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# Child Disability and Effects on Sibling Mental Health*

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**Abstract**

We ask how a younger sibling's physical disability affects sibling mental health using Danish register data on families with three or more children. Difference-in-difference models compare first- and second-born children when the third-born does or does not have a disability. Use of mental health services increases 13% among second-born children, with a 23% increase in psychiatric visits and an 18% increase in use of psychiatric medications. Effects are concentrated in households where the mother has less than high school and persist after conditioning on child test scores. Parental responses suggest that caregiving demands, stress, and strained resources are potential mechanisms.

Keywords: Disability, Mental Health, Siblings, Children

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Child mental health problems are common. According to the World Health Organization (2021) about 14% of children 10 to 19 years of age worldwide have such a disorder. Child mental health disorders are an important predictor of lower educational attainment, lower adult earnings, and lower probabilities of adult employment (Currie, 2025). Concern about child mental health issues has intensified significantly in the wake of the COVID pandemic. Understanding the underlying causes of childhood mental health disorders is therefore likely to remain a global priority in the years ahead.

This paper contributes to the literature on the effects of early childhood environments on the development of mental health conditions. We focus on the impact of a relatively common household stressor, the presence of a young child with a physical disability, on the mental health outcomes of older siblings in the household. In addition to requiring significant inputs of parental time and other resources, parenting a child with a disability can be stressful for parents and may reduce the quality of the time parents are able to spend with their other children.

Uncovering the causal effect of child disability on sibling mental health is complicated by the fact that child disability is not random: families in which children with disabilities are born tend to have lower income and parental education, which may be independently associated with sibling mental health conditions (e.g. Akee et al., 2024; Baird et al., 2013; Furzer et al., 2024; Golberstein et al., 2019), and they may also differ on unobservable characteristics such as genetic factors. To overcome this identification challenge, we use population-level Danish administrative data from 1987 to 2019 and implement a within-family design following Black et al. (2021). Specifically, focusing on families with at least 3 children, we compare "treated" families in which the third-born child is diagnosed with a disability before age five to "control" families in

which the third born does not have a disability.[1] Identification is based on the idea that in treated families, second-born children spend a larger fraction of their own early childhoods in a household impacted by the youngest child's health challenges.[2] Hence, we expect the second-born child to be impacted more than the first-born by the third-born's disability, an assumption that is tested and verified empirically using a matching model.

The results suggest that in affected families, second-born children are 2.8 percentage points (13%) more likely to use any mental health services than first-born children. The greatest increases are in the use of psychiatric visits (23%) and mental health medications (18%), with smaller increases of about 11% in the use of counselling services. The baseline effects are mainly accounted for by households in which mothers have less than a high school education.

Black et al. (2021) document that exposure to a third-born sibling's disability worsens second-born children's educational outcomes relative to the first born's. Given well-established links between schooling and mental health (Goodman et al. 2011; Clark and Royer 2013; Currie 2025), it is possible that academic setbacks contribute to later mental-health penalties. We replicate the earlier finding of modest declines in test performance among exposed siblings. However, the mental-health effects persist conditional on educational outcomes, suggesting that the two channels are largely orthogonal.

Parental strain is another plausible mechanism for effects on sibling mental health. Consistent with this hypothesis, we find substantial and persistent consequences for parents' mental health, economic outcomes, and family formation. By 6–10 years after the third child's

[1] Among families with at least three children, 7% have a third child with a disability.
[2] The broader literature on parental income shocks documents that the timing of exposure during childhood matters for child outcomes and that early childhood may be an especially sensitive period (Almond et al., 2018; Heckman, 2006). More directly related to our setting, Carneiro, Salvanes, Willage, and Willén (2023) and Bingley, Cappellari, and Ovidi (2023) ask how the effects of parental job displacement on children's educational outcomes vary with the child's age at the time of the shock.

birth, affected households have a 1.7 percentage point increase in fathers' mental-health-care use (about 7.7%), maternal employment that is about 6.4% lower, paternal employment that is about 3.2% lower, and total household wealth that is 7.6% lower. There is no significant impact on separations in the full sample, and the probability of having an additional child within ten years increases by about 8.7% more in treated households than in controls.

These impacts vary significantly by both disability severity and family socioeconomic status. The paternal mental health penalty and maternal employment losses are largest for episodic and unpredictable disabilities, where ongoing uncertainty may generate sustained psychological strain. Maternal employment falls by 11.8% for this group, compared to 4.9% for mild and manageable conditions. At the same time, labor market and family formation responses are concentrated among lower-SES families: the maternal employment gap reaches 13.4% among mothers with only basic schooling, with no discernible effect among college-educated mothers. Similarly, lower-educated households are 6% less likely to be cohabiting/married and about 13% more likely to have an additional child within years after the third child's birth, while there are no effects among higher-educated mothers. Taken together, these patterns point to both parental stress and persistent resource losses as plausible mechanisms through which childhood disability affects other family members' well-being.

Finally, we provide suggestive evidence that public support can moderate these spillovers. A 1998 reform substantially increased compensation for parents of severely sick children by replacing capped benefits with full wage replacement, extending eligibility to cover children less than 18, rather than children under 14 only, and allowing benefits to continue as long as eligibility criteria were met. Parental employment losses, wealth declines, and reductions in marriage associated with having a disabled third-born child are all larger and more precisely estimated in the pre-reform period. This pattern suggests that financial strain, and the constraints

it places on family stability, is more severe when welfare support is less generous. Spillover effects on sibling mental health are also larger when the third-born child was born before this expansion. This pattern suggests that income support and caregiving relief can partly buffer the broader family consequences of childhood disability.

Our paper contributes to a growing economics literature that seeks to understand the causes of childhood mental health problems. In addition to income shocks, some of the factors that have been previously highlighted include: A family history of mental illness (Bütikofer et al., 2024), school selectivity and peer composition (Bütikofer et al., 2023), social media (Alcott et al., 2020; Braghieri et al., 2022), *in utero* exposure to disease, nutritional deficiencies, or stressful events (e.g. Almond, 2006; Almond and Mazumder, 2011; Black et al., 2016; Persson and Rossin-Slater, 2018), and exposure to domestic violence (Bhuller et al., 2024) or mass shootings (Bharadwaj et al., 2021; Rossin-Slater et al., 2020). We add to these studies by examining the impact of having a younger sibling with a disability, which is arguably a more common shock than some that have been studied in the literature.

