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

Maya Rossin-Slater
Stanford University
NBER & IZA

Adrienne Sabety
Stanford University
NBER

Aileen Wu
Stanford University

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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 school-based services, speech-language pathology, occupational or physical therapy, and vision and dental services at ages three and four, compared to children born after the cutoff. They are also more likely to receive financial support through Supplemental Security Income. 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 beneficial effects of early childhood education on children's long-term outcomes, especially among disadvantaged populations (Campbell et al., 2014; Hahn and Barnett, 2023). As mechanisms, this literature points to early education curricula that promote the development of cognitive and non-cognitive skills, as well as to improvements in parent–child interactions and parental involvement (Heckman and Mosso, 2014; García and Heckman, 2023). Much less attention has been paid to the possibility that preschools connect children and their families to health and social services.[1] Access to these services may play an important role in shaping children's long-term trajectories given that many behavioral and developmental 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 from age three to five in the data.[2] 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.[3] 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.

We find that children born just before the cutoff date are 2.2 percentage points (26.6 percent relative to the sample mean) more likely to receive school-based services, which include Early and Periodic Screening Diagnostic and Treatment and Individualized Education Program plans, between the ages of three and five, compared to children born shortly after the cutoff.[4] They are also 1.0 percentage point (10.6 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 (9.6 percent) more likely to receive vision services, and 1.0 percentage point (1.7 percent) more likely to obtain dental care at the same ages. Access to services appears to extend beyond the school and healthcare systems—we document that children born before the

[1]Studies of the implementation of the federal 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). However, it is difficult to assess whether these aspects of the program are as relevant fifty to sixty years later.

[2]We select these two cohorts because we can observe them from ages three to five 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.

[3]As of 2023, nearly half of all three- and four-year-olds were enrolled in preschool in the United States, with low-income children typically attending publicly-funded programs (USA Facts, 2023). Public preschools use the same entry cutoff dates as elementary schools (NIEER, 2026).

[4]Medicaid pays for school-based services, so we can measure them in our Medicaid claims data.

cutoff are 0.2 percentage points (7.0 percent, marginally significant at the 10 percent level) more likely to receive Supplemental Security Income between the ages of three and five than those born after the cutoff.

While we cannot observe preschool enrollment directly in the Medicaid data, at least three facts point to preschool as a gateway to health and social services. First, diagnoses of behavioral and developmental health conditions, including speech and language disorders, hearing and 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.[5] Second, 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.[6] Third, we consider heterogeneity across states with and without universal public preschool during the analysis period, finding that most effects are driven by the former group.

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), 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 Hofer, 2016; Gray-Lobe, Pathak, and Walters, 2022; Cascio, 2023).[7]

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

[5]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.

[6]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.

[7]Related, a very large literature on older small-scale "model" interventions including the Perry Preschool Program and the Carolina Abecedarian Project find substantial evidence regarding lasting positive impacts of targeted high-quality preschool programs (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).

health and social services. An important exception is Hong, Dragan, and Glied (2019)'s study of the impacts of New York City's universal preschool program on physical health conditions among Medicaid-enrolled children. They combine variation from a January 1st school-entry cutoff with the implementation of the program in 2014 to measure the change in outcomes in a difference-in-regression-discontinuities design. They find 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. Our findings build on this work by expanding the range of health and social services considered and using a sample of over two million children from 32 states.

More generally, numerous studies have used elementary school-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), which is also included in our data—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 enrollment spells and 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–

2014) and TAF (2016–2019) periods, respectively.[8] We include children who are ever enrolled in full-scope Medicaid or CHIP at age three.[9]

We focus on children residing in 31 states and Washington, DC, that all had a uniform legislated school-entry cutoff date that remained the same throughout our analysis period.[10] Table A1 reports the relevant cutoff dates by state-cohort. We exclude states with cutoff dates that would compare beneficiaries born in different calendar years, i.e., Connecticut (January 1st cutoff) and Hawaii (December 31st cutoff). We also exclude four states—California, Michigan, Nebraska, and Tennessee—that changed their cutoff date over our analysis period.[11]

Our baseline sample is comprised of 2,432,225 children, of which 1,221,361 are in the first cohort, and 1,210,864 are 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 (1,432,303 children).[12]

CMS uses social security numbers to assign anonymized unique identifiers to all enrollees.[13] 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.[14] We then use the beneficiary's unique identifier to link to other services (OT) and inpatient (IP) claims over the window spanning the first day of the month in which the beneficiary turns three to the last day

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

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

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

[11] Cutoff dates for kindergarten entry for each state were primarily 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 National Institute for Early Education Research (2026), secondary sources in Table A2, and Head Start Program Performance Standards (2024).

[12] 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).

[13] 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.

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

of the month before the beneficiary turns five.[15,16] 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.

Outcomes. We focus on health and social services that teachers and other staff in formal early childhood settings may initiate or recommend. We create an indicator for receipt of any school-based services (SBS), defined as Medicaid claims filed by schools, as well as indicators for two of the most common types of SBS: Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) and Individualized Education Plans (IEPs). EPSDT encompasses screening, diagnostic services, and resulting treatment that states are mandated to provide at zero cost to Medicaid-enrolled children under age 21 (Centers for Medicare & Medicaid Services).[17] IEPs are legally mandated written plans developed by schools for every child with a disability (U.S. Department of Education, 2006).[18] A useful feature of these outcomes is that they are provided directly by schools, implying that a child who receives these services must be enrolled in a school.

We also create several indicators capturing the receipt of other types of health services provided outside of schools: speech-language pathology, occupational or physical therapy, vision services (e.g., glasses and contact lenses), and dental services. 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 and 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. Appendix A.2 and Table A3 provide more details on 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

[15]The IP files contain hospital stay records, including International Classification of Diseases (ICD) diagnosis and procedure codes, as well as dates of service. 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.

[16]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.

[17]The federally mandated benefit is quite expansive: 40 million children were eligible to receive EPSDT services in 2014 (Medicaid and CHIP Payment and Access Commission, 2021).

