Attention Deficit Hyperactivity Disorder (ADHD), are more common among children born just before than just after the cutoff. This diagnosis gap, which we observe at the preschool ages of three and four, parallels research showing that *elementary* school environments drive similar gaps among children aged five and older.[6] In further support of preschool as a main mechanism, we show that being born before versus after the cutoff does not affect three placebo diagnoses unlikely to be detected or triggered by school exposure.[7]

We also examine how the effects on our main outcomes vary with the age at which they are measured, using alternative samples of children observed at ages two through eight in the Medicaid data. At age two, we find no gap in service receipt between children born before and after the school entry cutoff. This aligns with preschool as a key channel because two-year-olds are not yet eligible to enroll in preschool. For speech-language pathology, occupational or physical therapy, and hearing or vision services, the positive effects of being born before the cutoff emerge at age three and persist through at least age eight. The pattern is similar for SSI, though the confidence intervals are wide. The evidence on dental services is less clear, with a significant increase in service receipt at age three, but a large drop in dental services at age five. These trends reflect a separate confounder: many states require an oral health screening in the 12 months before a child begins kindergarten.[8] Overall, these results imply that kids who are born after the cutoff do not

[5]Schools directly bill Medicaid for school-based services, so we can measure them in our Medicaid claims data.

[6]See, for example: Elder, 2010; Evans, Morrill, and Parente, 2010; Dhuey and Lipscomb, 2010; Mühlenweg and Puhani, 2010; Black, Devereux, and Salvanes, 2011; Dalsgaard et al., 2012; Morrow et al., 2012; Zoëga, Valdimarsdóttir, and Hernández-Díaz, 2012; Clark and Royer, 2013; Halldner et al., 2014; Krabbe et al., 2014; Pottegård, Hallas, and Zoëga, 2014; Chen et al., 2016; Schwandt and Wuppermann, 2016; Layton et al., 2018; Whitely et al., 2018; Dee and Sievertsen, 2018; Dhuey et al., 2019; Root et al., 2019; Balestra, Eugster, and Liebert, 2020; Furzer, 2020; Furzer, Dhuey, and Laporte, 2022; Nicodemo, Nicoletti, and Vidiella-Martin, 2024; Persson, Qiu, and Rossin-Slater, 2025; de Gage et al., 2025; Cavallo et al., 2026.

[7]We focus on the placebo diagnoses of congenital anomalies (e.g., Down syndrome), intellectual disabilities, and sickle cell disease which are typically diagnosed prenatally or in early infancy.

[8]Because the oral health screening must occur in the year before starting kindergarten, the effect of the school entry cutoff varies with age. Children born before the cutoff start kindergarten shortly after turning five, so their screening typically falls at age four; children born after the cutoff start nearly a year later, so theirs typically falls at age five. Therefore, at age five, the children most likely to be screened are those born after the cutoff, which reverses the usual direction of the effect. At age four, the screening instead pulls in the children born before the cutoff, reinforcing the effect for reasons unrelated to preschool. The kindergarten requirement therefore complicates the interpretation of the effects on dental services at ages four and five, whereas the age-three effect

necessarily "catch up" in their service use as they move through preschool and enter elementary school.

While our results suggest that public preschool serves as a gateway to health and social services for low-income children, the welfare implications are nuanced. The additional services may reflect beneficial and needed care or over- or mis-allocation. The SSI effect is relatively easy to quantify: it is a direct financial transfer, with the 2026 maximum annual payment of $11,929 representing a substantial share of income for families on Medicaid. The value of the other health and social services that we measure depends on underlying need and conditions. While it is possible that some children would have improved their speech and language skills without these services as they age, it is harder to argue that vision services (i.e., prescription glasses) and dental care reflects "over-use." In fact, when we decompose dental services into the top three categories—preventive, diagnostic, and restorative—we find that children born before the cutoff are more likely to receive preventive and diagnostic dental care and less likely to receive restorative dental care (most often cavity fillings), consistent with a welfare-improving pattern of earlier prevention averting later problems.[9]

This paper contributes to the literature about the effects of early childhood education programs on children's outcomes. Studies have shown that the federal Head Start program improves short-term outcomes such as test scores (Currie and Thomas, 1995; Kline and Walters, 2016) and longer-term outcomes like high school graduation, teen parenthood, college enrollment, adult economic well-being, mortality, and crime (Garces, Thomas, and Currie, 2002; Ludwig and Miller, 2007; Deming, 2009; Gibbs, Ludwig, and Miller, 2013; Carneiro and Ginja, 2014; Walters, 2015; Thompson, 2018; Johnson and Jackson, 2019; Bailey, Sun, and Timpe, 2021), and even the outcomes of the next generation (Barr and Gibbs, 2022). The literature on the effects of universal public preschool programs extends these insights, finding positive effects on educational outcomes, especially among lower-income children (Gormley and Gayer, 2005; Fitzpatrick, 2008; Wong et al., 2008; Weiland and Yoshikawa, 2013; Lipsey, Farran, and Durkin, 2018; Weiland et al., 2020; Gray-Lobe, Pathak, and Walters, 2023; Cascio, 2023), and on parental economic outcomes (Humphries et al., 2024; Jackson, Turner, and Bastian, 2025).[10]

While much of this literature emphasizes the importance of cognitive and non-cognitive skill development in the preschool environment, less is known about how preschools interact with health and social services. The Head Start Impact Study—a randomized evaluation of the Head Start program conducted by the US Department of Health and Human Services in 2002—found that

is more cleanly attributable to the preschool channel.

[9] A full welfare analysis would require tracing children's long-term outcomes and well-being, which our data and sample do not allow.

[10] Related, a large literature on older small-scale "model" early childhood education programs, including the Perry Preschool Program and the Carolina Abecedarian Project, find lasting positive impacts on a wide range of outcomes (see, e.g., Heckman et al., 2010; Heckman, Pinto, and Savelyev, 2013 as well as reviews in Almond and Currie, 2011 and Almond, Currie, and Duque, 2018).

the program led to higher use of health insurance and dental care in the short run, with effects fading out over time (Puma et al., 2010).[11] Additionally, an analysis of New York City's universal preschool program by Hong, Dragan, and Glied (2019) showed that eligibility for the program increased asthma- and vision-related diagnoses, immunizations and screenings for infectious diseases, and the treatment of hearing and vision conditions among children on Medicaid. Our findings build on this work by expanding the range of health and social services considered and using a sample of over two million Medicaid-enrolled children from 32 states.

We also build on the literature using kindergarten entry cutoffs to document differences in ADHD and other mental health-related diagnoses between younger-for-grade and older-for-grade children in the US (Elder, 2010; Evans, Morrill, and Parente, 2010; Layton et al., 2018), Canada (Morrow et al., 2012; Furzer, 2020), Denmark (Dalsgaard et al., 2012; Pottegård, Hallas, and Zoëga, 2014), Germany (Schwandt and Wuppermann, 2016), Iceland (Zoëga, Valdimarsdóttir, and Hernández-Díaz, 2012), the Netherlands (Krabbe et al., 2014), Sweden (Halldner et al., 2014; Persson, Qiu, and Rossin-Slater, 2025), Taiwan (Chen et al., 2016), and the United Kingdom (Root et al., 2019; Clark and Royer, 2013). These studies measure diagnosis gaps at elementary school ages (and older), and point to mechanisms related to mis- or over-diagnoses of children who are less mature than their classmates due to being relatively young-for-grade (see also Whitely et al., 2018 for a systematic review of the literature across nine countries). We show that there are significant gaps in access to health and social services—which are likely in part driven by gaps in diagnoses—that appear before children begin kindergarten due to earlier exposure to preschool.

2 Data and Sample

We use administrative data from the Medicaid program, the primary source of public insurance coverage for low-income individuals in the United States (Stanford Center for Population Health Sciences, 2023a,b,c). In 2025, Medicaid and, its extension, the Children's Health Insurance Program (CHIP) covered approximately 78 million Americans (Centers for Medicare & Medicaid Services, 2025a). The data are collected and curated by the Centers for Medicare & Medicaid Services (CMS), and capture all Medicaid and CHIP beneficiary claims from 2011 to 2019 (i.e., a 100 percent sample).

Two different data formats were used over this period. In 2011–2014, states submitted their data via Medicaid Analytic eXtract (MAX) files, while in 2016–2019, states used Transformed Medicaid Statistical Information System Analytic Files (TAF). Most states shifted formats in 2015 and there are known data quality issues associated with the transition (Schpero et al., 2025). Therefore, we focus on two cohorts of children born in March 2008–February 2009 and March 2013–February 2014, and restrict our observation windows to fall entirely within the MAX (2011–

[11] Related, studies of the initial implementation of the Head Start program in the 1960s point to the importance of the program's health and nutrition services, including vaccinations, screenings, referrals to medical providers, and healthy meals and snacks (Ludwig and Miller, 2007; Bailey, Sun, and Timpe, 2021).

2014) and TAF (2016–2019) periods, respectively.[12] We include children who are ever enrolled in full-scope Medicaid or CHIP at age three.[13]

Our main sample focuses on children residing in the 31 states and Washington, D.C. that have a uniform legislated kindergarten school entry cutoff date that remained the same throughout our analysis period.[14,15] Table A1 reports the relevant cutoff dates by state. We exclude five states—California, Hawaii, Michigan, Nebraska, and Tennessee—that changed their cutoff date over our analysis period. We also exclude Connecticut, which has a January 1st cutoff, to avoid potential bias due to manipulation of births in response to claiming the Earned Income Tax Credit (LaLumia, Sallee, and Turner, 2015).

Our baseline sample contains 2,432,094 children: 1,221,238 in the first cohort and 1,210,856 in the second cohort. The estimation sample is smaller because it only includes children born in narrow bandwidths around the school entry cutoff, as described in Section 3. Additionally, we test the robustness of our results to restricting our analysis to the sub-sample of children continuously enrolled in Medicaid throughout the observation period (1,432,989 children; see Appendix A.2 for more details).

We use the demographic enrollment file to construct our cohort-based samples. The file contains information on beneficiaries' birth date, race, ethnicity, sex, and residence ZIP code.[16] It also contains anonymized unique identifiers for each beneficiary based on social security numbers.[17] We use unique identifiers to link the enrollment file to beneficiaries' other services (OT) claims over the window spanning the first day of the month in which they turn three to the last day of the month before they turn five.[18,19] Crucially for our research design, all children in our analysis sample are observed at the exact same ages, which means that any discontinuities at the school entry cutoff cannot be explained by differences in outcome observation windows.

[12] We use March-February cohorts to center birth dates around the modal school entry cutoff date of September 1.

[13] We drop beneficiaries who receive partial benefits (e.g., undocumented immigrants in some states) to ensure we observe their full set of claims.

[14] Cutoff dates for kindergarten entry for each state were sourced from the National Center for Education Statistics (2018) and the Education Commission of the States (2014, 2011, 2013). Whenever the sources provided conflicting information or a cutoff date changed, we referred to legislative documents and newspaper articles for clarification, as described in Table A2. To confirm public preschool programs follow school entry cutoff dates, we used NIEER, 2026, secondary sources in Table A2, and, specific to Head Start, Head Start Program Performance Standards (2024).

[15] We assign beneficiaries to their state of residence in the year they turn three.

[16] We define beneficiaries' race and ethnicity as the most frequently reported non-missing value over 2011–2019.