This paper is also related to previous studies examining the impact of having a child with a disability. Most of this literature has focused on the effects on parental outcomes and has shown that having a child with a disability leads to reductions in parent's labor supply (especially mothers), increases in the probability of divorce or separation, and increases in the use of social assistance (Chen et al. 2024; Deshpande 2016; Gunnsteinsson and Steingrimsdottir 2024; Kvist et al. 2013; Noonan et al. 2005; Powers 2003). Evidence on the effects on siblings is scarce, with the notable exception of Black et al. (2021) who investigate the effects of sibling (physical and mental health) disability on academic achievement using a similar framework.[3] We replicate

[3] Breining (2014) uses Danish register data and a cousin–fixed-effects design to show that the educational outcomes of firstborns decline when a younger sibling has ADHD. Several studies offer evidence on sibling spillovers

their findings but show that accounting for effects on test scores does not reduce the estimated effects of child disability on sibling mental health.

These results demonstrate the importance of stressful events in early childhood in the etiology of childhood mental health conditions. Given the generosity of the Danish support system (discussed further below), these results also speak to how difficult it is to fully buffer families from the stresses of coping with childhood disability.

The rest of the paper is laid out as follows: Background information about the effects of having a child with a disability on parents and about the supports available to parents in Denmark is discussed in section 2. Section 3 provides an overview of the rich longitudinal Danish registry data we draw on. Section 4 discusses empirical methods, while the estimates are presented in section 5. Conclusions appear in section 6.

## 2. Background

### *2.1 Healthcare Services for Children and Adolescents*

Denmark's universal public health insurance includes comprehensive maternity care and infant health screenings. Newborns are automatically enrolled in a pediatric examination program provided by the primary care physicians. This program includes health examinations at 5 weeks, 5 months, and annually until age 5 (Gørtz et al. 2020) and overlaps with a universal child vaccination program (Hirani and Wüst 2024). Participation rates are high, with more than 90% of infants attending the first three appointments (Mathiesen et al. 2016). In addition, infants receive care through a nurse home visiting program over the first year of life. Nurses provide advice and assistance for challenges such as breastfeeding and postnatal depression, screen for

generally. See, for example, Daysal et al. (2022), Nicoletti and Rabe (2019), Joensen and Nielsen (2018) and Dahl et al. (2014).

issues related to child development, and refer families in need of a higher level of care. This system means that most cases of early childhood disability are likely to be detected and referred to the child's primary care physician.

Primary care physicians (PCPs) are the usual first point of contact for children and adolescents with mental health concerns and play an important role in referrals to more specialized care. Under the publicly financed Danish health care system, children can receive mental health care through several channels, including hospital-based child and adolescent psychiatry; private-practice psychiatrists, psychologists, school-based counseling; and municipality-based services. However, formal coverage does not imply immediate or equal access. Access to specialist care depends on referral decisions, local capacity, waiting times, and, for some services (including medication), out-of-pocket costs.[4] These access frictions motivate our focus on mental health care utilization over a broad age range, from ages 9 to 20, since the initiation of care could be delayed.

The costs faced by families differ across types of care. Services provided by PCPs are fully covered by public health insurance. Psychiatric care is covered when provided by clinicians in the national insurance network and accessed through referrals from the PCP. Psychological treatment in private practice may be publicly subsidized for eligible patients with a referral, but typically involve co-payments, while services outside the publicly covered or publicly subsidized system must be paid out of pocket.[5] Municipalities offer free school-based Pedagogical Psychological Counselling (PPR) for children and youth (0–18 years) who need special educational, social, or psychological support. Prescription drugs are subsidized according to a

[4] A recent report from the Danish Economic Councils (2025) suggests that waiting times for assessment and diagnostics in child and youth psychiatry has substantial consequences for child and parent outcomes.
[5] Our data do not capture services provided by providers outside the public insurance network. However, the prescription data include all prescriptions filled at Danish pharmacies, regardless of whether the prescribing provider was publicly or privately financed.

nonlinear schedule in which the coinsurance rate declines as annual prescription drug spending rises.[6]

*2.1 Income Insurance Against Child Health Shocks*

Denmark offers a sickness benefit program that compensates parents of children with disabilities or severe illness for lost earnings. In addition to paid maternity leave and parental leave offered to all new parents, parents of children with disabilities may take a paid temporary employment absence to care for their child. The generosity of this support has changed over time. Before 1998, benefits were available to parents of severely sick children under age 14 for a maximum of 52 weeks and were capped. A 1998 reform expanded eligibility to parents of severely sick children under age 18, replaced capped benefits with full wage replacement, and allowed benefits to continue as long as eligibility criteria were met. Parents can also receive assistance with daily tasks, such as cleaning and caring for healthy siblings, through municipality-based programs. The availability of these support services suggests that the impacts of childhood disability may be larger in settings with less generous public support than Denmark's.

## 3. Data and Sample

We combine several Danish administrative data sets for 1987 to 2019. These databases record individual-level data for the entire population with unique personal identifiers that allow individuals to be followed over time and linked to family members. Information on birth order comes from the national *Birth Register*, which includes unique parental identifiers, child gender, birth weight and gestation, and the year and month of birth.

[6] Parents typically pay 40-50% of the first 1,500 DKK (200 USD), 25% of costs between 1,500-3,500 DKK (200-460 USD) and 15% of costs afterwards. There is a stop-loss amount, which was approximately 24,000 DKK (3,200 USD) in 2021.