[18]Our "IEP" outcome captures both IEPs and Individualized Family Service Plans (IFSPs), which are legally binding written plans for the provision of early intervention services to children from birth to age three. However, children are mostly receiving IEPs at ages three and four. Children must transition from an IFSP to an IEP by age three and can only extend their IFSP beyond that point under exceptional circumstances (U.S. Department of Education, Office of Special Education Programs, 2023).

date.[19] 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.[20]

Around nine percent of children in our sample receive SBS at ages three and four, with the most common types being EPSDT (four percent) and IEPs (two percent). Approximately nine percent of children receive speech-language pathology therapy, four percent receive occupational or physical therapy, four percent receive vision services, 63 percent receive dental services, and three percent are enrolled 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 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 below.

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:

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

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 a school-based service at some point between a child's third and fifth birthdays. $\mathbf{1}[D_i < c_s]$ 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

[19] 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.

[20] We use the urban/rural zip code crosswalk from the U.S. Department of Agriculture, Economic Research Service (2025).

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 procedures, and apply an optimal bandwidth selection algorithm (Calonico, Cattaneo, and Titiunik, 2014a,b; Calonico et al., 2017, 2019). We obtain optimal bandwidths ranging from 43.05 to 70.98 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 should be 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, as this makes the child eligible for 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. Second, we 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 between their third and fifth birthdays. Figure 1 contains raw data plots using seven-day bins in the running variable of the percentage of children who receive (a) any school-based services (SBS), (b) EPSDT, (c) IEPs, (d) speech-language pathology services, (e) occupational or physical therapy, (f) vision services, (g) dental services, and (h) SSI. 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.[21]

Our results indicate that children born before the cutoff are 2.2 percentage points (26.6 percent relative to the mean among children born after the cutoff) more likely to receive SBS between the ages of three and five, compared to children born after the cutoff. This overall effect is driven by a 1.0 percentage point (25 percent) increase in the probability of receiving EPSDT services and a 0.5 percentage point (26 percent) increase in the likelihood of receiving an IEP. Children born before the cutoff are also 1.0 percentage point (10.6 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 (9.6 percent) more likely to receive vision services, and 1.0 percentage point (1.7 percent) more likely to obtain dental care at the same ages. Lastly, we find that children born before the cutoff are 0.2 percentage points (7.0 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 1(h).

[21] 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.

Mechanisms. The results in Figure 1 and Panel A of Table 2 suggest that being able to start public preschool from a younger age leads to more health and social services for children and their families. While our Medicaid data do not allow us to observe preschool attendance directly, we present three additional findings that suggest that entry into preschool is a main mechanism. First, we quantify discontinuities in behavioral and developmental health diagnoses that are received between the ages of three and five. Figure 2 presents the raw data plots for rates of diagnoses of (a) speech and language disorders, (b) hearing and 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 (9.3, 14.8, and 16.9 percent) more likely to be diagnosed with speech and language disorders, hearing and vision conditions, and ADHD, respectively, between the ages of three and five, although the estimate for hearing and vision conditions is only marginally significant at the 10% level. 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.[22]

Second, we 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 Figure 3. These are severe, mostly genetically influenced conditions, typically diagnosed prenatally or in 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.

Third, we examine heterogeneity in effects across children living in states with and without universal public preschool programs. Twenty-four of the 32 states we use in our study have universal public preschool programs during the entire analysis period, while four states (IN, MN, MS, and MT) implemented one between 2011 and 2019. Just four small states (ID, SD, UT, and WY) do not have a universal public preschool program at all (National Institute for Early Education Research, 2026). Table 3 illustrates that children living in states with pre-existing programs drive the effects on health and social services. We do find a significant effect on the receipt of SBS in the "no program" states, but there is no corresponding effect on health and social services provided outside of schools. This pattern likely reflects the fact that under the Individuals with Disabilities Education Act (IDEA), states must provide free preschool special

[22]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.

education to children with disabilities aged three to five (U.S. Department of Education, Office of Special Education Programs, 2023). This is aligned with IEPs making up half of SBS in "no program" states and consistent with the fact that children already identified as eligible for special education are more likely to have an existing connection to the healthcare system.

Heterogeneity across individual characteristics. We also explore heterogeneity in the main effects by children's race/ethnicity, sex, and residence in an urban or rural ZIP code in Appendix Figures A4 and A5. Specifically, we present sub-group-specific β_1 coefficients and 95 percent confidence intervals in absolute terms in Appendix Figure A4 and as relative effects scaled by the respective sub-group outcome means in Appendix Figure A5. 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.

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 A3 and Table A4 show that our results are robust to using alternative optimal bandwidth algorithms and different bandwidths.[23]

Appendix Table A5 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 1(h).

Appendix Table A6 presents estimates of model (1) without the individual-level controls, while Appendix Table A7 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 and 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 3-5 are receiving Medicaid through SSI—it is not surprising that we lose statistical significance in these cases.

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,

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

including a lack of information, time, and money necessary to seek appropriate diagnoses and 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.

Specifically, using administrative data from the Medicaid program and a regression discontinuity design, we show that, between the ages of three and five, children born shortly before their state's preschool-entry cutoff date are more likely to receive health and social services than their counterparts born shortly after. The additional resources 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. 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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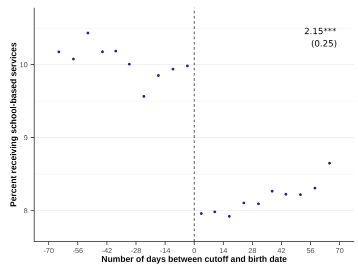
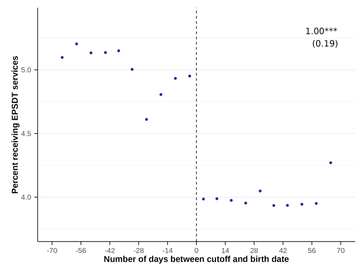
6 Figures