[17] There are state-specific Medicaid identifiers for individuals without a social security number, but these identifiers are not necessarily unique over time. We therefore omit children without a CMS unique identifier, since our analyses require the ability to follow children over time.

[18] The OT files contain claims for services occurring in many settings, including physician offices, emergency departments, and outpatient clinics, along with the associated ICD diagnosis and procedure codes.

[19] The data contain fee-for-service claims and "encounter" records for individuals enrolled in Medicaid managed care plans. We broadly refer to our data as "claims" although the encounter information does not include payment information.

Outcomes. We focus on health and social services that teachers and other staff in formal early childhood settings may initiate or recommend.[20] A useful feature of the data is that we can separately identify claims billed by preschools, implying that a child who receives these services is interacting with the school environment (MACPAC, 2024).[21] We create indicators capturing the receipt of the following services: speech-language pathology, occupational or physical therapy, hearing or vision services (e.g., hearing aids, glasses, and contact lenses), and dental services. We further decompose dental services into diagnostic, preventive, and restorative. Diagnostic care includes exams and radiographs used to detect disease; preventive care includes cleanings, fluoride treatments, and sealants that avert disease; and restorative care includes procedures like fillings and crowns that treat disease after it has developed. Lastly, we construct an indicator for receipt of Supplemental Security Income (SSI), which we observe in the Medicaid enrollment files for children who are enrolled as SSI recipients.

As secondary outcomes, we consider diagnoses of conditions that impede learning, are known to benefit from early intervention, and are likely to be diagnosed as a result of a referral or nudge from an educator in a formal learning environment: speech and learning disorders, hearing or vision conditions, and Attention Deficit Hyperactivity Disorder (ADHD). For placebo tests, we include three outcomes that are unlikely to be affected by preschool attendance—congenital anomalies (e.g., Down syndrome), intellectual disabilities, and sickle cell disease—because they are typically diagnosed prenatally or in infancy (NICHD, 2024; Moeschler, Shevell, and Committee on Genetics 2014; NHLBI, 2024). Appendix A.2 and Table A3 provide more details on all of our outcomes and the exact codes used to define them.

Descriptive statistics. Table 1 presents means of observable characteristics for the children in our sample, split by whether they are born in the 70 days before or after the school entry cutoff date.[22] Our sample is fairly evenly split between the two cohorts and balanced in terms of child sex. About 23 percent of the children are Black, 32 percent are Hispanic/Latino, 34 percent are white, and just over 11 percent belong to another race and ethnicity group or are missing this information. Around 19 percent reside in a rural ZIP code.[23]

Approximately nine percent of children receive speech-language pathology therapy, four percent receive occupational or physical therapy, four percent receive hearing or vision services, 63 percent

[20] Our focus is on services targeting conditions that impede learning and development, which may be flagged by preschool staff. We exclude health outcomes like respiratory diagnoses (e.g. flu infections) and accidental injuries (e.g., broken bones), which may be directly caused by preschool attendance.

[21] This includes claims filed by Head Start programs, but whether we categorize the place of service as a school depends on whether the Head Start program is run by an Local Education Agency or some other type of organization, like a non-profit. For instance, in Missouri, "office" is explicitly stated as the place of service for services delivered by Head Start (Missouri Department of Social Services, MO HealthNet Division, 2018).

[22] We use a 70-day bandwidth in this table because it is the maximum one selected by the optimal bandwidth algorithm used in estimation that is divisible by seven (for seven days in the week), as described in Section 3.

[23] We use the urban/rural zip code crosswalk from the USDA (2025).

receive dental services, and three percent are enrolled in Medicaid via SSI. When it comes to diagnoses of behavioral and developmental conditions, we observe that seven percent of children have a speech or language disorder, one percent have a hearing or vision condition, and two percent are diagnosed with ADHD. The rates of our placebo outcomes—congenital anomalies, intellectual disabilities, and sickle cell disease—are all lower than one percent.

Table 1 shows that the observable characteristics of children born before and after the cutoff are very similar. However, the percentages receiving health and social services and the rates of behavioral and developmental health diagnoses differ. We explore the differences between children born before and after the school entry cutoff more formally using the regression discontinuity design approach, as described in Section 3.

Preschool enrollment. Since the Medicaid data do not allow us to directly observe preschool enrollment, we supplement our analysis using data from the American Community Survey (ACS) for years 2011–2019. We construct a sample of 135,208 three- and four-year-old children who are reported to be insured by Medicaid and who reside in the 31 states and Washington, DC included in our main analysis. We then calculate the share of children enrolled in public and private preschools by year. The ACS defines public preschool as any nursery school or preschool that is operated and funded primarily by a local, county, state, or federal government, which includes universal public preschool programs and Head Start (U.S. Census Bureau, 2011).

Figure 1 presents the trends in public preschool enrollment among three- and four-year-olds in this sample. Over 2011-2019, we find that about 18 percent of Medicaid-covered three-year-olds and 40 percent of Medicaid-covered four-year-olds attended public preschools, respectively. We find that less than eight percent of these children reported attending private preschools. This implies that the most common counterfactual to public preschool is informal or family-based care. Figure 1 also shows that attendance rates are stable over our analysis period.[24] These estimates could be used to scale the impacts of preschool entry age into approximate treatment-on-the-treated effect sizes for children attending public preschools.

3 Empirical Framework

To estimate the impacts of preschool entry age, we use a regression discontinuity design that compares children with birthdays shortly before and after the school entry cutoff date in their state of residence. We estimate the following regression model using individual-level data, with the running variable measuring the number of days between a child's exact birthday and the school entry cutoff:

[24] In contrast, NIEER (2026) shows public preschool enrollment grows over time because their definition does not include Head Start.

$$Y_{its} = \beta_0 + \beta_1 \mathbf{1}[D_i < c_s] + f(D_i - c_s) + \mathbf{1}[D_i < c_s] \times f(D_i - c_s) + \mathbf{x'}_i\gamma + \delta_t + \rho_s + \epsilon_{its} \quad (1)$$

for each child i born in cohort t (either 2008–2009 and 2013–2014) and residing in state s. Y_{its} is the outcome of interest, such as an indicator for receiving speech-language pathology services at some point at ages three and four. $\mathbf{1}[D_i < c_s]$ is an indicator for a child's birthday D_i being before the cutoff c_s in their state, and $f(D_i - c_s)$ is a function of the running variable, which captures the difference in days between a child's birthday and the cutoff, and which we allow to differ on opposite sides of the cutoff. $\mathbf{x}_i$ is a vector of individual-level controls, which include indicators for whether one's birthday falls on a weekend or holiday, female sex, residing in an urban ZIP code, and race and ethnicity (white, Black, Hispanic, and other or missing). We also include fixed effects for the child's birth cohort, δ_t, and state of residence, ρ_s, to account for aggregate time trends and differences in policy environments and data quality across states, respectively. We cluster standard errors on the running variable (Lee and Card, 2008).

Our key coefficient of interest, β_1, captures the effect of being born before the cutoff date—and therefore eligible to start preschool shortly after turning three—on each outcome of interest. We estimate model (1) non-parametrically with a triangular kernel and bias-corrected inference procedure, and apply an optimal bandwidth selection algorithm (Calonico, Cattaneo, and Titiunik, 2014a,b; Calonico et al., 2017, 2019). We obtain optimal bandwidths ranging from 43.15 to 71.12 days around the cutoff in our primary specifications.

Identification and interpretation. The regression discontinuity design relies on the assumption that only the treatment variable changes discontinuously at the cutoff, and all other variables related to the outcomes are continuous functions of the running variable (Imbens and Lemieux, 2008; Lee and Lemieux, 2010). In our setting, treatment is measured by whether a child's birthday is before the school entry cutoff date, or that the child is eligible to start preschool at a younger age.

Since the school entry cutoff date is known, parents may strategically time births in a way that leads to non-random sorting, violating the identification assumption (Dickert-Conlin and Elder, 2010). To assess this possibility, Appendix Figure A1 plots the distribution of births of Medicaid enrollees in seven-day bins. There does not appear to be any major sorting around the cutoff visually, and the Cattaneo, Jansson, and Ma (2018) regression discontinuity design manipulation test yields an insignificant t-statistic of 0.08. Nevertheless, to address this possibility, we implement a "doughnut regression discontinuity design" in a robustness check by dropping children with birthdays within a week of the cutoff date. Since our analyses use a running variable with a daily frequency, the main concern is strategic manipulation of birth timing among families who conceive around the same time. This can happen through, for example, planned cesarean sections or inductions, and can alter the timing of birth by no more than a few days to a couple weeks.

Therefore, by dropping children born one week before to one week after the cutoff, we remove any such manipulations. As we discuss in Section 4, our results are very similar when using this alternative specification.

Another concern is that there could be non-random sorting around the cutoff because preschools facilitate enrollment in Medicaid, either by referring families to program offices or even signing them up directly. Importantly, this type of sorting would imply that we should expect to observe more children with birthdays before than after the cutoff in our sample, which we do not. That said, it is still possible that the composition of children differs between the two groups. We address this concern in two ways. First, we check whether there are any discontinuities in children's observable characteristics in the Medicaid data. Appendix Figure A2 shows that there are no significant jumps in the shares of female, Black, Hispanic/Latino, or white children at the cutoff. The share of children residing in an urban ZIP code shows a slight and only marginally significant discontinuity of 0.5 percentage points, which is very small compared to the sample mean of 81 percent. As noted in Section 2, Table 1 provides further support for the comparability of children born before and after the cutoff by showing that the means of observable characteristics are similar across the two groups. Moreover, we find that our results are not sensitive to the inclusion or exclusion of individual-level controls. We also show that our results are robust to using a sub-sample of children who are continuously enrolled in Medicaid throughout the observation window. Overall, our sensitivity analyses support the identifying assumption and suggest that non-random sorting is unlikely to influence our key findings.

4 Results

We begin by presenting the results for health and social services received by children at ages three and four. Figure 2 contains raw data plots using seven-day bins in the running variable of the percentage of children who receive (a) speech-language pathology services, (b) occupational or physical therapy, (c) hearing or vision services, (d) dental services, and (e) SSI.[25] The graphs show clear discontinuities in each outcome at the cutoff date: children born before the cutoff are more likely to receive each type of service than children born after. We report the corresponding regression estimates for these outcomes in Panel A of Table 2, and print the estimate of β_1 from equation (1) on each graph for reference.[26]

Our results indicate that children born before the cutoff are 1.0 percentage point (10.5 percent) more likely to receive speech-language pathology services, 0.4 percentage points (11.9 percent) more likely to get physical or occupational therapy, 0.4 percentage points (9.8 percent) more likely to receive hearing or vision services, and 1.0 percentage point (1.7 percent) more likely to obtain dental care at the same ages. We also find that children born before the cutoff are 0.2 percentage

[25] We cannot show day-level bins due to minimum cell size disclosure requirements.

[26] Our regression models use the optimal bandwidth for each outcome (reported in the last column of Table 2), while our graphs use a consistent 70-day bandwidth for visual ease.

points (6.6 percent) more likely to receive SSI, but this result is marginally significant at the 10 percent level, consistent with the smaller visual gap in Figure 2(e).