Measures of mental health care include indicators for receipt of psychological counselling, outpatient/ER psychiatric visits, and psychiatric medications. Information on use of counselling services comes from the *Health Insurance Register.* This register includes reimbursements to private-practice physicians for any service covered by national health insurance.[7] Data on psychiatric visits is derived from both the *Health Insurance Register* and the *Psychiatric Central Research Register*, with the latter capturing outpatient visits to psychiatric departments in public and private hospitals.[8] Data about all prescriptions filled at Danish pharmacies come from the *National Prescription Register*. The Anatomical Therapeutic Chemical (ATC) classification of each medication can be used to divide drugs into broad categories such as psychoanaleptics (stimulants and antidepressants) and psycholeptics (antipsychotics and sedatives).[9] Children's receipt of mental health care services is measured between the ages of 9 and 20 because data on children's mental health care utilization are available from 1997, and mental health treatment before age 9 is rare.[10] The same data sets are used to derive measures of parental mental health care utilization.

Information about whether a child has a disability comes from the *National Patient Register*, a dataset of all patient contacts with public and private hospitals. We focus on physical disabilities that were diagnosed by age 5 to rule out genetic determinants of child mental health that might also affect siblings. There are 626 children with mental health disabilities diagnosed before age 5, but the results are similar if we exclude the families of these children. The pediatric

[7] Private psychologists are identified using the physician's specialty code 63 and mental health services provided by primary care physicians are based on the physician's specialty code 80 combined with reimbursement codes for mental health diagnostic tests and counselling (802147–802149, 804003, 804021–804027, 804050, 804063, 804106, 804116, 806000, 806100, 806101).
[8] Visits to outpatient psychiatric clinics are identified in the Health Insurance Register based on the physician's specialty code 24 or 26.
[9] ATC codes are documented in https://atcddd.fhi.no/atc_ddd_index/.
[10] The means of outcomes for children less than 9 among families without a disabled third-born are 0.4 percent for counseling services, 1.8 percent for psychiatric visits, and 0.8 percent for mental health prescriptions.

examination program and nurse home visiting program described above imply that young children are routinely observed by health professionals during early childhood. This broad screening and referral infrastructure helps alleviate concerns that early physical disability diagnoses are driven solely by differential parental help-seeking or access to care.[11]

Since families of children with disabilities may differ from other families, several additional registers are used to obtain information about parental characteristics to include as control variables. The *Population Register* provides a snapshot of the demographics of all Danish residents as of January 1st of each year, including information about immigration status and the marital status of the parents. Information about parents' education comes from the *Education Register*, which reports each person's highest completed schooling level. Parental employment and income come from the *Register-based Labour Force Statistics* and the *Income Statistics Register*. The former records the labor force participation status of all individuals at the end of November each year, while the latter provides information extracted from tax records on total annual gross income and salaries for all Danish residents.[12]

**Defining the Analysis Sample:**

Starting with the entire population of families, the following restrictions are imposed to arrive at the analysis sample. We focus on families with at least three children born to the same mother in which the first two children also have the same father. Families in which one of the first three births was a multiple birth are excluded. The sample is restricted to families whose first two children were born between 1988 and 1999, ensuring that outcomes can be observed

[11] The conditions included in the definition of childhood disability, detailed in the Data Appendix, are based on the physical health conditions used in Black et al. (2021), conditions that are included in the United States Social Security Administration's List of Compassionate Allowances Conditions, and conditions included in the Global Burden of Disease Study that have a disability weight of more than 20% (see Gunnsteinsson and Steingrimsdottir 2024).
[12] Income and earnings are reported in 2015 prices. We winsorize monetary variables at the 1st and 99th percentiles to reduce the influence of outliers.

between ages 9 and 20. Families in which the gap between the second and third births exceeds nine years are excluded, so that all children are exposed to the presence of the third child throughout the outcome measurement window. These restrictions leave 60,405 families. Of these, 3,854 families have a third child diagnosed with a physical disability by age 5. The most common disabilities among these children are congenital malformations and deformations (85%),[13] epilepsy (9%), hearing loss (7%), coagulation defects, purpura and other hemorrhagic conditions (4.9%), and cerebral palsy and other paralytic syndromes (4.4%). This distribution of disabilities is very similar to what is seen in the full population of children who have a diagnosed disability by age 5.

Table 1 shows descriptive statistics by treatment status. Column 1 focuses on families where the third born was diagnosed with physical disability by age 5. Column 2 presents summary statics for families where the third-born child was not diagnosed with a disability by age 5. Column 3 presents p-values for a test of equal means between columns 1 and 2, while the final column reports standardized differences between columns 1 and 2. The standardized difference is defined as $\frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{1}{2}(s_A^2 + s_B^2)}}$, where $\bar{X}_A$ and $\bar{X}_B$ are group means, and $s_A^2$ and $s_B^2$ are variances. This standardization provides a scale-invariant measure of imbalance, with values below 0.1 commonly interpreted as indicating acceptable balance (Imbens and Rubin 2015). In this table, parental age, educational attainment, immigration status, and marital/cohabiting status are measured at the time of the first birth, household labor market outcomes are measured in the year before the first birth, and parental mental health care utilization is measured in the year before the third birth.[14]

[13] The specific types of congenital malformations and deformations are of the musculoskeletal system (31%), genital organs (16%), circulatory system (15%), eye, ear, face and neck (7.9%), urinary system (4.9%), or other (5.6%).
[14] Parental mental health indicators are measured in the year before the third birth because the psychiatric health

While Table 1 shows that there are some statistically significant differences between the two groups, the standardized differences suggest that the two samples are well balanced. The largest standardized difference is for hospitalizations of first and second-born children and suggests that families in which the third-born has a disability were more likely to have older children with hospitalizations in early life. These differences raise questions about the potential for unobserved differences between the two groups of families that could make a simple comparison of treatment and control families misleading. The next section describes identification strategies that address these issues.

## 4. Empirical Strategy

The main identification strategy follows Black et al. (2021) and implements a difference-in-differences design with family fixed effects: in the sample of families with 3 or more children, the difference in the mental health outcomes of second- and first-born children in treatment and control families is compared.