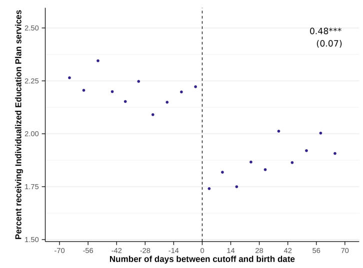
Figure 1: Receipt of Health and Social Services at Ages Three and Four by Birth Date



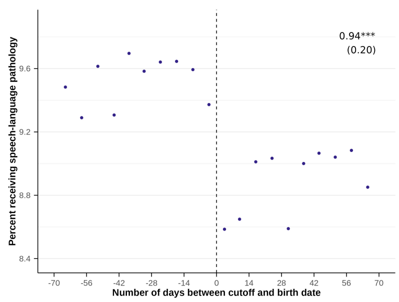
(a) School-based services



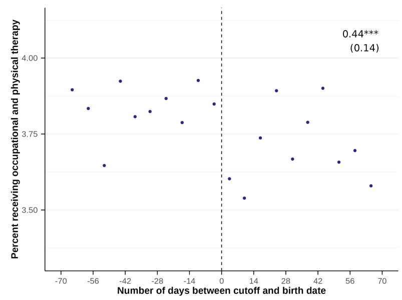
(b) EPSDT



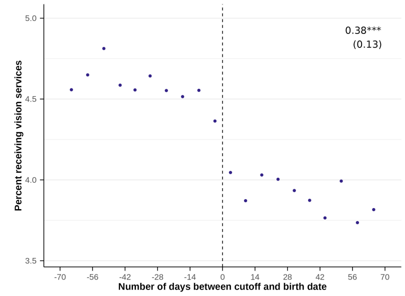
(c) Individualized Education Plan



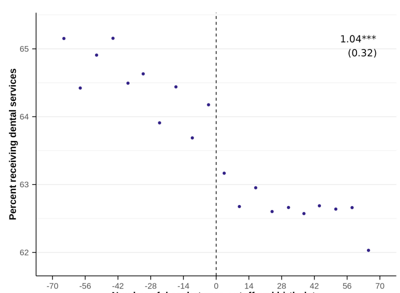
(d) Speech-language pathology



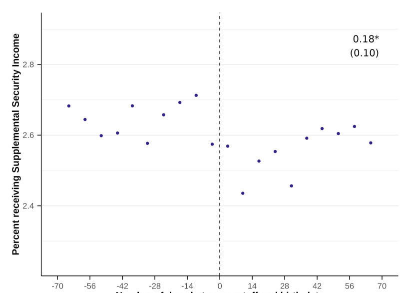
(e) Occupational or physical therapy



(f) Vision services



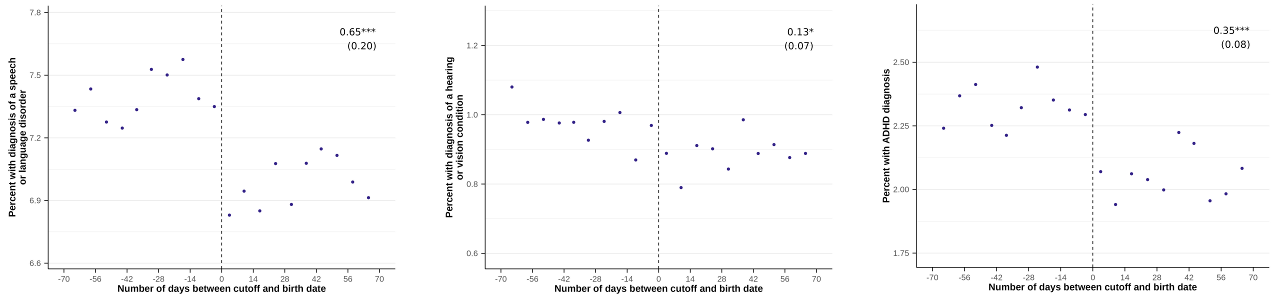
(g) Dental services



(h) 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 between the ages of three and five. 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. "EPSDT" stands for Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts. Figures include the regression discontinuity estimate and standard errors from Panel A of Table 2.

Figure 2: Behavioral and Developmental Health Diagnoses at Ages Three and Four by Birth Date



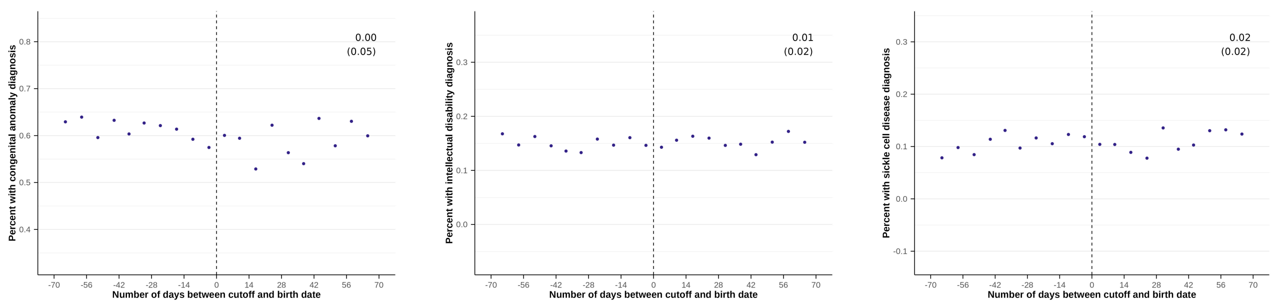
(a) Speech and language disorders

(b) Hearing and vision conditions

(c) ADHD

Notes: See notes under Figure 1 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 3: 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 1 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.