Services delivered at versus outside of schools. Earlier preschool entry could improve access to services in two ways: directly, through services delivered at the school, or indirectly, through referrals to outside healthcare providers. To distinguish these channels, we construct an aggregate binary indicator for the receipt of any services across the five categories, and then separate the aggregate category into whether the services were or were not provided at school. The results appear in Figure 3. Overall, being born before the school entry cutoff raises the probability of receiving any services by 1.3 percentage points (1.9 percent). Receipt of school-delivered services rises by 1.4 percentage points (22.3 percent), while receipt of services from outside healthcare providers rises by 1.1 percentage points (1.8 percent). The much larger relative effect on school-based services suggests that direct provision by preschools is an important pathway behind our results, though the increase in outside services indicates that referrals also play a role.

Diagnoses. Since some of the health and social services that we study are only provided to children with diagnosed conditions or impairments (e.g., SSI), we also examine how earlier preschool entry affects behavioral and developmental health diagnoses at ages three and four. Figure 4 presents the raw data plots for rates of diagnoses of (a) speech and language disorders, (b) hearing or vision conditions, and (c) ADHD. We report the corresponding regression estimates in Panel B of Table 2 and, as before, print the estimate of β_1 from equation (1) on each graph for reference. We find that children born before the cutoff are 0.7, 0.1, and 0.4 percentage points (9.2, 14.8, and 16.9 percent) more likely to be diagnosed with speech and language disorders, hearing or vision conditions, and ADHD, respectively, at ages three and four, although the estimate for hearing or vision conditions is only marginally significant at the 10% level.[27] These conditions can impede children's learning at an early age and are likely to be flagged by educators in a preschool environment, suggesting that earlier preschool attendance drives the discontinuities. Our findings echo a large literature documenting similar diagnostic gaps (mostly in ADHD) due to starting elementary school at a younger age.[28]

We also present results for three placebo outcomes—congenital anomalies (e.g., Down syndrome), intellectual disabilities, and sickle cell disease—in Panel C of Table 2 and in Figure 5. These are severe, mostly genetically influenced conditions, typically diagnosed prenatally or in

[27] Our definition of vision conditions is restricted to profound visual impairments (e.g., blindness, glaucoma, retinal disorders) and excludes common conditions typically corrected with glasses. Because these severe conditions are relatively rare, our statistical power to detect effects is limited.

[28] E.g., Elder, 2010; Evans, Morrill, and Parente, 2010; Dhuey and Lipscomb, 2010; Mühlenweg and Puhani, 2010; Black, Devereux, and Salvanes, 2011; Dalsgaard et al., 2012; Morrow et al., 2012; Zoëga, Valdimarsdóttir, and Hernández-Díaz, 2012; Clark and Royer, 2013; Halldner et al., 2014; Krabbe et al., 2014; Pottegård, Hallas, and Zoëga, 2014; Chen et al., 2016; Schwandt and Wuppermann, 2016; Layton et al., 2018; Whitely et al., 2018; Dee and Sievertsen, 2018; Dhuey et al., 2019; Root et al., 2019; Balestra, Eugster, and Liebert, 2020; Furzer, 2020; Furzer, Dhuey, and Laporte, 2022; Nicodemo, Nicoletti, and Vidiella-Martin, 2024; Persson, Qiu, and Rossin-Slater, 2025; de Gage et al., 2025; Cavallo et al., 2026.

early infancy, for which we do not expect preschool attendance to affect the likelihood of diagnosis. Consistent with this conjecture, we do not find any significant discontinuities at the school entry cutoff for these outcomes.

Effects by age. Next, we explore how the effects of being born before the school entry cutoff date vary with the age of service receipt. To do so, we create several additional samples of children who are observed at different ages in the MAX and TAF data. Specifically, to study outcomes at age two, we use cohorts born in March 2009–February 2010 and March 2014–February 2015. To study outcomes at ages six to eight, we use two cohorts of children born in March 2005–February 2006 and March 2010–February 2011. We also exclude children residing in the three states (AR, DC, and IN) that used different cutoffs before 2011. We use our main analysis sample to study effects separately at ages three, four, and five, limiting each age-specific sample to children who are enrolled at that age.[29]

Figure 6 presents the RD estimates and 95% confidence intervals for each of our five main categories of services that are observed at the ages specified on the x-axis. We find no significant discontinuities in services delivered at age two, consistent with entry into public preschools being the main channel (since children are eligible to start preschool starting at age three). We then observe significant discontinuities in services starting from age three through eight. These patterns suggest that children who start preschool at an older age (i.e., those born after the cutoff) do not catch up in regard to service receipt as they move through preschool and into elementary school.

There is one important exception to the broad pattern. For dental services, we observe a flipped discontinuity at age five—that is, children born before the cutoff are less likely to receive dental care at age five than those born after the cutoff. This pattern is explained by state-level oral health screening mandates, which require children to have a dental evaluation in the year before beginning kindergarten (Association of State and Territorial Dental Directors, 2008; Heller et al., 2018). Children born after the cutoff are not eligible to start kindergarten until they are almost six, meaning that their pre-kindergarten-entry dental visit must occur when they are age five. By contrast, children born before the cutoff can start kindergarten right when they turn five, so their mandatory dental visit typically happens at age four. Importantly, these mandates also affect the interpretation of the discontinuity in dental services received at age four—that is, children born before the cutoff are more likely to have dental care not only due to preschool exposure, but also due to this kindergarten entry mandate. In light of this, in some of the dental care analyses that follow, we focus on the receipt of services at age three, which is unaffected by kindergarten entry mandates for children with birth dates on both sides of the school entry cutoff date.

Heterogeneity across individual characteristics. A large literature finds that the likelihood of diagnosis and the use of social and health services varies with children's race and ethnicity, sex,

[29] Although our main outcomes are defined as services received at ages three and four, we observe our main sample through the end of age five.

and residence in an urban versus rural area. For instance, Elder et al. (2021) find that Black and Hispanic students receive special education at lower rates than observationally similar white students, and Chauhan et al. (2023) find that Black and Hispanic children have lower rates of vision care access and higher rates of uncorrected vision impairment. Differences between boys and girls are also well documented—for example, girls are more likely to wear glasses than boys (Centers for Disease Control and Prevention, 2017). Urban-rural disparities exist as well: Bush et al. (2014) find that children with congenital hearing loss in rural Appalachia experience greater delays in diagnosis and are more likely to be lost to follow-up than children in non-rural areas.

Therefore, we ask whether the effects of earlier exposure to public preschool vary with these characteristics in Appendix Figures A3 and A4. Specifically, we present sub-group-specific β_1 coefficients and 95% confidence intervals in absolute terms in Appendix Figure A3 and as relative effects scaled by the respective sub-group outcome means in Appendix Figure A4. The effects are broadly similar across children from different racial and ethnic sub-groups, boys and girls, and those living in urban and rural ZIP codes, with overlapping confidence intervals for all outcomes. Thus, it does not appear that public preschools exacerbate pre-existing disparities in service use; if anything, they facilitate access similarly irrespective of children's race/ethnicity, sex, or urban/rural residence.

Welfare. While our results show that earlier entry into preschool increases the likelihood of receipt of a broad range of health and social services among Medicaid-covered children, how increases in these services affect welfare is less clear. For instance, there is considerable debate over whether the gap in ADHD diagnoses between young-for-grade versus old-for-grade children reflects over- or under-diagnosis of the condition (see e.g., Layton et al., 2018; Hinshaw and Scheffler, 2014; Evans, Morrill, and Parente, 2010).

In our setting, the welfare implications likely vary across the different categories of services. For example, while it is possible that some children who are young-for-grade (i.e., born before the school entry cutoff) would have improved their speech and language skills in the absence of speech-language pathology services, it is much harder to argue that providing prescription glasses or dental care to preschoolers represents over-use. Dental care, in particular, is neither stigmatized nor influenced by peer comparisons that educators in school settings may make between young-for-grade and old-for-grade students as they might in the context of ADHD and comparing students who are more or less mature. Therefore, we focus on dental care and binary indicators for the three largest subcategories—diagnostic, preventive, and restorative care—to shed light on the welfare implications of our findings.[30] Diagnostic care includes exams and radiographs used to detect disease; preventive care includes cleanings, fluoride treatments, and sealants that avert disease; and restorative care includes procedures like fillings and crowns that treat disease after it has

[30]Dental care is also interesting in its own right. Out of all of the services we study, it is the single largest category, accounting for 64.7 percent of health and social services received by children with a birthday within seventy days of the cutoff date (see Table 1).

developed. We therefore interpret a shift toward diagnostic and preventive care, and away from restorative care, as an improvement in children's dental health.

As discussed above, we focus on dental care received at age three to avoid confounding our estimates with kindergarten entry mandates regarding oral health screenings. Figure 7 and Table A5 present results.[31] We find that children born before the cutoff have a 0.92 percentage point (1.8 percent) higher likelihood of receiving diagnostic and preventive dental services, and a 0.65 percentage point (5.1 percent) *lower* likelihood of receiving restorative dental services, compared to their counterparts born after the cutoff. The decline in restorative care is meaningful relative to the baseline mean of about 12 percent. Together, these results suggest that earlier diagnostic and preventive care among children born before the cutoff reduces the need for downstream restorative care, a welfare-improving pattern.

Robustness. We conduct a number of analyses probing the sensitivity of our results and addressing concerns regarding possible non-random sorting around the school entry cutoff. Appendix Figure A5 and Table A6 show that our results are robust to using alternative optimal bandwidth algorithms and different bandwidths.[32]

Appendix Table A7 shows results from the "doughnut" regression discontinuity model that omits beneficiaries born in a one-week bandwidth around the cutoff. The results are similar to our main findings. Interestingly, the discontinuity in SSI receipt becomes larger and more significant in the doughnut regression discontinuity specification, consistent with there being an outlier point immediately to the right of the threshold in Figure 2(h).

Appendix Table A8 presents estimates of model (1) without the individual-level controls, while Appendix Table A9 presents the results for the subset of beneficiaries who are continuously enrolled throughout the observation period from their third to fifth birthday. All specifications largely confirm our main results.

That said, the outcomes of SSI and hearing or vision conditions are slightly sensitive to specification, although all point estimates are directionally similar. In some of the robustness tests, the sample size changes substantially. For instance, when we restrict to continuously enrolled beneficiaries, the sample size is 40 percent smaller, which reduces our statistical power. Given that some of the outcomes are quite rare—for example, 2.6 percent of children aged three and four are receiving Medicaid through SSI—it is not surprising that we lose statistical significance in these cases.

[31] Table A5 shows that 50.6 percent of children receive a dental service at age three. Of these children, 50.2 percent receive a diagnostic and preventive service, whereas 12.9 percent receive a restorative service. Diagnostic, preventive, and restorative are not defined to be mutually exclusive.

[32] Specifically, we use all of the possible options available in the `rdrobust` command.

5 Conclusion

The value of early intervention for children with behavioral and developmental conditions has been recognized for decades (e.g., Shonkoff and Phillips, 2000; Conroy and Brown, 2004; Petrenko, 2013; Britto et al., 2017; Nelson, Sullivan, and Engelstad, 2024). Yet low-income families often face barriers to accessing these interventions for their children due to multiple structural factors, including a lack of information, time, and money necessary to seek appropriate diagnoses, follow-up care, and resources.

This paper suggests that public preschool programs in the United States link families to health and social services that can support children's learning and development. Using administrative data from the Medicaid program and a regression discontinuity design, we show that, at ages three and four, children born shortly before their state's preschool entry cutoff date are more likely to receive health and social services than children born shortly after. The additional resources also seem meaningful. For instance, receiving SSI benefits from a younger age translates into a material increase in income—for 2026, the annual SSI payment is $11,929. And the increase in dental services reflects an increase in diagnostic and preventive care, and a decrease in restorative care. These effects appear to be universal in the Medicaid population, spanning all races, ethnicities, sexes, and urbanicity subgroups.