Because outcomes are measured at a fixed age, the second-born child is affected at a younger age in treatment households, and second-born children spend a larger share of their early lives with a sibling who has a disability. For example, if the two older children are five and two when the third is born, then the two-year-old is potentially affected from age two onwards, whereas the eldest child can only be affected from age five onwards. For these reasons, the second-born child is arguably more affected by the third child's disability.

To capture this intuition, we estimate the following model:

$$Y_{if} = \alpha_f + \beta_0 + \beta_1 SB_i + \beta_2 SB_i D_f + \beta_3 X_{if} + \epsilon_{if}, i = 1,2, \quad (1)$$

registers are available only from 1995.

where $Y_{if}$ is one of the measures of mental health care utilization for child $i$ in family $f$ described above, $SB_i$ is an indicator for the second-born child, $D_f$ is an indicator equal to one if the third-born child was diagnosed with a physical disability by age 5, $X_{if}$ is a set of child characteristics (indicators for gender, birth weight, gestational age, 5-minute Apgar score, and year and month of birth) and parental characteristics in the year before the birth of each child (indicators for age, deciles of gross personal income, marital/cohabitation status, educational attainment and employment status). Finally, $\alpha_f$ is a family-fixed effect that controls for fixed unobservable differences between families that could be correlated both with mental health outcomes and the probability that a family has a child with a disability.[15]

The key coefficient of interest in model (1) is $\beta_2$ which measures the gap in the mental health outcomes of second-born children versus first-born children in families with and without a third-born child diagnosed with a disability by age 5. To interpret $\beta_2$ as a causal estimate of the effect of having a third child with a diagnosed disability on the second-born child compared to the first-born child requires the assumption that differences in the mental health of first and second-born children would have evolved similarly in treatment and control households in the absence of the third child's disability.

To assess the plausibility of this parallel trends assumption, we first ask whether gaps between first and second-born children in predetermined child and parent characteristics differ in treatment and control families. Additional robustness checks explore the sensitivity of the

[15] Concerns have been raised about using family fixed effects models to identify causal effects (see Galama et al. 2018; Behrman et al., 1982; Price, 2008; Lleras-Muney et al., 2022; Lundborg et al., 2016; Halpern-Manners et al., 2020; Gensowski and Gørtz, 2024). The issue is that parents may reallocate resources within the family to compensate or reinforce initial endowments. In our setting, we are assuming that the way families reallocate towards the third child is more impactful for the second child than for the first because it affects more of the second child's early life. If parents tried to compensate the second child (more than the first child), then this would lead us to underestimate the effects.

estimates to excluding parents with previous treatment for mental health conditions, excluding households where the first-born or second-born child has a disability, tightening or loosening the birth spacing gap requirement between the second and third-born children, and experimenting with replacing the indicator for having a third-born sibling with a disability with the gap in "exposure" to the third child's disability between first- and second-born children.

Finally, a matching method is implemented to see whether having a third-born child with a disability does indeed have a larger effect on second-born children than on first-born children in families with at least three children. We begin with older siblings born between 1988 and 1999, matching the cohort restriction in the main analysis sample. We then identify their younger disabled siblings, imposing the same restriction as in the baseline sample that the spacing between the older sibling and the disabled younger sibling is no more than nine years. Each older sibling is matched to an unrestricted number of children from the control pool based on birth year, birth order, child gender, mother and father's age at first birth, mother's years of education at first birth, and the number of siblings in the family at the time of the disability diagnosis. The matching design requires the assumption that the occurrence and timing of a childhood disability diagnosis is random conditional on the rich set of observable characteristics. The matching models suggest that having a third-born child with a disability has little effect on the first-born child, while for second-born children, the estimated effects of having a third-born with a disability are very similar to the estimates from the difference-in-difference models.

## 5. Results

### *5.1 Effects of Exposure to a Disabled Sibling on Child Mental Health*

Table 2 presents estimates of the difference-in-differences models based on Equation (1). Each cell represents a separate regression and presents the estimated coefficient on the interaction

between the indicator for the second-born child and the indicator for the third-born child having a disability.[16] The dependent variable is indicated in the panel heading. Column (1) shows difference-in-difference results from a model that includes family fixed effects and indicators for child gender, year, and month of birth. The estimates suggest that exposure to a disabled third-born sibling increases the second-born child's likelihood of receiving mental health services between the ages of 9 and 20 relative to the first-born child's probability, which is shown in the table as the control group mean. The point estimates of 2.9 percentage points for any service, 1.7 percentage points for any counseling, 2.4 percentage points for having a psychiatric visit, and 1.7 percentage points for any mental health prescription are large. These estimates represent a 10 to 20% increase relative to the mean outcomes among first-born children.

Estimates including additional child characteristics are shown in column (2) and estimates adding parental characteristics in the year before the birth of each child are shown in column (3). These estimates are remarkably similar to those in column (1), suggesting that the estimates are not sensitive to the inclusion or exclusion of additional control variables.[17]

*5.2 Assessing Key Identification Identifying Assumptions*

The key identifying assumption in the difference-in-differences approach is that of parallel trends: The mental health gaps between first- and second-born children in families where the third-born has a disability would have evolved similarly to those in families where the third child does not have a disability. While this assumption cannot be tested directly, there are a number of things that can be done to assess its plausibility.

First, we check that the third child's disability has no significant "effect" on family

[16] The full regression models are shown in Appendix Table A1.
[17] Appendix Table A2 shows that simple difference-in-difference models without controls also yield remarkably similar estimates.

outcomes that were determined prior to the birth of the third child using models similar to equation (1). The estimates are shown in Table 3. Panel A focuses on the health outcomes of first- and second-born children during the first two years of life, while Panel B treats time-varying parental socio-economic characteristics (measured in the year before the birth of each child) as the dependent variables. Panel A shows that there are no statistically significant gaps in predetermined health characteristics between first- and second-born children in treatment and control families. The magnitudes are also economically insignificant. For example, the gap in the birth weight of second- and first-born children is only 9 grams (0.26%) lower in treatment families than in control families. Gaps in the use of hospital care at 1 year and at 2 years are also tiny which suggests that the estimated effects on mental health are unlikely to be due to differences in care-seeking behaviors between families with and without a disabled third child. The estimates in Panel B are equally small and statistically insignificant in all but one case.[18]

Appendix Figure A1 provides complementary evidence by showing pre-third-birth trajectories for a set of parental and family characteristics.[19] This exercise allows us to ask whether families in which the third-born child is later diagnosed with a disability exhibit systematically different pre-birth trajectories in relevant observables. The figure suggests that treatment and control families look similar in terms of pre-birth dynamics.