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 between ages 3 and 5		
School-based services	9.9	8.1
EPSDT	4.9	3.9
Individualized Education Plan	2.2	1.9
Speech-language pathology	9.5	8.9
Occupational or physical therapy	3.8	3.7
Vision services	4.6	3.9
Dental services	64.7	62.9
Supplemental Security Income	2.6	2.6
Percent with a behavioral and developmental health diagnosis between ages 3 and 5		
Speech and language disorders	7.4	7.0
Hearing and vision conditions	1.0	0.9
ADHD	2.3	2.1
Percent with a placebo diagnosis between ages 3 and 5		
Congenital anomalies	0.6	0.6
Intellectual disabilities	0.1	0.2
Sickle cell disease	0.1	0.1
Number of observations	491,803	479,411

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 between the ages of three and five 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like 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

	Mean	Estimate	Bandwidth
Panel A: Health and social services			
School-based services	8.09	2.15*** (0.25)	42.99
EPSDT	4.00	1.00*** (0.19)	39.39
Individualized Education Plan	1.85	0.48*** (0.07)	53.54
Speech-language pathology	8.87	0.94*** (0.20)	48.65
Occupational or physical therapy	3.71	0.44*** (0.14)	43.08
Vision services	3.94	0.38*** (0.13)	52.12
Dental services	62.80	1.04*** (0.32)	49.73
Supplemental Security Income	2.56	0.18* (0.10)	70.98
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	6.99	0.65*** (0.20)	49.78
Hearing and vision conditions	0.88	0.13* (0.07)	51.66
ADHD	2.07	0.35*** (0.08)	52.11
Panel C: Placebo diagnoses			
Congenital anomalies	0.58	0.00 (0.05)	70.79
Intellectual disabilities	0.15	0.01 (0.02)	50.45
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 between the ages of three and five. 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 538,068 to 942,613 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.

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

Table 3: Heterogeneity in the Effect of Being Born Before the School-Entry Cutoff Date by State-Level Universal Public Preschool Status

	Pre-Existing Program			Implemented During Analysis Period			No Program		
	Mean	Estimate	BW	Mean	Estimate	BW	Mean	Estimate	BW
School-based services	8.18	2.35***	36.84	7.54	0.88	50.62	6.05	2.27***	34.22
		(0.26)			(0.58)			(0.87)	
EPSDT	4.28	1.11***	38.56	2.30	0.31	57.14	0.50	0.57*	37.99
		(0.21)			(0.34)			(0.32)	
Individualized Education Plan	1.62	0.51***	43.94	3.38	0.18	71.48	3.80	0.77	43.07
		(0.07)			(0.26)			(0.64)	
Speech-language pathology	9.16	1.11***	53.29	6.98	-0.52	43.79	5.94	0.46	40.39
		(0.20)			(0.57)			(0.67)	
Occupational or physical therapy	3.78	0.50***	42.34	3.38	-0.31	52.84	2.64	0.74	51.70
		(0.13)			(0.42)			(0.49)	
Vision services	3.79	0.50***	59.08	5.14	-0.68	53.90	4.61	-0.76	55.82
		(0.14)			(0.42)			(0.89)	
Dental services	62.99	1.09***	48.73	64.35	0.60	73.06	51.69	-1.40	38.76
		(0.29)			(0.91)			(1.69)	
Supplemental Security Income	2.59	0.19*	74.80	2.58	0.23	52.76	1.64	-0.27	73.91
		(0.11)			(0.28)			(0.41)	

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 between the ages of three and five. 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 sample is split into three groups based on whether a child resides in a state that had a pre-existing universal public preschool program, a state that implemented a program over the analysis period, and a state that never has a program during the analysis period. States that implemented a preschool program during our analysis period include: IN, MN, MS, and MT. States that never had a public preschool program during our analysis period include: ID, SD, UT, and WY. Within $\pm$ 70 days of the cutoff, the sample sizes for the respective groups are 856,603, 84,795, and 29,816. See notes under Table 2 for more details on the specifications and estimation. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts. Means are calculated among beneficiaries born after the cutoff. "BW" denotes bandwidth.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

A Appendix

A.1 Preschool and kindergarten cutoff dates

Table A1: Preschool and Kindergarten Cutoff Dates

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

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. Dashes indicate that the state did not have a public preschool program. *Arizona's public early childhood program supports children from birth to age 5, so it has no minimum age. 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 Serices (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 National Institute for Early Education Research (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 outcomes

We measure claims filed by schools through the receipt of school-based services (SBS) (Harmon Sanchez, and Pomerantz, 2023) and break out two subcategories, Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) services and Individualized Education Program (IEP) services following Morris et al. (2025). 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. For speech-language pathology, we exclude the procedure code 96110, which primarily captures well-child visits (Kenney and Pelletier, 2010).[24] We define vision services as the receipt of frames, lenses, and other specialized items (AAPC, n.d.). 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 and 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.

[24] 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

School-based services	HCPCS code T1018, HCPCS modifier TM, Place of Service code 03, benefit type code 060, CMS-64 Form category of service code 0039, or billing provider taxonomy codes 101YS0200X, 103TS0200X, 1041S0200X, 163WS0200X, 251300000X, 261QS1000X, 363LS0200X, 364SS0200X
EPSDT	Type of Service codes 010, 039, 040, 041; benefit type codes 007, 033, 034, 035; program type code 01; CMS-64 Form category of service codes 0015, 018; CPT codes 99381-99385, 99391-99395, 99460-99463; CPT/HCPCS codes 99202-99205, 99213-99215, T1015 with ICD-9 codes V201, V202, V203, V6889, V700, V703-V708, or ICD-10 codes Z0001, Z001, Z005-Z008, Z020-Z026, Z0281-Z0283, Z0289, Z762; CPT code 83655 without ICD-9 codes 9091, 9849, 9809, E8660, E9509, E9621, V5889, and ICD-10 codes M1A1, T560; or any claim satisfying the dental services criteria (see below)
IEP	HCPCS code T1018, HCPCS modifiers TM, TL, TR, benefit type code 060, or CMS-64 Form category of service code 0039
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
Vision services	HCPCS codes V2020-V2799
Dental services	CDT codes D0100-D9999, CPT code 99188, or CPT codes 99202-99205, 99211-99215, 99381-99385, 99391-99395 with modifier DA
Supplemental Security Income	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