While our findings are strongly consistent with the possibility that attending public preschool at a younger age leads to earlier access to health and social services, our data are limited by a lack of information on actual preschool enrollment. Future research linking health and education data can assess this more directly. Moreover, an analysis of the longer-term outcomes of children who receive services at preschool ages would help illuminate the long-term value of public preschool for human capital development and well-being.

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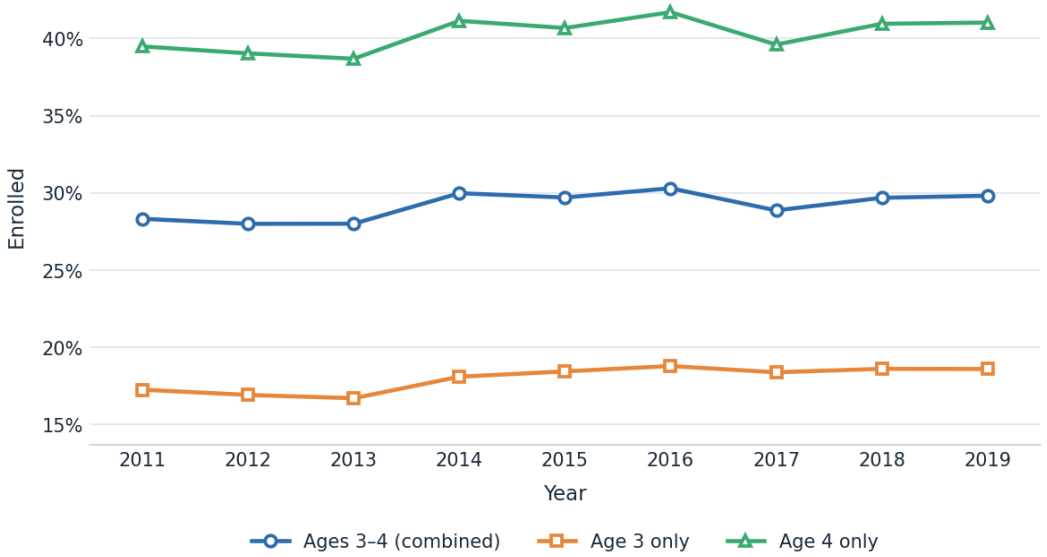
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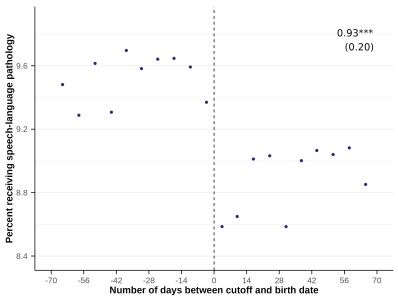
6 Figures

Figure 1: Percent of Children on Medicaid Enrolled in Public Preschool

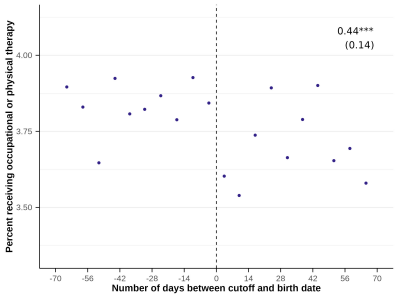


Notes: This figure displays the percentage of children aged three and four on Medicaid who are enrolled in public preschool, from 2011 to 2019. Using the ACS 1-year estimates, we restrict to 135,208 three- and four-year-olds in our 32 analysis states who receive Medicaid or any government-assistance plan for those with low incomes or a disability. Then, we tabulate the yearly percentage of children attending public nursery school or preschool, defined as facilities controlled and supported primarily by a local, county, state, or federal government (e.g., universal public preschool programs and Head Start).

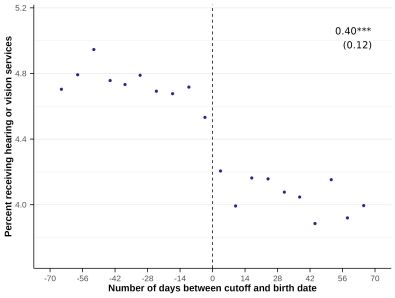
Figure 2: Receipt of Health and Social Services at Ages Three and Four by Birth Date



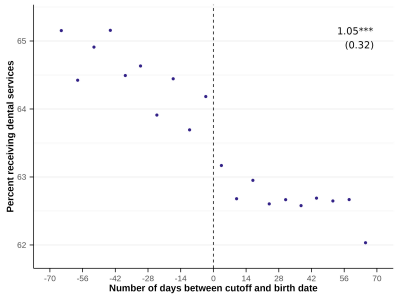
(a) Speech-language pathology



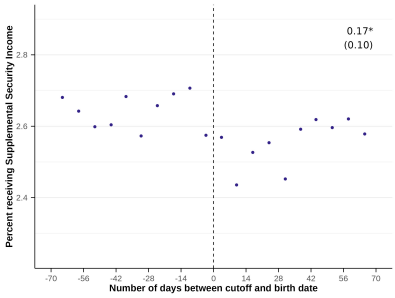
(b) Occupational or physical therapy



(c) Hearing or vision services



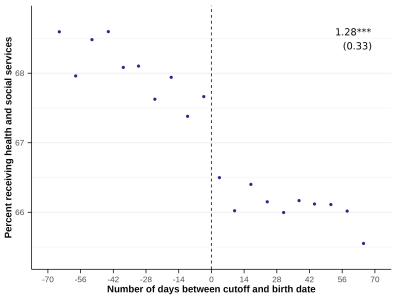
(d) Dental services



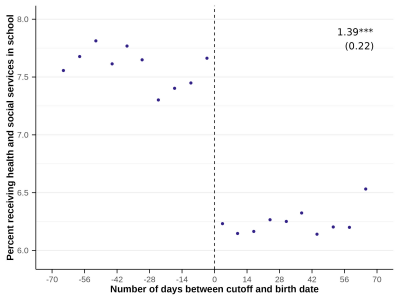
(e) Supplemental Security Income

Notes: The sample is comprised of two cohorts of children born in March 2008–February 2009 and March 2013–February 2014 who are observed in the Medicaid data at ages three and four. We include children residing in the 31 states and Washington, DC that have a uniform legislated school entry cutoff date that remained the same throughout our analysis period. The plots display the percentages of receipt of services in seven-day bins within a bandwidth of 70 days around the cutoff. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. Figures include the regression discontinuity estimate and standard errors from Panel A of Table 2.

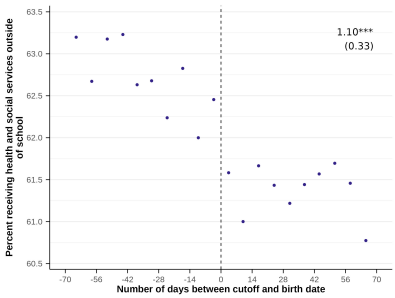
Figure 3: Whether Health and Social Services Occur Inside or Outside of School



(a) Any health or social service



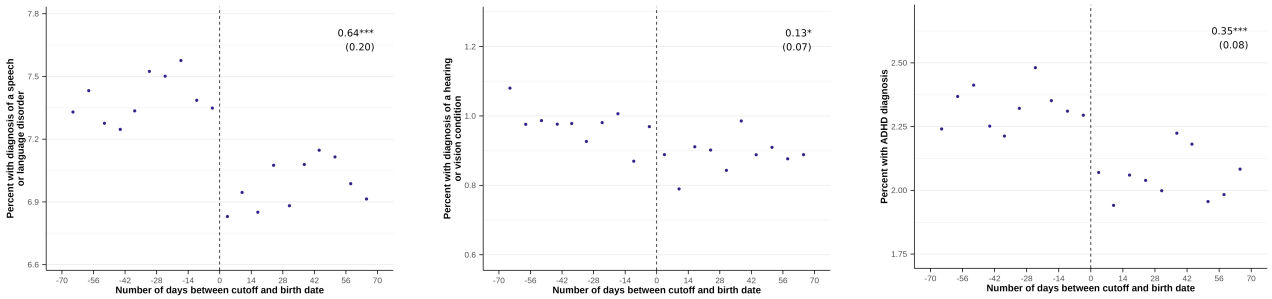
(b) Inside of school



(c) Outside of school

Notes: See notes under Figure 2 for more details on the sample. The plots display the percentages of receipt of services in seven-day bins within a bandwidth of 70 days around the cutoff. Figures include the regression discontinuity estimate of β_1 in equation 1 and standard errors (in parentheses), which are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code.

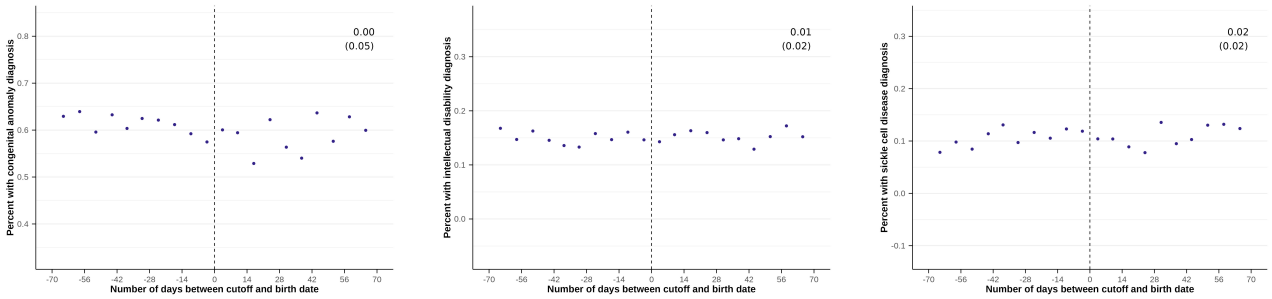
Figure 4: Behavioral and Developmental Health Diagnoses at Ages Three and Four by Birth Date



(a) Speech and language disorders (b) Hearing or vision conditions (c) ADHD

Notes: See notes under Figure 2 for more details on the sample. The plots display the percentages of diagnosis in seven-day bins within a bandwidth of 70 days around the cutoff. "ADHD" denotes attention-deficit/hyperactivity disorder. Figures include the regression discontinuity estimate and standard errors from Panel B of Table 2.