Second, we estimate event-study figures for children's mental health outcomes, using cumulative indicators for whether the child had any contact at each age from birth to age 20. To

[18] Unfortunately, it is not possible to conduct a similar test for parents' mental health status because the register starts in 1995 and these outcomes are missing for many cohorts. However, the results are robust to excluding parents with mental health problems in the year before the birth of the third child, as shown below.

[19] For each outcome, we residualize the characteristic with respect to parents' immigrant status, marital/cohabitation status, highest education, parental age fixed effects, and third-born birth-year fixed effects, and then plot the residualized means and confidence intervals separately for treatment and control families by year relative to the third birth. The indicator for marital/cohabitation status is omitted when we examine dynamics in parental marital/cohabitation status.

implement this analysis, we restrict the sample to sibling pairs for whom outcomes can be observed from birth through age 20, which implies focusing on sibling pairs born in 1995 or later. The specification includes indicators for having a disabled third-born sibling, being second-born, age indicators (age 8 is the omitted category), and the full set of interactions between second-born status, age, and third-born disability status. The coefficients plotted in Figure 1 show, at each age, the difference in cumulative mental health care utilization between second- and first-born children in families with a disabled third-born, relative to the same birth-order difference in families without a disabled third-born. The figure shows little evidence of differential divergence prior to age 8, with coefficients fluctuating closely around zero in early childhood. Beginning at ages 9 to 11, however, the estimates turn positive and then rise gradually through adolescence. This pattern is visible in all four outcomes. For any mental health utilization, the estimated differential increases steadily to roughly 2.5 to 3 percentage points by the late teenage years. Psychiatric visits follow a similar trajectory. The gap in prescription drug use becomes positive at about age 10 and rises more gradually, reaching 1.5 to 2 percentage points by ages 18 to 19. Overall, these event studies suggest that the effects are not driven by different early-childhood trends and emerge progressively over time in a way that is consistent with accumulating exposure to the family strain associated with a disabled younger sibling.

*5.3 Additional Robustness Checks*

Table 4 presents additional robustness checks that examine the sensitivity of the estimates to alternative ways of measuring third-born disability status and to the selection of the analysis sample. Each cell of Table 4 presents estimates from a separate regression using the outcome indicated in the column heading. Panel A shows the baseline difference-in-difference results for ease of comparison.

Panel B presents models interacting the indicator for the third child having a disability

with the age gap between the first and second child. For example, if the first and second child are born three years apart, then the gap in "exposure" to the third child as of age 20 is three years. The coefficient estimate indicates that an additional year of exposure to a disabled sibling increases the second-born sibling's probability of receiving any mental health care services by 0.99 percentage points. Multiplying this number by the mean gap in birth spacing between the first and second child, (2.59 years) implies a treatment effect of 2.56 percentage points which can be compared to the corresponding baseline estimate of 2.84 shown in Panel A.[20]

Panel C shows estimates excluding households in which either the first- or second-born sibling has a physical disability. Panel D reports estimates excluding households where a parent received mental health services in the year before the third child was born. In both cases, the estimated effects are larger than in Panel A, suggesting that the impact of a having a third child with a disability is smaller in households where older siblings have a disability or where parents have already experienced mental health problems. Given that disability may itself affect mental health outcomes, and that parents receiving treatment might be more likely to seek services for their children, it is reassuring that excluding these households strengthens the main conclusions.

Panel E shows estimates from a sample that excludes households in which the third-born child was diagnosed with a mental disability from the "control" group. The estimated effects are slightly larger but statistically indistinguishable from the baseline.[21]

[20] Appendix Table A3 further explores the role of birth spacing by splitting the sample into two groups based on the median spacing between the first- and second-born children. The results show larger spillover effects in families where the age gap between the first- and second-born children is larger. This pattern is consistent with the idea that second-born children are more affected because they spend a larger share of early childhood exposed to a sibling with a disability.

[21] Appendix Tables A4-A5 focus on disabilities arising from random genetic mutations as these conditions are largely independent of parental characteristics that might otherwise confound the estimates (see Appendix Table A4). Unfortunately, families with a child affected by these specific conditions are too rare in our data to implement the main difference-in-differences design with adequate precision. We therefore estimate an OLS specification using families with more than one child, restricting the sample to children born between 1988 and 1999, and excluding younger siblings of disabled children, older siblings spaced more than nine years apart from the affected sibling, and children whose mothers were aged 35 or older at birth. The specification controls for maternal age fixed effects, birth

Panels F and G assess the sensitivity of the estimates to the restriction on the birth spacing between the second and third child.[22] Panel F, limits the gap between the second- and third-born children to at most five years, ensuring that the outcome measurement window begins after the diagnosis window. Panel G removes the spacing restriction altogether. The results are similar to those presented in Panel A in both cases.

Table 5 examines effects on health-care use for physical conditions.[23] These estimates speak to possible differences in patterns of health care use between families with and without a disabled third-born child. It is possible that families in which a child has been diagnosed have patterns of health care use that make it more likely that siblings will receive medical attention (e.g. siblings might "tag along" to appointments). Specifically, we investigate effects on the likelihood of any hospital contact, the number of hospital contacts, and the number of GP visits, but find no evidence that second-born children in treated families experience higher overall utilization of health-care services. These null effects suggest that the baseline estimates are unlikely to be driven by increases in medical attention for the family after a third-born child has been diagnosed.[24]

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order, the number of children in the family, the birth year of both the child and the affected sibling, and spacing between the two siblings. Panel A of the Table reports results for Down syndrome. Panel B reports results for a broader group of de novo and chromosomal mutation diagnoses. The corresponding numbers of treated children are 134 and 238, respectively. Two conclusions emerge. First, we continue to document significant spillover effects on sibling mental health even when the sample is restricted to these more obviously exogenous disability conditions. Second, the estimated spillover effects are larger in magnitude for these chromosomal conditions than in the baseline, consistent with the greater disease burden they may impose on affected children and, consequently, on the family as a whole.