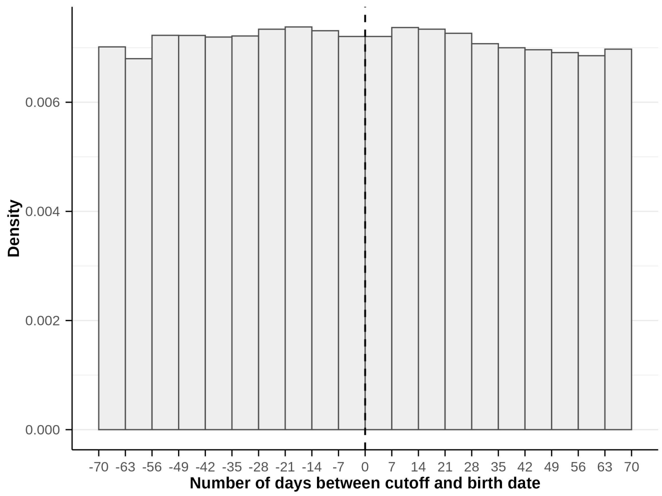
Diagnosis codes:	ICD-9	ICD-10
Speech and language disorders	31500, 31501, 31502, 3151, 31532, 31534, 31539, 78461	F800, F802, F804, F8082, F8089, F810, F812, H9325, R480

Hearing and 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "IEP" denotes Individualized Education Plan. "Vision services" includes specialized items like glasses and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.

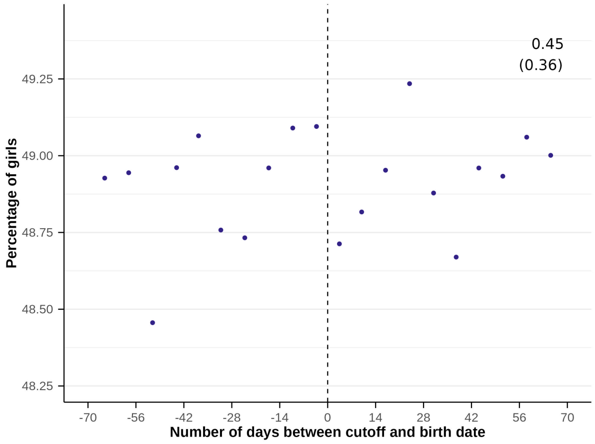
A.3 Additional results

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

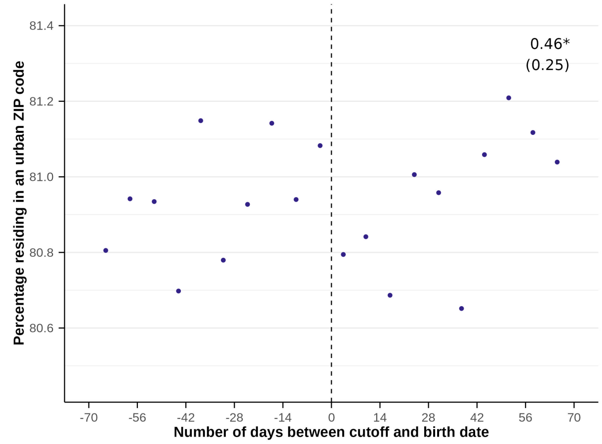


Notes: See notes under Figure 1 for more details on the sample. The histogram shows the sample distribution of birth dates in seven-day bins, within a bandwidth of 70 days around the cutoff.

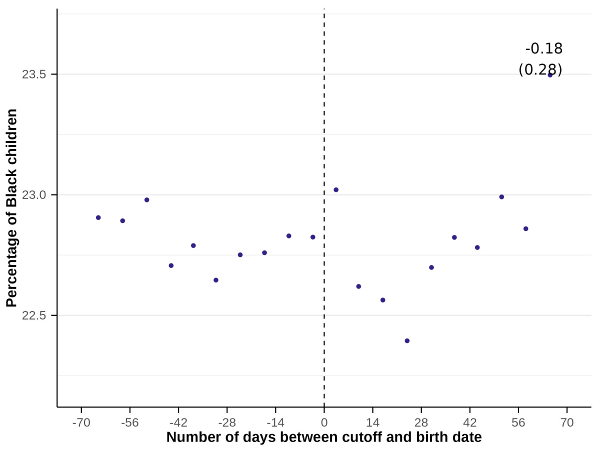
Figure A2: Gender, Urban/Rural, and Race/Ethnicity Composition by Birth Date



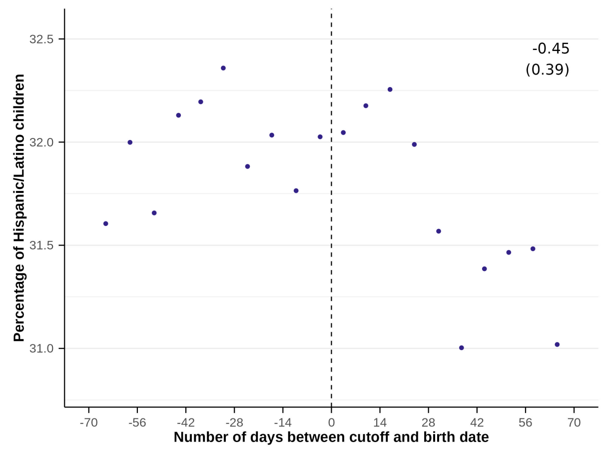
(a) Share of girls



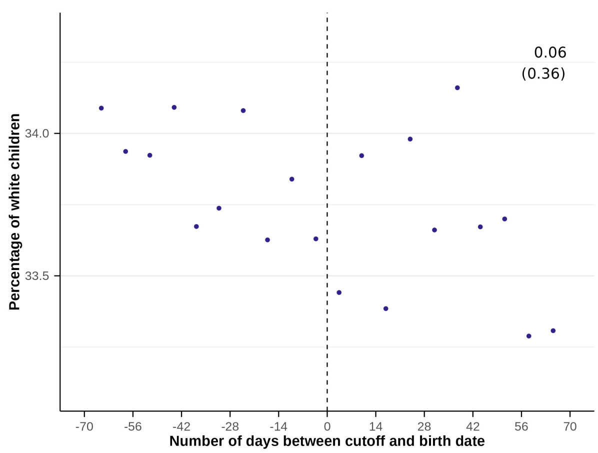
(b) Share residing in urban ZIP code



(c) Share of Black children



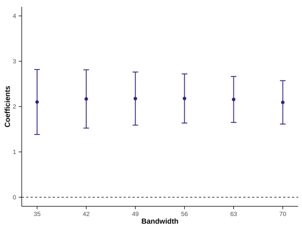
(d) Share of Hispanic/Latino children



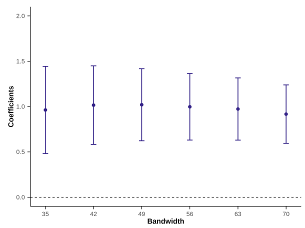
(e) Share of white children

Notes: See notes under Figure 1 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.