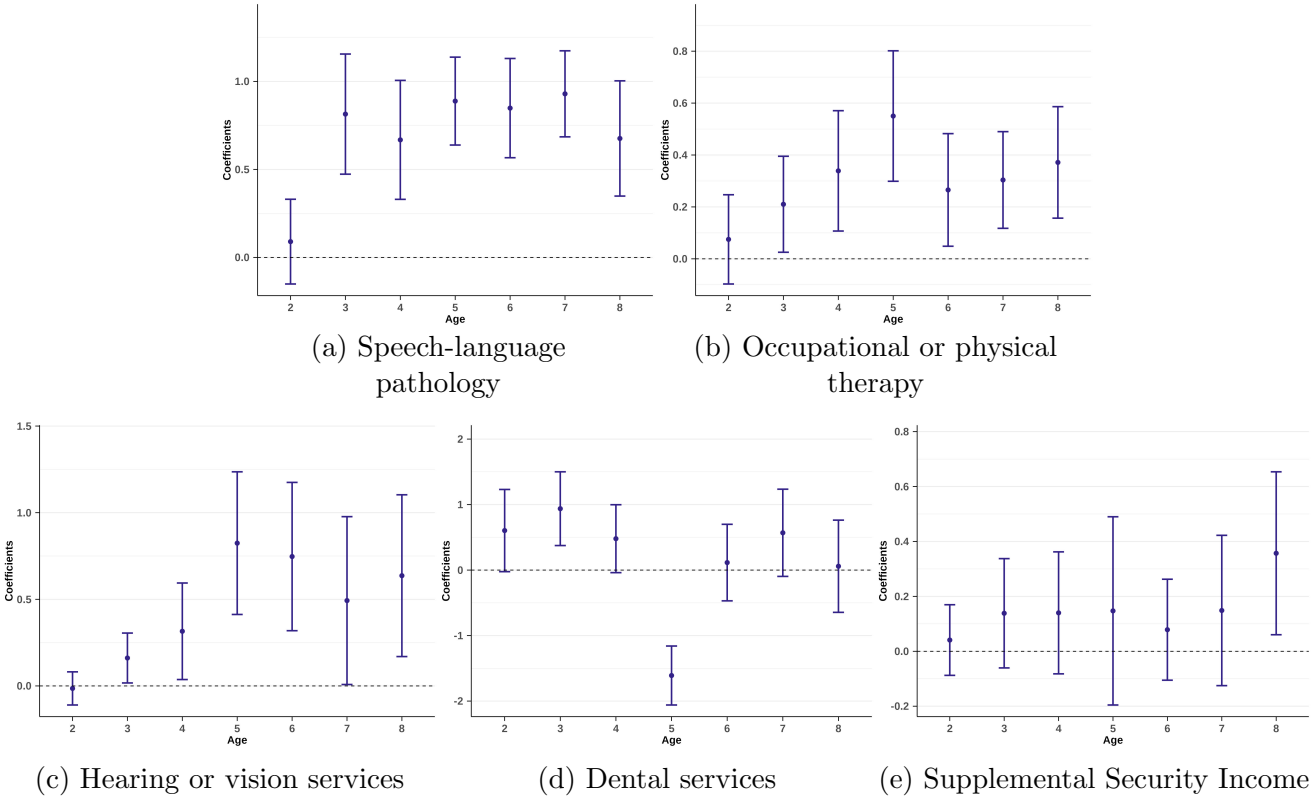
Figure 5: Placebo Diagnoses at Ages Three and Four by Birth Date



(a) Congenital anomalies (b) Intellectual disabilities (c) Sickle cell disease

Notes: See notes under Figure 2 for more details on the sample. The plots display the percentages of diagnosis in seven-day bins within a bandwidth of 70 days around the cutoff. Figures include the regression discontinuity estimate and standard errors from Panel C of Table 2.

Figure 6: Regression Discontinuity Estimates of the Effect of Being Born Before the School Entry Cutoff Date at Ages Two to Eight



(a) Speech-language pathology

(b) Occupational or physical therapy

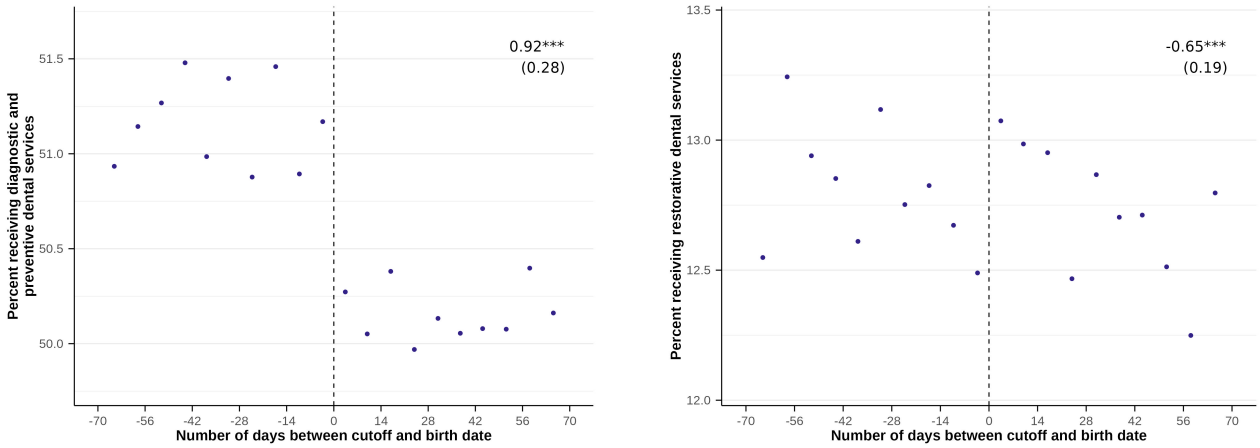
(c) Hearing or vision services

(d) Dental services

(e) Supplemental Security Income

Notes: We plot the coefficients and 95 percent confidence intervals of the regression discontinuity estimates at various ages, denoted on the x-axis. For age two, we use a sample of two cohorts of children born in March 2009–February 2010 and March 2014–February 2015. Ages three to five use the same sample found in Table 2. Ages six through eight use the sample of children born in March 2005–February 2006 and March 2010–February 2011. Each age-specific sample is limited to children who are enrolled at that age. AR, DC, and IN used different school entry cutoff dates before 2011 and are excluded from these figures. Standard errors are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Table 2 for more details on the sample and specifications, and Table A4 for the corresponding regression estimates. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts.

Figure 7: Type of Dental Care Received



(a) Diagnostic and preventive

(b) Restorative

Notes: See notes under Figure 2 for more details on the sample. The plots display the percentage of children at age three receiving a dental service that is diagnostic, preventive, or restorative in seven-day bins within a bandwidth of 70 days around the cutoff. See A.2 for sub-category definitions. Figures include the regression discontinuity estimate and standard errors from Table A5.

7 Tables

Table 1: Sample Means of Key Variables

	Children born [-70, 0] days relative to the cutoff	Children born [1, 70] days relative to the cutoff
Observable characteristics		
Birth cohorts: percent born in...		
2008-2009	50.4	50.4
2013-2014	49.6	49.6
Percent female	48.8	48.9
Percent Black	22.8	22.8
Percent Hispanic/Latino	32.0	31.6
Percent white	33.9	33.6
Percent other or missing race/ethnicity	11.4	11.9
Percent residing in rural ZIP code	19.1	19.1
Percent receiving health and social services		
Speech-language pathology	9.5	8.9
Occupational or physical therapy	3.8	3.7
Hearing or vision services	4.8	4.1
Dental services	64.7	62.9
Supplemental Security Income	2.6	2.5
Percent with a behavioral and developmental health diagnosis		
Speech and language disorders	7.4	7.0
Hearing or vision conditions	1.0	0.9
ADHD	2.3	2.1
Percent with a placebo diagnosis		
Congenital anomalies	0.6	0.6
Intellectual disabilities	0.1	0.2
Sickle cell disease	0.1	0.1
Number of observations	491,772	479,376

Notes: The table displays sample means of key variables used in our analysis. The sample is comprised of two cohorts of children born in March 2008–February 2009 and March 2013–February 2014 who are observed in the Medicaid data at ages three and four and further limited to children born within 70 days of the cutoff in their state. We include children residing in the 31 states and Washington, DC that have a uniform legislated school entry cutoff date that remained the same throughout our analysis period. Outcome means capture services and diagnoses received at ages three and four. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.

Table 2: Regression Discontinuity Estimates of the Effect of Being Born Before the School Entry Cutoff Date at Ages Three and Four

	Mean	Estimate	Bandwidth
Percent receiving health and social services			
Speech-language pathology	8.87	0.93*** (0.20)	48.71
Occupational or physical therapy	3.71	0.44*** (0.14)	43.15
Hearing or vision services	4.09	0.40*** (0.12)	53.22
Dental services	62.80	1.05*** (0.32)	49.71
Supplemental Security Income	2.56	0.17* (0.10)	71.12
Percent with a behavioral and developmental health diagnoses			
Speech and language disorders	6.99	0.64*** (0.20)	49.81
Hearing or vision conditions	0.88	0.13* (0.07)	51.66
ADHD	2.07	0.35*** (0.08)	52.25
Percent with a placebo diagnosis			
Congenital anomalies	0.58	0.00 (0.05)	70.84
Intellectual disabilities	0.15	0.01 (0.02)	50.55
Sickle cell disease	0.11	0.02 (0.02)	56.06

Notes: This Table reports estimates of β_1 in equation (1) using our sample of two cohorts of children born in March 2008–February 2009 and March 2013–February 2014 who are observed in the Medicaid data at ages three and four. We include children residing in the 31 states and Washington, DC that have a uniform legislated school entry cutoff date that remained the same throughout our analysis period. The regression models are estimated non-parametrically and apply an optimal bandwidth selection algorithm for each outcome. The sample sizes range from 587,998 to 954,551 across the outcomes due to different optimal bandwidths. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. Means are calculated among beneficiaries born after the cutoff. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder. See Figure 3 for the impact on "any health and social services" by whether the service was provided in our outside of a school.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

A Appendix

A.1 School Entry Cutoff Dates

Table A1: School Entry Cutoff Dates

State	Date	State	Date	State	Date
AL	9/1	KS	8/31	OR	9/1
AR	8/1	MD	9/1	RI	9/1
AZ	8/31	ME	10/15	SC	9/1
DC	9/30	MN	9/1	SD	9/1
DE	8/31	MS	9/1	TX	9/1
FL	9/1	MT	9/10	UT	9/1
GA	9/1	NC	8/31	VA	9/30
IA	9/15	ND	7/31	WA	8/31
ID	9/1	NM	8/31	WI	9/1
IL	9/1	NV	9/30	WY	9/15
IN	8/1	OK	9/1		

Notes: The dates are the latest birth date one can have to be eligible for school entry. For example, a cutoff date of 9/1 means children must be 5 years old on or before 9/1 to enter kindergarten that year. We follow legislation and apply these dates to public preschool entry. See Table A2 for sources.

Table A2: Prioritization of Sources for Cutoff Dates After Main References

State	Preschool	Kindergarten
AZ	Arizona Department of Education (n.d.)	
DC	Code of the District of Columbia (2008)	
IN	Indiana Family and Social Services Administration (2015)	
MS	Mississippi Legislature (2013)	
ND	North Dakota Department of Health and Human Services (n.d.)	
UT		Utah Administrative Code (2014)

Notes: Kindergarten cutoff dates were primarily determined from National Center for Education Statistics (2018) followed by the Education Commission of the States (2014, 2011, 2013). We referred to Utah's administrative code because NCES and ECS provided conflicting information on whether the cutoff date is inclusive or exclusive of September 2. Preschool cutoff dates were primarily sourced from the State of Preschool Yearbooks by the NIEER, 2026. Whenever there were inconsistencies, or if a state enacted some change (such as implementing a new program or adjusting their cutoff date), we sought clarification from a secondary source.

A.2 Defining variables

We consider beneficiaries to be continuously enrolled if they are continuously eligible and continuously receive full-scope benefits. Our eligibility criteria include CHIP eligibility (`EL_CHIP_FLAG_mm`

= 1, 2, or 3 in MAX and CHIP_CD_mm = 1, 2, 3, or 4 in TAF) and Medicaid eligibility (MAX_ELG_CD_MO_mm between 01 and 72 in MAX and ELGBLTY_GRP_CD_mm between 01 and 72 in TAF, along with a missing CHIP eligibility code). We define full-scope benefits as EL_RSTRCT_BNFT_FLG_mm = 1, 7, 8, or A in MAX and RSTRCTD_BNFTS_CD_mm = 1, 7, A, or D in TAF (Centers for Medicare & Medicaid Services, 2025b).