[22] We also assessed the robustness of the estimates to controlling for birth spacing. For the first-born child, we assign spacing as the gap between the first- and second-born children, while for the second-born child, we assign spacing as the gap between the second- and third-born children. The results remain are close to the baseline findings (see Appendix Table A6).

[23] Appendix Table A7 examines the effects of exposure to a disabled younger sibling on child mental health outcomes measured at ages 0-9. The effects are economically small and statistically insignificant.

[24] Appendix Table A8 splits the sample by the birth year of the second-born child (born between 1988 and 1999) using 1994 as the cutoff. We then estimate the baseline model separately for the earlier and later cohorts. Control group means are consistently higher among the later cohorts, consistent with the secular rise in mental health care utilization. However, the estimated spillover effects are not uniformly larger for later cohorts. Effects on any mental health utilization and counseling are larger for earlier cohorts, while effects on psychiatric visits and prescription use

Table 6 shows estimates using an alternative identification approach based on matching. The baseline estimates are repeated in Panel A for ease of comparison. As described above, we identify families whose children were diagnosed with a physical disability between 1999 and 2008 and match each *older* sibling of a disabled child to an unrestricted number of children from the control pool of families without a disabled child. The matching is based on birth year, birth order, child gender, mother and father's age at first birth, mother's years of education at first birth, and the number of siblings in the family at the time of the disability diagnosis. The outcomes are then regressed on an indicator for having a disabled sibling. Fixed effects are included for each matched treatment–control group. The samples in these models are smaller than in the difference-in-differences because it was not always possible to find a match.

Panel B of Table 6 shows the effect of having a third-born sibling with a disability on second-born children. This is the specification that is most similar to the baseline difference-in-difference model. The estimated effects are remarkably close to those shown in Panel A except for the effects on medication use, which are weaker. Panel C estimates the matching model using only the first-born children. These estimates are much smaller than the baseline which suggests that second-born children are indeed more affected than first-born children by having a third-born sibling with a disability. Panel D shows, not surprisingly, that when first- and second-born children are pooled together, the effects are halfway between those of Panels B and C.

Finally, matching models can be used to extend the analysis to families with two plus children, comparing first-born children in all families that do or do not have a disabled younger sibling. Panel E shows that in this sample the estimated effects of exposure to a disabled sibling are somewhat smaller than in the baseline estimates but remain statistically significant for all

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are similar across cohorts. These results do not suggest that the baseline findings are driven by secular increases in utilization.

outcomes.[25]

Overall, the results from matching models are consistent with the baseline findings based on the difference-in-difference strategy. Given the differing assumptions between these identification strategies, the fact that both methods lead to similar conclusions provides evidence of the robustness of the effects.

*5.4 Comparing Magnitudes and Assessing Fiscal Implications*

How do the estimated effects on child mental health compare to those documented in the previous literature about determinants of child mental health? Second-born children in affected families are 11% more likely to use counselling services, 23% more likely to have a psychiatric visit and 18% more likely to consume mental health medications, whereas first-born children are much less affected. These effect sizes are comparable to those found in other studies evaluating the consequences of family stressors on child mental health. For example, Rossin-Slater and Persson (2018) show that *in utero* exposure to the death of a mother's close relative leads to a 25% increase in the likelihood of using an ADHD medication between ages 9-11. In our setting, exposure to a sibling with a disability increases the likelihood of using a psychostimulant (used to treat ADHD) between the ages of 9-20 by 47%. Our effect sizes are also comparable to Bhuller et al. (2024), who find that children exposed to domestic violence experience a 19% increase in mental health diagnoses in the year of the event, with a sustained average increase of 15% in the four years afterwards.

It may also be helpful to compare these estimates to studies examining the impact of income on child mental health. Exploiting changes in child benefits in Canada, Milligan and

[25] The matching design relies on the assumption that a sibling's disability diagnosis is as good as random conditional on the matched characteristics and observed covariates. If unobserved factors correlated with both disability risk and family outcomes remain, the estimates may still reflect residual selection. For this reason, the matching results should be interpreted with caution.

Stabile (2011) find that an extra $1,000 of benefit reduces children's hyperactivity-inattention scores by 6.8% of a standard deviation, reduces anxiety scores by 9.6% of a standard deviation and reduces conduct disorder scores by 10% of a standard deviation. Our effect sizes represent reductions of 7% of a standard deviation for the use of any mental health care service and 6% of a standard deviation for consumption of prescription drugs.

Finally, it may be informative to gauge the fiscal relevance of these effects. We therefore provide back-of-the-envelope calculations that translate the estimated effects into dollars per affected family and then scale using national population counts. A recent Danish study reports that 10–14-year-old children with a mental health diagnosis incur annual health-care costs of USD 4,068 (Christensen et al. 2022).[26] Applying the estimated 2.9 percentage-point increase implies an incremental cost of about USD 118 per affected family per year (0.029 × 4,068). Combining this figure with the estimated number of families with three or more children that have at least one child with a disability yields an aggregate cost of roughly USD 0.88 million annually, about 0.002% of total public health-care spending. Extrapolating to families with two or more children increases the estimate to USD 3.25 million per year, or 0.007% of total public health-care spending.

*5.5 Treatment Effect Heterogeneity*

This section presents several analyses intended to shed light on the extent to which there are heterogeneous treatment effects. Table 7 focuses on heterogeneity by disability severity. Guided by a physician, we broke disabilities into the three categories shown in Panels B-D:

[26] Christensen et al. (2022) define annual health care costs as the sum of four components: psychiatric hospital costs from inpatient, outpatient, and emergency-room psychiatric contacts; somatic hospital costs from somatic inpatient, outpatient, and emergency-room contacts; subsidized prescription drug costs, measured as the part of prescription costs covered by public subsidies; and primary health care costs, including services provided by general practitioners, practicing specialists, psychologists, dentists, physiotherapists, chiropodists, and chiropractors with an agreement with the tax-financed health care system.