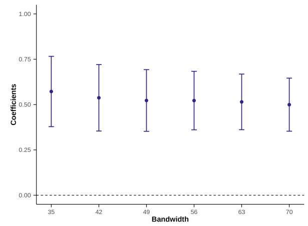
Figure A3: Regression Discontinuity Estimates of the Effect of Being Born before the School-Entry Cutoff Date, with Varying Bandwidth



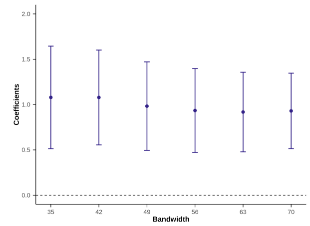
(a) School-based services



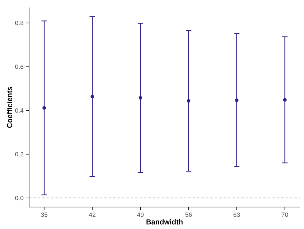
(b) EPSDT



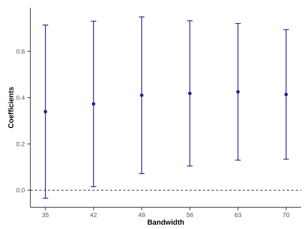
(c) Individualized Education Plan



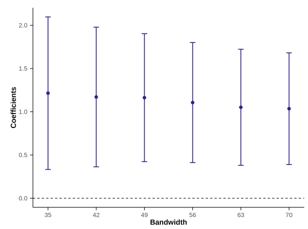
(d) Speech-language pathology



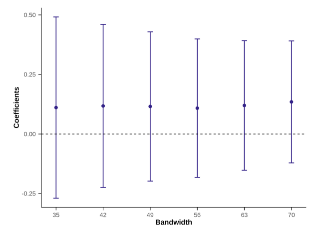
(e) Occupational or physical therapy



(f) Vision services



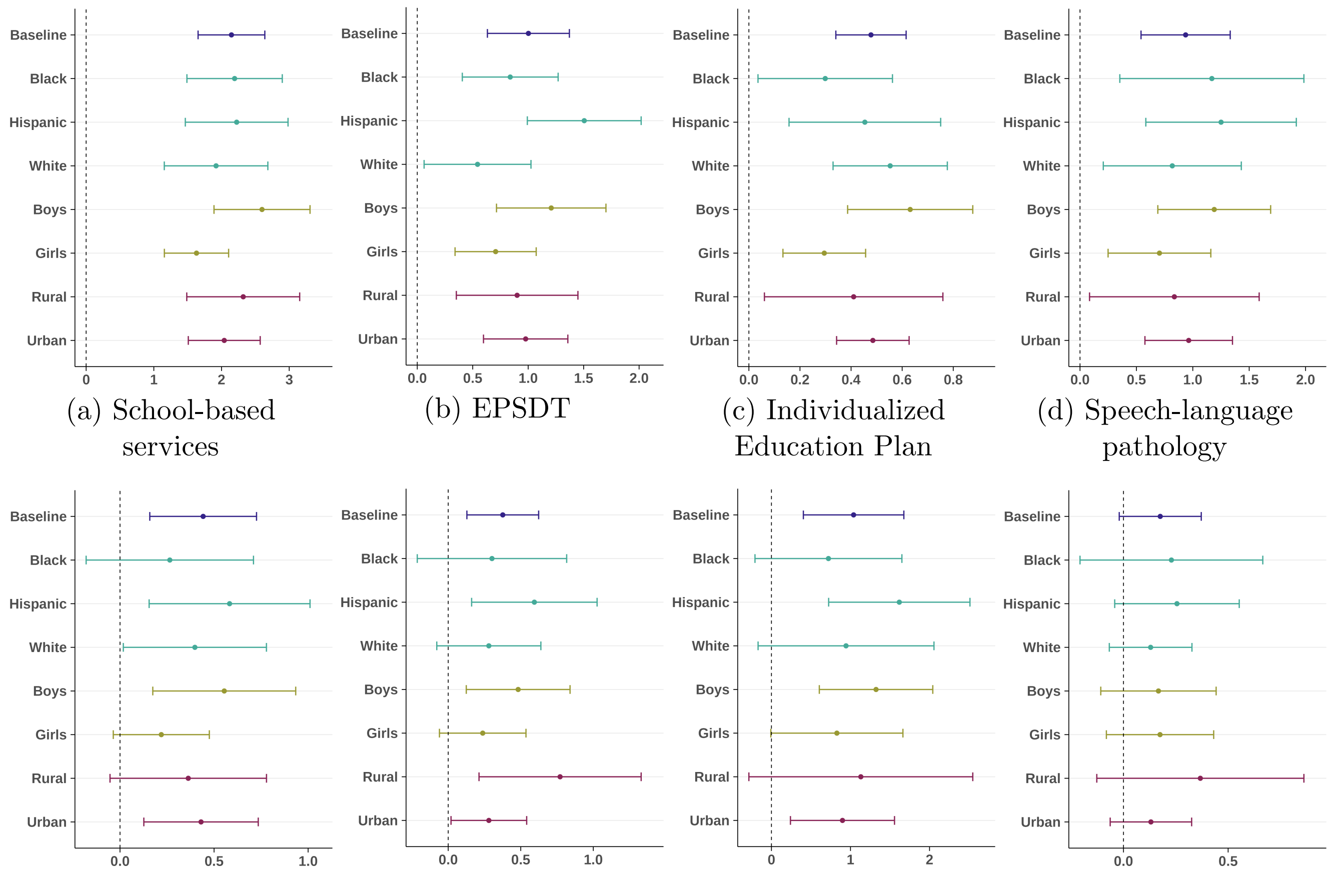
(g) Dental services



(h) 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts.