We measure claims filed by schools using the place of service code 03 (Centers for Medicare & Medicaid Services, 2024) and the billing provider taxonomy code identifying local education agencies, 251300000X (National Uniform Claim Committee, 2026). We define speech-language pathology therapy, occupational or physical therapy, and dental services using procedure codes following Morris et al. (2025) but do not treat them as subcategories of SBS. To decompose dental services into diagnostic, preventive, and restorative services, we follow (American Academy of Pediatric Dentistry, 2017), and we additionally consider the application of topical fluoride varnish in a medical setting (procedure code 99188) to be a preventive dental service Dental Quality Alliance (2024). For speech-language pathology, we exclude the procedure code 96110, which primarily captures well-child visits (Kenney and Pelletier, 2010).[33] We define hearing or vision services as the receipt of hearing aids, frames, lenses, and other specialized items (AAPC, n.d.; Saunders et al., 2021). Enrollment in SSI is defined as an indicator for receiving Medicaid due to being enrolled in SSI (Centers for Medicare & Medicaid Services, 2022, 2016). We define diagnoses of speech and language disorders, hearing or vision conditions, congenital anomalies, and intellectual disabilities following the Children With Disabilities Algorithm (Chien et al., 2015, 2023), diagnoses of ADHD following Shi et al. (2021), and diagnoses of sickle cell disease following Grosse, Green, and Reeves (2020). Table A3 lists all codes used to define these outcomes.

[33] In our data, we observe that over 87 percent of claims with the procedure code 96110 have a well-child visit diagnosis code (V20.2, V20.31, V20.32 in ICD-9; Z00.110, Z00.111, Z00.121, Z00.129 in ICD-10), whereas only 0.3 percent of claims with any of the other procedure codes for speech-language pathology have such a diagnosis code.

Table A3: Definition of Outcomes

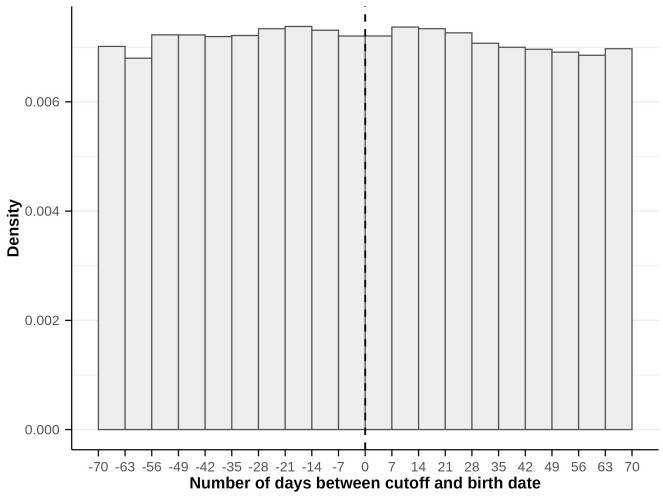
Speech-language pathology	CPT codes 92507, 92508, 92520–92526, 92606–92617, 96105, 96111–96113, 96116, 96121, 96125	
Occupational or physical therapy	CPT codes 90912, 90913, 92548, 92549, 95831, 95851, 96000–96004, 97010, 97012, 97016, 97018, 97022, 97024, 97026, 97028, 97032–97037, 97039, 97110, 97112, 97113, 97116, 97124, 97129, 97130, 97139, 97140, 97150, 97161–97168, 97350, 97530, 97533, 97535, 97537, 97542, 97545, 97546, 97550–97552, 97597, 97598, 97602, 97605, 97610, 97696, 97750, 97755, 97760, 97761, 97763, 97799, and HCPCS codes G0237–G0239, G0515	
Hearing or vision services	CPT codes 69710, 92590–92595, 92601, 92602, HCPCS codes V2020–V2799, V5011–V5299, ICD-9 code V532, and ICD-10 code Z461	
Dental services	CDT codes D0100–D9999, CPT code 99188, or CPT codes 99202–99205, 99211–99215, 99381–99385, 99391–99395 with modifier DA (diagnostic: D0100–D0999; preventive: D1000–D1999, 99188; restorative: D2000–D2999)	
Supplemental Security Income	TAF Eligibility group code (`ELGBLTY_GRP_CD_mm`/`TMSIS_ELG_CD_MO_mm`) equal to 11, 12, or 13, or MAX eligibility code (`MAX_ELG_CD_MO_mm`) equal to 11 or 12	
Diagnosis codes:	ICD-9	ICD-10
Speech and language disorders	31500, 31501, 31502, 3151, 31532, 31534, 31539, 78461	F800, F802, F804, F8082, F8089, F810, F812, H9325, R480
Hearing or vision conditions	36081, 36221, 36226, 36227, 36271, 36272, 36322, 36355, 36424, 36510, 36511, 36515, 36524, 36541, 36542, 36543, 36573, 36633, 36634, 36900, 36901, 36903, 36904, 36906, 36907, 36908, 3691 except for 36910, 36922, 36924, 3693, 3694, 37711, 37713, 37714, 3777, 37856, 37953, 38843, 38904, 3891 except for 38917, 38920, 38922, 3897	H20829, H26219, H26229, H30819, H3121, H35159, H35169, H35179, H36, H4010, H4011, H40159, H40249, H4089, H44829, H47219, H47239, H47299, H47619, H47629, H47639, H47649, H4930, H540X, H541, H542X12, H542X2, H543, H548, H5503, H902, H903, H904, H905, H906, H908, H913, H93299
ADHD	314	F90

Congenital anomalies	740, 741, 7423, 7424, 74251, 74259, 7428, 74300, 74306, 74312, 7432, 74342, 74345, 74348, 74400, 74402, 74405, 74409, 7467, 75011, 7535, 7542, 75533, 75534, 75651, 7580, 7581, 7852, 7583, 7585, 7594, 75981, 75983	G901, Q00, Q030, Q031, Q038, Q045, Q046, Q048, Q05 except for Q053 and Q059, Q060, Q061, Q062, Q063, Q068, Q0701, Q0702, Q0703, Q078, Q111, Q112, Q131, Q133, Q1389, Q150, Q161, Q165, Q169, Q234, Q383, Q6410, Q6419, Q675, Q7210, Q7240, Q763, Q7642 except for Q76429, Q780, Q871, Q894, Q909, Q913, Q917, Q928, Q933, Q934, Q937, Q9381, Q9388, Q9389, Q992
Intellectual disabilities	317, 318	F70, F71, F72, F73
Sickle cell disease	28241, 28242, 2826	D57 except for D573

Notes: "ICD-9" are International Classification of Diseases, Ninth Revision and "ICD-10" are International Classification of Diseases, Tenth Revision diagnosis codes. "HCPCS" stands for Healthcare Common Procedure Coding System, "CPT" stands for Current Procedural Terminology, and "CDT" stands for Current Dental Terminology, all of which classify procedure codes in the Medicaid data. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.

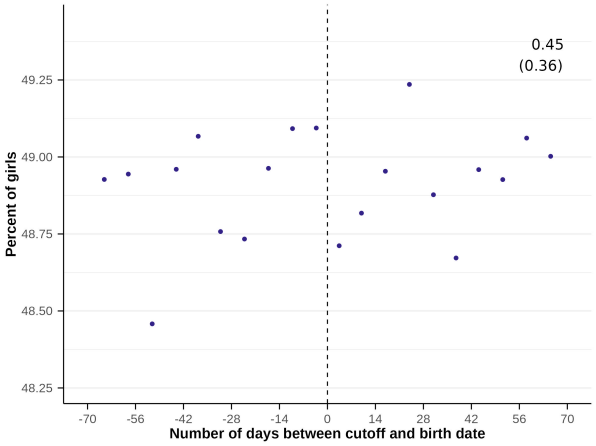
A.3 Additional results

Figure A1: Distribution of Birth Dates in Seven-Day Bins

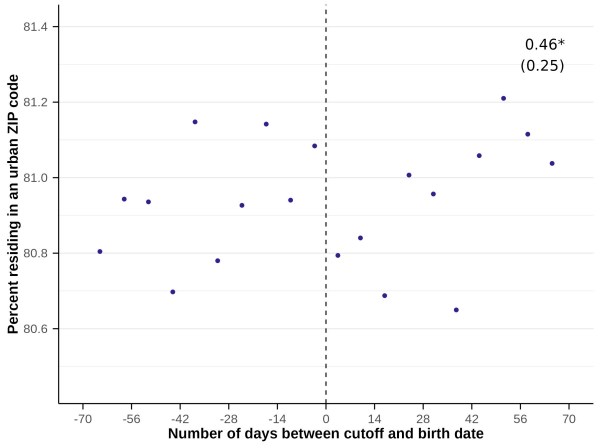


Notes: See notes under Figure 2 for more details on the sample. The histogram shows the sample distribution of birth dates in seven-day bins, within a bandwidth of 70 days around the cutoff.

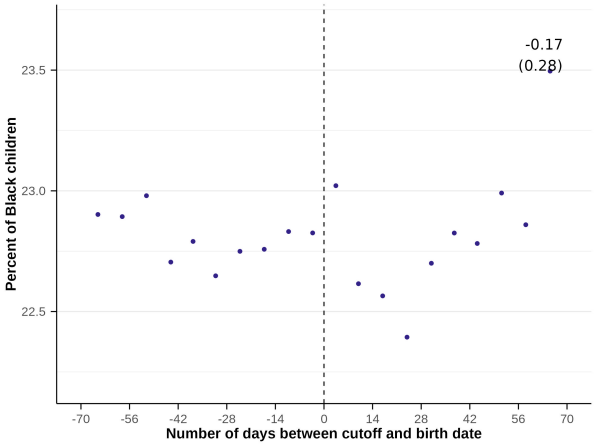
Figure A2: Gender, Urban/Rural, and Race/Ethnicity Composition by Birth Date