(i) episodic and unpredictable conditions such as epilepsy/status epilepticus, coagulation defects and related hemorrhagic conditions, juvenile arthritis, and Crohn's disease; (ii) stable but highly demanding conditions such as cerebral palsy and other paralytic syndromes, diabetes, visual impairment including blindness, neoplasms, congenital malformations of the circulatory and nervous systems, and chromosomal abnormalities; and (iii) mild and manageable conditions such as hearing loss, anaemia, cleft lip/palate, and a range of congenital malformations affecting the musculoskeletal, genital, urinary, respiratory, and eye/ear/face/neck systems.[27] Although the smaller sample sizes in both the episodic and unpredictable as well as in the stable but highly demanding groups reduce statistical power, the point estimates suggest substantially larger spillovers for disabilities of this type than for mild and manageable disabilities. For any mental health utilization, the estimated effects are 4.15 percentage points (17.4%) for episodic conditions, 4.76 percentage points (22.6%) for stable but highly demanding conditions, and 1.81 percentage points (8.2%) for mild and manageable conditions. These patterns are consistent with more serious mental health problems among siblings of children with more severe disabilities.

Panel E of Table 7 examines the impact of the third-born child's age at diagnosis. Figure A2 shows that a little over half of the disabilities that are ever diagnosed in third-born children occur by age 5. So far, we have considered only disabilities diagnosed before age 5 for several reasons. First, young children in Denmark get a lot of screening and medical attention so that conditions that exist before age 5 are likely to be detected. Second, it is important to focus on

[27] Using this guidance, we were able to classify 3,803 (out of 3,854) disabled children in our sample. Appendix Table A9 assesses whether this clinical classification aligns with a utilization-based measure by comparing hospital utilization between ages 0 and 5 across the three groups, as well as among children without a disability. Third-born children in the stable but highly demanding group have by far the highest total number of hospital contacts by age 5, averaging 13.11 contacts, compared with 7.39 in the episodic and unpredictable group, and 5.98 in the mild and manageable group. Children with stable but highly demanding conditions have more inpatient stays and outpatient visits than children in the other two categories. Children with episodic and unpredictable conditions, on the other hand, have the highest number of Emergency Department visits. These patterns suggest that this classification captures meaningful differences in underlying disease burden and caregiving demands.

conditions that occur early enough for the older siblings to be affected. Once older siblings reach school age, spend more time out of the house and with peers, so their younger sibling's disabilities may have less impact on them (as evidenced by the smaller effects among first-born children). Third, a disability that is not diagnosed until after age 5 might be less severe. Consistent with these arguments, Panel E shows that disabilities diagnosed when the third-born child was five to nine have no differential impact on the mental health care of second-born siblings.

Panel F of Table 7 shows estimates from models that focus on whether the third-born child was in poor health at birth rather than on whether the third-born child was diagnosed with a disability. Poor health at birth is defined as birth weight less than 2500 grams, APGAR less than 6, or gestation less than 37 weeks. By this definition, 3.54% of children have poor health at birth. However, only 15% of these children have a disability diagnosed before age 5. While this rate is much higher than the rate of disability in children who are not in poor health at birth, the correlation between disability and poor health at birth is only 0.06, suggesting that most children recover from poor health at birth. Panel F shows that having a sibling with poor health at birth has little effect on the gap in mental health care utilization between first and second-born siblings. The only coefficient on poor health at birth that is even marginally statistically significant is in the model for any psychiatric visits, but it is much smaller than the baseline estimates in Panel A.

Table 8 explores heterogeneity by mother's education. The table shows that the overall effect of having a disabled sibling is driven by families in which the mother has less than a high school education.[28] Despite relatively generous supports for families with disabilities, these

[28] This heterogeneity by education is unlikely to be driven by differences in the types or severity of the third-born child's disability. Appendix Table A10 shows that, although the overall likelihood of having a disabled third-born

families may be the most burdened financially, and the least able to afford to hire additional caregivers. These stresses in turn may impact the quality of caregiving that is available to older siblings.

*5.6 Potential Mechanisms*

Black et al. (2021) show that exposure to a disabled third-born sibling worsens the second-born child's educational outcomes relative to the first-born's. Given the well-documented links between schooling and mental health (Goodman et al. 2011; Clark and Royer 2013; Currie 2025), it is possible that poorer academic performance contributes to the observed mental-health penalties or vice-versa. Columns 1–2 of Panel A in Appendix Table A11 replicate Black et al.'s finding: exposure to a disabled sibling lowers 9th-grade Danish (math) test scores by 0.0368 (0.0226) standard deviations. Columns 3–6 replicate our main findings about the effects on mental health in the sample of test takers.[29] Panel B examines the robustness of the test score estimates to conditioning on mental-health and vice-versa. The estimated effects on mental health are close to those in Panel A, indicating that the mental health effects of having a disabled sibling are largely orthogonal to the effects on siblings' test performance.

Strain on parents might be another possible mechanism for the negative effects of having a younger sibling with a disability on a child's mental health. Appendix Table A12 divides the sample by whether the maternal grandmother lives in the same municipality. Nearby grandparents may provide childcare and other forms of support, which could reduce parental stress and mitigate labor-market impacts. The estimated effects are larger, in both absolute and relative terms, when the maternal grandmother resides in a different municipality, a pattern that is

child declines with parental education, the distribution of specific disability conditions among affected children is very similar across education groups.

[29] Exposure to a disabled sibling has no discernible effect on the likelihood of taking the tests (coefficient = –0.00170, s.d. = 0.00650).

consistent with the idea that access to informal family support may moderate sibling spillovers. However, as grandparent proximity is not randomly assigned and may reflect broader family circumstances (including the possibility that some families choose to live near grandparents if they expect their support and a positive interaction), the estimates should be interpreted cautiously.