Figure A4: Heterogeneity in the Effect of Being Born Before the School-Entry Cutoff Date by Individual Characteristics



(a) School-based services

(b) EPSDT

(c) Individualized Education Plan

(d) Speech-language pathology

(e) Occupational or physical therapy

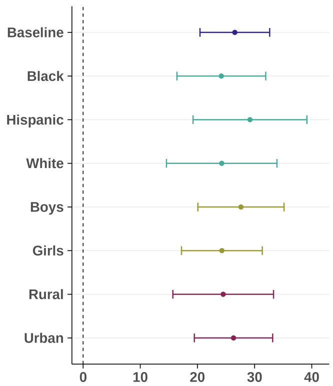
(f) Vision services

(g) Dental services

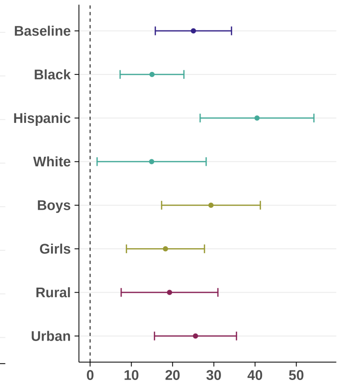
(h) Supplemental Security Income

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 (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 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts.

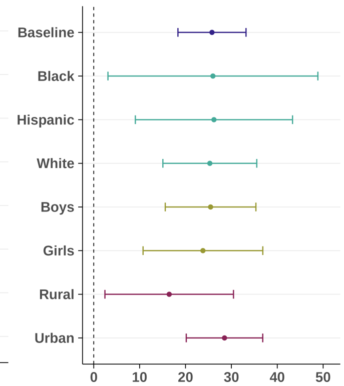
Figure A5: Heterogeneity in the Effect of Being Born Before the School-Entry Cutoff Date by Individual Characteristics, Normalized Relative to Sub-Group Mean



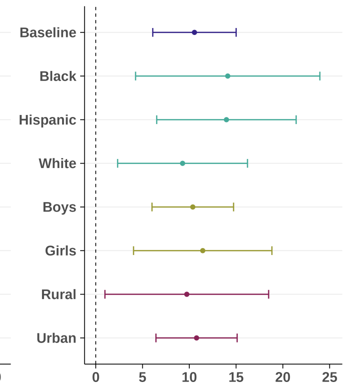
(a) School-based services



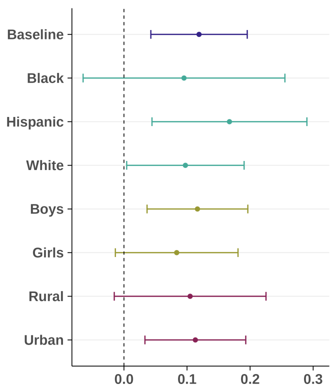
(b) EPSDT



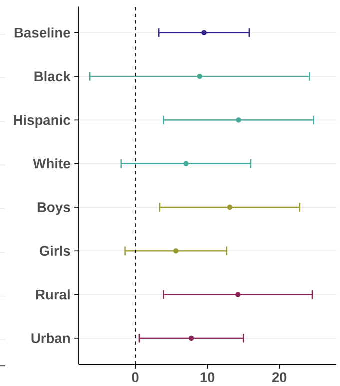
(c) Individualized Education Plan



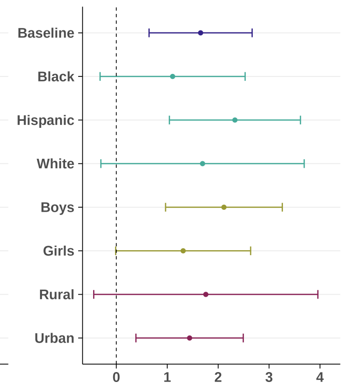
(d) Speech-language pathology



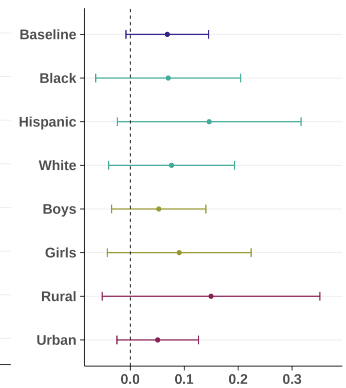
(e) Occupational or physical therapy



(f) Vision services



(g) Dental services



(h) 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 (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 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts.