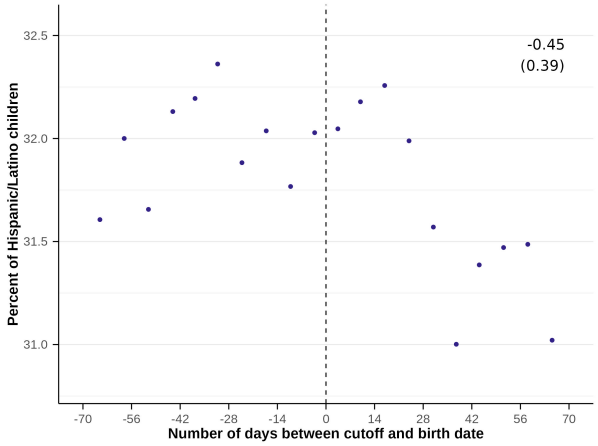
(a) Share of girls



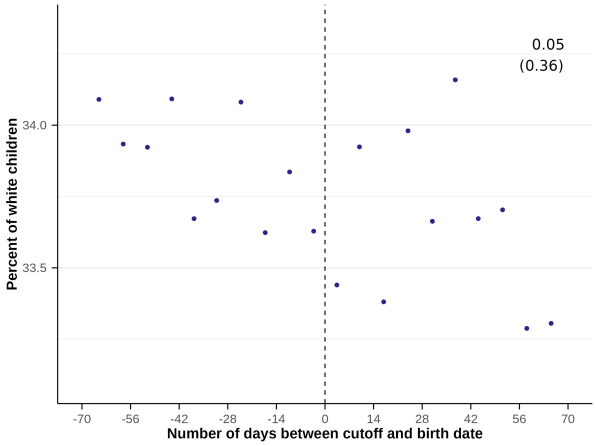
(b) Share residing in urban ZIP code



(c) Share of Black children



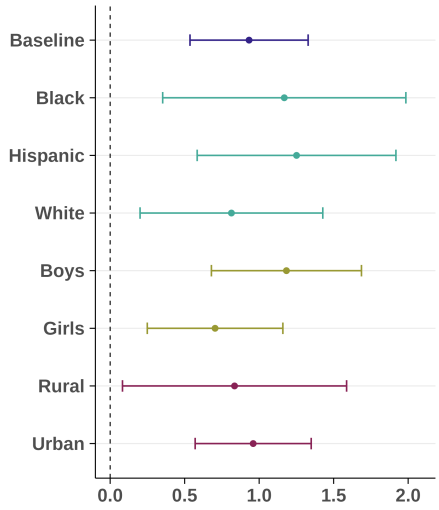
(d) Share of Hispanic/Latino children



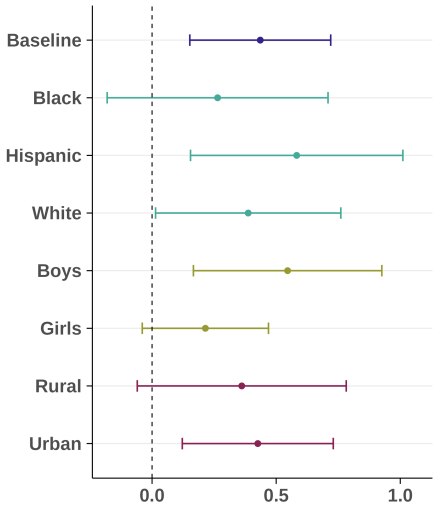
(e) Share of white children

Notes: See notes under Figure 2 for more details on the sample. The plots display the percentages in seven-day bins within a bandwidth of 70 days around the cutoff. Figures include the regression discontinuity estimate and standard errors, which are bias-corrected using the optimal bandwidth and clustered by the running variable, the number of days between the school entry cutoff date and birth date.

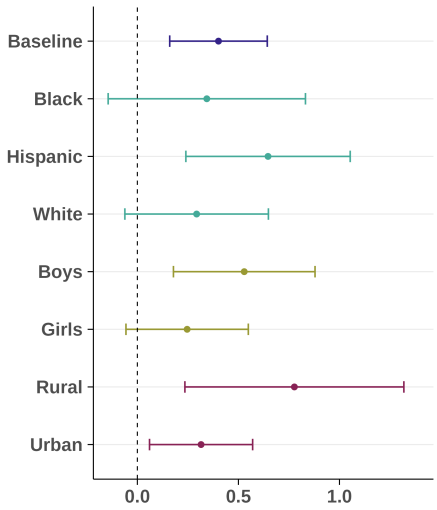
Figure A3: Heterogeneity in the Effect of Being Born Before the School Entry Cutoff Date by Individual Characteristics



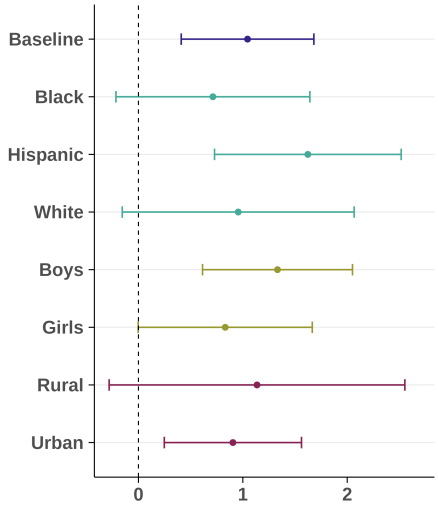
(a) Speech-language pathology



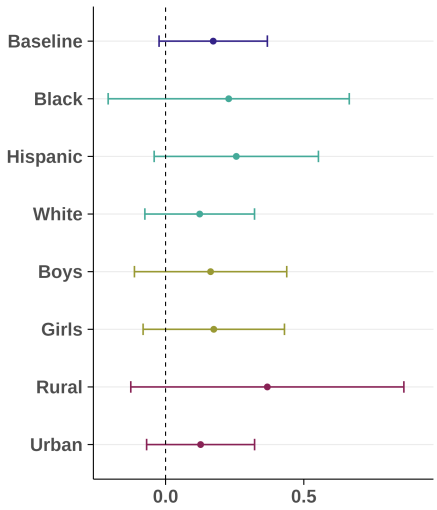
(b) Occupational or physical therapy



(c) Hearing or vision services



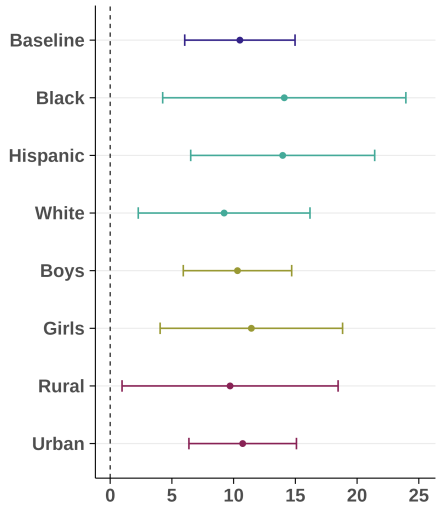
(d) Dental services



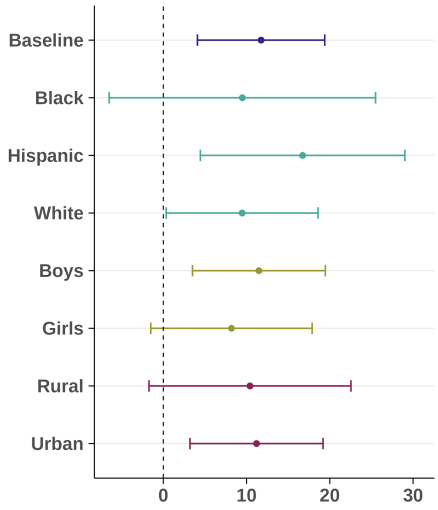
(e) Supplemental Security Income

Notes: We plot the coefficients and 95 percent confidence intervals of the regression discontinuity estimates for children belonging to the sub-group denoted on the y-axis. Standard errors are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and all individual-level demographic controls except for the characteristic being grouped on. See notes under Table 2 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts.

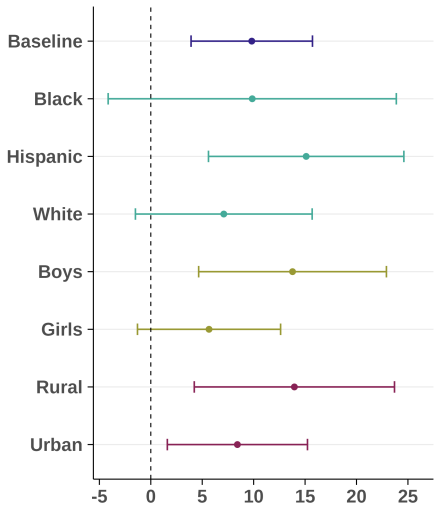
Figure A4: Heterogeneity in the Effect of Being Born Before the School Entry Cutoff Date by Individual Characteristics, Normalized Relative to Sub-Group Mean



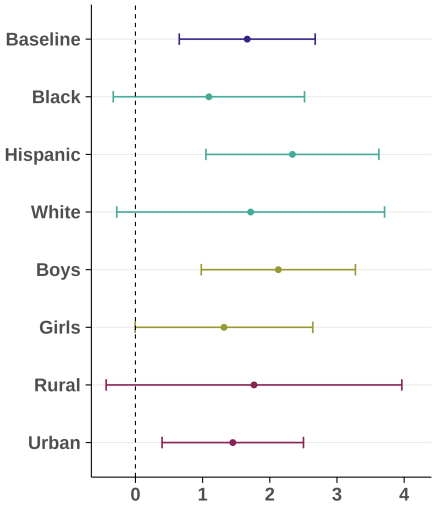
(a) Speech-language pathology



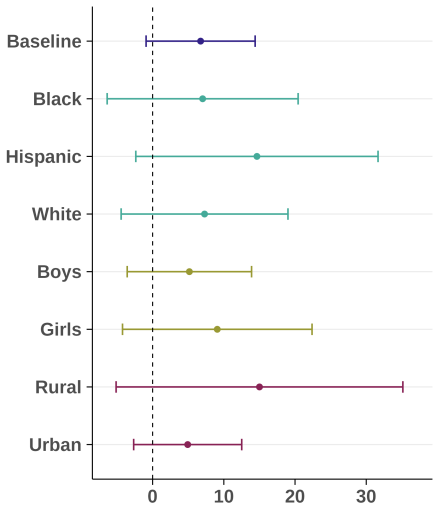
(b) Occupational or physical therapy



(c) Hearing or vision services



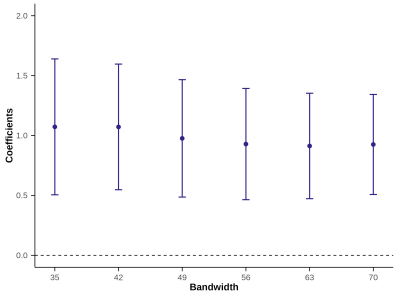
(d) Dental services



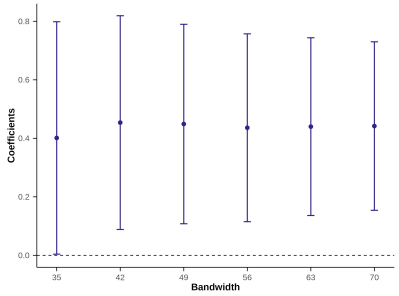
(e) Supplemental Security Income

Notes: We plot the coefficients and 95 percent confidence intervals of the regression discontinuity estimates for children belonging to the sub-group denoted on the y-axis. Coefficient estimates are scaled relative to the baseline outcome mean for each sub-group. Standard errors are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and all individual-level demographic controls except for the characteristic being grouped on. See notes under Table 2 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts.

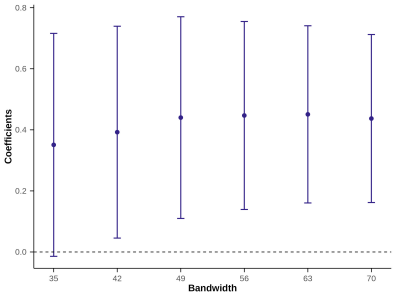
Figure A5: Regression Discontinuity Estimates of the Effect of Being Born before the School Entry Cutoff Date, with Varying Bandwidth



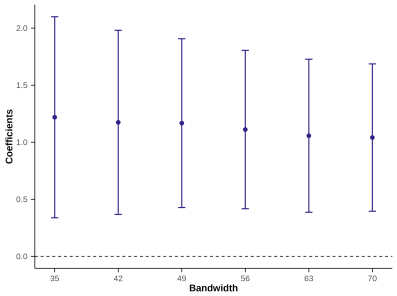
(a) Speech-language pathology



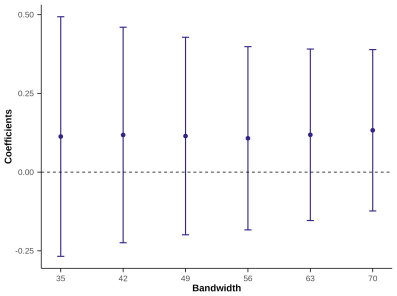
(b) Occupational or physical therapy



(c) Hearing or vision services



(d) Dental services



(e) Supplemental Security Income

Notes: We plot the coefficients and 95 percent confidence intervals of the regression discontinuity estimates, varying the bandwidth from 35 to 70 days in seven-day increments. Standard errors are bias-corrected and clustered by the running variable, number of days between cutoff and birth date, and we set the bias bandwidth equal to the main bandwidth. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Table 2 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts.

Table A4: Regression Discontinuity Estimates of the Effect of Being Born Before the School Entry Cutoff Date at Ages Two to Eight

	Speech-language pathology			Occupational and physical therapy			Hearing or vision services			Dental services			Supplemental Security Income		
Age	Mean	Estimate	BW	Mean	Estimate	BW	Mean	Estimate	BW	Mean	Estimate	BW	Mean	Estimate	BW
2	6.13	0.09	54.54	2.40	0.07	54.84	0.79	-0.01	53.18	41.54	0.60*	58.09	1.68	0.04	71.78
		(0.12)			(0.09)			(0.05)			(0.32)			(0.07)	
3	6.35	0.81***	47.00	2.51	0.21**	63.60	1.68	0.16**	70.72	50.62	0.94***	39.13	2.13	0.14	56.35
		(0.17)			(0.09)			(0.07)			(0.29)			(0.10)	
4	7.24	0.67***	63.14	3.08	0.34***	61.70	3.68	0.32**	46.82	56.59	0.48*	50.29	2.66	0.14	63.37
		(0.17)			(0.12)			(0.14)			(0.26)			(0.11)	
5	7.35	0.89***	53.62	3.22	0.55***	52.47	6.94	0.82***	45.78	57.81	-1.61***	45.58	2.92	0.15	37.76
		(0.13)			(0.13)			(0.21)			(0.23)			(0.17)	
6	5.89	0.85***	37.02	2.59	0.27**	69.73	8.50	0.75***	41.51	58.46	0.11	64.45	3.27	0.08	32.01
		(0.14)			(0.11)			(0.22)			(0.30)			(0.09)	
7	6.32	0.93***	66.04	2.80	0.30***	64.93	11.67	0.49**	56.83	59.81	0.57*	62.47	3.86	0.15	33.11
		(0.12)			(0.10)			(0.25)			(0.34)			(0.14)	
8	5.94	0.68***	36.95	2.78	0.37***	55.90	13.75	0.64***	46.95	57.62	0.06	41.16	4.14	0.36**	35.04
		(0.17)			(0.11)			(0.24)			(0.36)			(0.15)	

Notes: The sample sizes range from 368,147 to 916,526 across the outcomes and age groups due to different optimal bandwidths. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Figure 6 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "BW" denotes bandwidth.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A5: Regression Discontinuity Estimates of the Effect of Being Born Before the School Entry Cutoff Date on Receipt of Dental Services at Age Three

	Mean	Estimate	Bandwidth
Dental services	50.62	0.94*** (0.29)	39.13
Diagnostic and preventive	50.16	0.92*** (0.28)	39.23
Restorative	12.86	-0.65*** (0.19)	41.09

Notes: The sample sizes range from 482,304 to 505,746 across the outcomes due to different optimal bandwidths. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Table 2 for more details on the sample and specifications, and A.2 for sub-category definitions..
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A6: The Effect of Being Born before the School Entry Cutoff Date, Alternative Optimal Bandwidth Algorithms

	MSE	MSE-2	MSE-Sum	Min-MSE	Med-MSE	CER	CER-2	CER-Sum	Min-CER	Med-CER
Speech-language pathology										
Estimate	0.93***	0.89***	0.95***	0.93***	0.92***	0.96***	0.93***	0.92***	0.96***	0.94***
	(0.20)	(0.20)	(0.17)	(0.20)	(0.20)	(0.22)	(0.21)	(0.19)	(0.22)	(0.21)
Mean	8.87	8.87	8.90	8.87	8.87	8.80	8.80	8.83	8.80	8.80
N	657,132	633,580	827,124	657,132	669,758	494,830	476,452	616,533	494,830	502,245
Left/Right BW	48.71	50.14/43.01	61.17	48.71	50.14/48.71	36.25	37.31/32.00	45.52	36.25	37.31/36.25
Occupational or physical therapy										
Estimate	0.44***	0.44***	0.43***	0.44***	0.43***	0.47***	0.45***	0.45***	0.47***	0.46***
	(0.14)	(0.15)	(0.14)	(0.15)	(0.15)	(0.16)	(0.16)	(0.15)	(0.16)	(0.16)
Mean	3.71	3.70	3.74	3.71	3.71	3.69	3.69	3.70	3.69	3.69
N	587,998	651,587	657,132	587,998	624,176	444,505	484,400	494,830	444,505	470,298
Left/Right BW	43.15	41.61/54.86	48.63	43.15	43.15/48.63	32.11	30.96/40.83	36.18	32.11	32.11/36.18
Hearing or vision services										
Estimate	0.40***	0.39***	0.36***	0.40***	0.39***	0.43***	0.42***	0.39***	0.43***	0.42***
	(0.12)	(0.12)	(0.11)	(0.12)	(0.12)	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)
Mean	4.09	4.09	4.07	4.09	4.09	4.13	4.12	4.09	4.13	4.12
N	723,777	768,478	942,547	723,777	768,478	538,029	575,695	709,166	538,029	575,695
Left/Right BW	53.22	57.68/56.94	70.50	53.22	57.68/56.94	39.60	42.92/42.37	52.46	39.60	42.92/42.37
Dental services										
Estimate	1.05***	0.99***	1.20***	1.20***	0.99***	1.12***	1.06**	1.21**	1.21**	1.06**
	(0.32)	(0.38)	(0.42)	(0.42)	(0.38)	(0.36)	(0.43)	(0.49)	(0.49)	(0.43)
Mean	62.80	62.82	62.89	62.89	62.82	62.83	62.91	62.96	62.96	62.91
N	668,574	505,091	364,349	364,349	505,091	494,830	375,460	268,610	268,610	375,460
Left/Right BW	49.71	31.77/42.90	26.04	26.04	31.77/42.90	36.99	23.64/31.92	19.38	19.38	23.64/31.92
Supplemental Security Income										
Estimate	0.17*	0.17*	0.17*	0.17*	0.17*	0.16	0.15	0.15	0.15	0.16
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
Mean	2.56	2.56	2.55	2.55	2.55	2.54	2.54	2.54	2.54	2.54
N	954,551	963,979	942,547	942,547	947,516	709,166	721,125	709,166	709,166	709,166
Left/Right BW	71.12	66.31/77.27	70.42	70.42	70.42/71.12	52.93	49.34/57.50	52.40	52.40	52.40/52.93

Notes: Each column presents the regression discontinuity results using a different optimal bandwidth algorithm from Calonico et al. (2017) to select the bandwidths on each side of the school entry cutoff. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Table 2 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "BW" denotes bandwidth.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A7: Regression Discontinuity Estimates of the Effect of Being Born before the School Entry Cutoff Date, Doughnut Regression Discontinuity Design

	Mean	Estimate	Bandwidth
Panel A: Health and social services			
Any health and social services	66.17	1.93*** (0.65)	27.49
Speech-language pathology	8.91	1.03*** (0.25)	50.52
Occupational or physical therapy	3.73	0.61** (0.25)	39.49
Hearing or vision services	4.06	0.61*** (0.16)	50.43
Dental services	62.71	1.27** (0.59)	29.97
Supplemental Security Income	2.53	0.37** (0.17)	48.47
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	7.02	0.76*** (0.25)	51.48
Hearing or vision conditions	0.89	0.08 (0.07)	57.37
ADHD	2.04	0.44*** (0.16)	37.04
Panel C: Placebo diagnoses			
Congenital anomalies	0.59	0.02 (0.07)	61.69
Intellectual disabilities	0.16	0.00 (0.04)	40.28
Sickle cell disease	0.10	0.03 (0.04)	46.53

Notes: We additionally exclude all beneficiaries born in the one-week bandwidth around the cutoff. The sample sizes range from 282,612 to 732,717 due to different optimal bandwidths. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Table 2 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A8: Regression Discontinuity Estimates of the Effect of Being Born Before the School Entry Cutoff Date, Without Controls

	Mean	Estimate	Bandwidth
Panel A: Health and social services			
Any health and social services	66.42	1.24*** (0.33)	49.64
Speech-language pathology	8.88	0.91*** (0.20)	48.99
Occupational or physical therapy	3.72	0.39*** (0.14)	43.48
Hearing or vision services	4.11	0.42*** (0.12)	53.61
Dental services	63.03	1.02*** (0.33)	49.39
Supplemental Security Income	2.55	0.19* (0.10)	68.95
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	7.00	0.63*** (0.20)	48.95
Hearing or vision conditions	0.91	0.12* (0.07)	48.59
ADHD	2.05	0.31*** (0.07)	59.46
Panel C: Placebo diagnoses			
Congenital anomalies	0.59	-0.00 (0.05)	71.31
Intellectual disabilities	0.15	0.01 (0.02)	48.22
Sickle cell disease	0.10	0.03* (0.02)	55.97

Notes: The sample sizes range from 605,908 to 983,522 across the outcomes due to different optimal bandwidths. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date. See notes under Table 2 for more details about the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A9: Regression Discontinuity Estimates of the Effect of Being Born Before the School Entry Cutoff Date, Among Those Continuously Enrolled

	Mean	Estimate	Bandwidth
Panel A: Health and social services			
Any health and social services	76.70	1.11*** (0.42)	45.76
Speech-language pathology	11.41	1.21*** (0.22)	65.66
Occupational or physical therapy	4.95	0.33** (0.17)	71.50
Hearing or vision services	5.12	0.58*** (0.20)	45.96
Dental services	72.85	0.94** (0.43)	48.76
Supplemental Security Income	3.57	0.25 (0.16)	60.90
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	8.84	0.76*** (0.22)	53.34
Hearing or vision conditions	1.14	0.16 (0.12)	52.98
ADHD	2.66	0.37*** (0.14)	54.23
Panel C: Placebo diagnoses			
Congenital anomalies	0.81	-0.02 (0.08)	72.51
Intellectual disabilities	0.20	-0.02 (0.03)	47.74
Sickle cell disease	0.14	0.04 (0.03)	55.52

Notes: We only include beneficiaries who are continuously enrolled in Medicaid at ages three and four. The sample sizes range from 365,947 to 574,833 across the outcomes due to different optimal bandwidths. Standard errors (in parentheses) are bias-corrected and clustered by the running variable, number of days between cutoff and birth date. Regressions include fixed effects for state, cohort, and weekend/holiday birth date, and control for sex, race/ethnicity, and urban/rural ZIP code. See notes under Table 2 for more details on the sample and specifications. "Hearing or vision services" includes specialized items like hearing aids, glasses, and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.