Table A4: Regression Discontinuity Estimates of 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
School-based services										
Estimate	2.15***	2.22***	1.94***	2.15***	2.15***	2.18***	2.17***	1.98***	2.18***	2.18***
	(0.25)	(0.25)	(0.19)	(0.25)	(0.25)	(0.27)	(0.27)	(0.21)	(0.27)	(0.26)
Mean	8.09	8.09	8.26	8.09	8.09	8.02	8.04	8.12	8.02	8.04
N	575,735	537,159	1,033,521	575,735	590,254	429,801	403,298	773,612	429,801	443,515
Left/Right BW	42.99	44.73/34.22	77.53	42.99	44.73/42.99	31.99	33.28/25.46	57.69	31.99	33.28/31.99
Speech-language pathology										
Estimate	0.94***	0.90***	0.96***	0.94***	0.93***	0.96***	0.94***	0.92***	0.96***	0.95***
	(0.20)	(0.20)	(0.17)	(0.20)	(0.20)	(0.22)	(0.21)	(0.19)	(0.22)	(0.21)
Mean	8.87	8.88	8.90	8.87	8.88	8.80	8.80	8.83	8.80	8.80
N	657,175	626,661	827,183	657,175	662,840	494,866	476,484	616,573	494,866	502,282
Left/Right BW	48.65	49.94/43.47	61.12	48.65	49.94/48.65	36.20	37.16/32.35	45.48	36.20	37.16/36.20
Occupational or physical therapy										
Estimate	0.44***	0.45***	0.44***	0.44***	0.44***	0.47***	0.46***	0.46***	0.47***	0.47***
	(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	588,038	636,546	657,175	588,038	624,217	444,535	476,843	494,866	444,535	470,333
Left/Right BW	43.08	41.48/52.99	48.40	43.08	43.08/48.40	32.06	30.87/39.43	36.02	32.06	32.06/36.02
Vision services										
Estimate	0.38***	0.36***	0.32***	0.38***	0.36***	0.40***	0.39***	0.36***	0.40***	0.39***
	(0.13)	(0.12)	(0.11)	(0.13)	(0.12)	(0.14)	(0.13)	(0.12)	(0.14)	(0.13)
Mean	3.94	3.95	3.91	3.94	3.95	3.99	3.97	3.94	3.99	3.97
N	709,214	755,613	931,264	709,214	755,613	523,195	569,780	709,214	523,195	569,780
Left/Right BW	52.12	56.50/55.44	69.92	52.12	56.50/55.44	38.79	42.05/41.25	52.03	38.79	42.05/41.25
Dental services										
Estimate	1.04***	0.98***	1.20***	1.20***	0.98***	1.11***	1.05**	1.21**	1.21**	1.05**
	(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	62.82	62.91	62.96	62.96	62.91
N	668,618	510,354	364,376	364,376	510,354	508,570	382,963	268,631	268,631	382,963
Left/Right BW	49.73	31.87/43.19	26.13	26.13	31.87/43.19	37.01	23.71/32.14	19.44	19.44	23.71/32.14
Supplemental Security Income										
Estimate	0.18*	0.17*	0.18*	0.18*	0.18*	0.16	0.16	0.16	0.16	0.16
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)

	MSE	MSE-2	MSE-Sum	Min-MSE	Med-MSE	CER	CER-2	CER-Sum	Min-CER	Med-CER
Mean	2.56	2.57	2.56	2.56	2.56	2.54	2.54	2.54	2.54	2.54
N	942,613	956,717	942,613	942,613	942,613	709,214	721,172	709,214	709,214	709,214
Left/Right BW	70.98	65.94/77.32	70.11	70.11	70.11/70.98	52.82	49.06/57.54	52.17	52.17	52.17/52.82

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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like 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, Doughnut Regression Discontinuity Design

	Mean	Estimate	Bandwidth
Panel A: Health and social services			
School-based services	8.05	2.33*** (0.45)	38.47
EPSDT	3.98	0.94*** (0.32)	38.86
Individualized Education Plan	1.87	0.40*** (0.12)	48.35
Speech-language pathology	8.91	1.03*** (0.25)	50.49
Occupational or physical therapy	3.73	0.62** (0.25)	39.20
Vision services	3.91	0.59*** (0.16)	49.11
Dental services	62.71	1.27** (0.59)	29.98
Supplemental Security Income	2.53	0.38** (0.17)	48.07
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	7.02	0.76*** (0.25)	51.27
Hearing and vision conditions	0.89	0.08 (0.07)	57.41
ADHD	2.04	0.44*** (0.16)	37.03
Panel C: Placebo diagnoses			
Congenital anomalies	0.59	0.02 (0.07)	61.59
Intellectual disabilities	0.16	0.00 (0.04)	40.24
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 306,716 to 732,768 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A6: 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			
School-based services	8.02	2.06*** (0.25)	43.10
EPSDT	3.89	0.99*** (0.19)	37.89
Individualized Education Plan	1.87	0.45*** (0.07)	55.23
Speech-language pathology	8.88	0.91*** (0.19)	48.92
Occupational or physical therapy	3.72	0.40*** (0.14)	43.38
Vision services	3.97	0.40*** (0.12)	52.38
Dental services	63.03	1.02*** (0.33)	49.30
Supplemental Security Income	2.55	0.19* (0.10)	68.77
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	7.00	0.63*** (0.20)	48.92
Hearing and vision conditions	0.91	0.12* (0.07)	48.49
ADHD	2.05	0.31*** (0.07)	59.19
Panel C: Placebo diagnoses			
Congenital anomalies	0.59	-0.00 (0.05)	71.28
Intellectual disabilities	0.15	0.01 (0.02)	48.15
Sickle cell disease	0.10	0.03* (0.02)	55.97

Notes: The sample sizes range from 524,047 to 983,588 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.

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

Table A7: Regression Discontinuity Estimates of the Effect of Being Born Before the School-Entry Cutoff Date, Among Those Continuously Enrolled

	Mean	Estimate	Bandwidth
Panel A: Health and social services			
School-based services	10.72	2.85*** (0.37)	38.53
EPSDT	5.53	1.36*** (0.27)	39.91
Individualized Education Plan	2.32	0.52*** (0.11)	44.75
Speech-language pathology	11.41	1.22*** (0.22)	65.30
Occupational or physical therapy	4.94	0.34** (0.17)	70.89
Vision services	4.93	0.56*** (0.20)	47.67
Dental services	72.87	0.94** (0.43)	48.72
Supplemental Security Income	3.56	0.25 (0.16)	62.76
Panel B: Behavioral and developmental health diagnoses			
Speech and language disorders	8.83	0.75*** (0.22)	52.93
Hearing and vision conditions	1.14	0.16 (0.11)	53.26
ADHD	2.66	0.37*** (0.14)	54.13
Panel C: Placebo diagnoses			
Congenital anomalies	0.81	-0.01 (0.08)	73.12
Intellectual disabilities	0.20	-0.02 (0.03)	47.46
Sickle cell disease	0.13	0.04* (0.03)	56.03

Notes: We only include beneficiaries who are continuously enrolled in Medicaid between the ages of three and five. The sample sizes range from 310,021 to 583,172 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. "EPSDT" denotes Early and Periodic Screening, Diagnostic, and Treatment. "Vision services" includes specialized items like glasses and contacts. "ADHD" denotes attention-deficit/hyperactivity disorder.
* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.