Table 9 provides additional evidence on the consequences of having a disabled child for parental mental health, economic resources, separations, and future fertility. These estimates are from a difference-in-differences model that compares changes in outcomes from the year before the third child's birth to 6–10 years later (i.e., after the diagnosis window) between households whose third child does and does not have a disability.[30] The estimates in Table 9 indicate that fathers in treated families experience a deterioration in their mental health compared with fathers in non-affected households: their likelihood of using mental health care increases by an additional 1.7 percentage points (about 7.7% of the control group mean in the year before the third birth). Parents in treated households also experience substantial employment and financial penalties. By 6–10 years after the third child's birth, maternal employment has declined by 5.14 percentage points (6.4%) more in treated households than in comparison households, while fathers' employment has declined by 2.76 percentage points (3.2%) more. There are no detectable effects on total household income, consistent with the safety net providing some buffer against immediate income losses. At the same time, the point estimates imply economically large reductions in total household wealth, with wealth declining by 7.6% more in treated households than in comparison households, although this effect is not statistically significant at conventional levels. Finally, having a disabled third-born child does not significantly alter the probability of

[30] Divorce and future fertility are measured over the period from the year before the third child's birth up to the calendar year in which the third child turns 10.

separation, but the probability of having an additional child within ten years increases by 1.9 percentage points (8.7%) more in treated households than in comparison households.

Figure 2 summarizes heterogeneous effects by disease severity and maternal education. Each panel displays the difference-in-differences point estimates and 95% confidence intervals, expressed as a percentage of the subgroup control group mean.[31] Figure 2a shows that the estimated mental health penalty among fathers is driven by families with episodic and unpredictable disabilities, where ongoing uncertainty may generate sustained psychological strain. The maternal employment gap also increases with severity, from 4.9% for mild and manageable conditions to 7.3% for stable but highly demanding conditions and 11.8% for episodic and unpredictable disabilities. This pattern is consistent with more demanding conditions requiring greater parental time. The difference-in-differences estimates show little effect on total household income across disability severity groups. By contrast, the estimated reductions in household wealth are largest for families whose third child has a mild disability, a pattern that may reflect more limited access to public financial support for milder conditions, leaving families to bear a larger share of the costs privately. Finally, parents whose third child has an episodic and unpredictable disability experience a larger decline in cohabitation or marriage during the ten years following the birth than parents in the comparison group.

Figure 2b shows that the labor market and family formation responses are concentrated among lower-SES families. The maternal employment gap is largest among mothers with only basic schooling, at 13.4%, compared with a much smaller effect among mothers with a high school degree or some college and no discernible effect among college-educated mothers. A similar, though smaller, gradient is visible for fathers' employment and for parental earnings.

[31] Appendix Tables 13 and 14 provide the corresponding estimates.

While total household income remains largely unaffected across education groups, lower-SES households experience much larger relative wealth declines. Family formation responses display a similar SES gradient. Lower-SES families experience a significant decline in cohabitation or marriage and a sizable increase in subsequent fertility, whereas the corresponding estimates are smaller and less precise for higher-education households.[32]

Overall, the results suggest that the groups that face the greatest overall strain (whether from more demanding disabilities or from fewer economic resources) tend to experience the largest parental responses. These results suggest that parental stress as well as losses of employment and earnings are plausible mechanisms mediating the effect of a sibling's disability on the mental health of other children in the household.

*5.7 Can Public Policy Mitigate Sibling Spillovers?*

The evidence above points to parental stress, caregiving demands, and resource strain as plausible channels through which a younger sibling's disability may affect older siblings' mental health. We next ask whether more generous public support can moderate these spillovers. This analysis is motivated by the 1998 reform described in Section 2, which increased compensation for parents of severely sick children by expanding eligibility, replacing capped benefits with full wage replacement, and allowing benefits to continue as long as eligibility criteria were met.

In Appendix Table A15, we examine effects on parental outcomes by the year of the third birth, splitting the sample into families whose third child was born before 1998 and those born in or after 1998. Mothers in the pre-reform period experienced a larger reduction in employment following the birth of a disabled third child compared to those in the post-reform period (11%

[32] The increase in fertility may reflect several related responses: reductions in maternal employment may lower the opportunity cost of another child, while changes in partnership status may also lead to additional childbearing within new relationships.

versus 5% of the control group mean). Wealth losses are observed only among pre-reform families and amount to nearly 14% of the control group mean. In addition, the probability of remaining married or cohabiting declines in the pre-reform period but is negligible and insignificant post-reform. This pattern is consistent with the interpretation that, when welfare support is less generous, the acute financial strain and caregiving demands associated with raising a disabled child place greater stress on relationships, making couples more likely to separate.

Appendix Table A16, turns to pre and post-reform effects on child mental health outcomes. The sample is split by whether the third-born child was born before or after the reform and the baseline difference-in-differences model is estimated separately for each group. The results suggest that spillover effects are larger among families whose third child was born in the pre-reform period. For any mental health utilization, the estimated effect is 4.0 percentage points (21%) in the pre-reform sample, compared to 2.1 percentage points (9%) in the post-reform sample. The same pattern is visible for counseling and prescriptions, whereas the estimates for psychiatric visits are similar across the two periods. These results suggest that more generous income support and caregiving relief moderate both the parental consequences of childhood disability and its spillover effects on siblings' mental health.

## 6 Conclusion

This paper studies the impact of a common family stressor, the presence of a younger sibling with a disability, on the utilization of mental health care among older siblings. The main estimates compare families with at least three children in which the third-born child is diagnosed with a disability before age 5 to those in which the third-born child does not have a disability in a fixed effect, difference-in-differences framework.

In treated families, second-born children spend a larger fraction of their early childhoods with a disabled sibling, and so are more exposed to family stresses arising from the disability than first-born children. A supplementary analysis using matching models suggests that first-born children are much less affected, while replicating the estimates for second-born children. The matching model is also used to show that the results hold in families with two plus children.

In affected families, second-born children are 13% more likely to use mental health services than first-born children. The biggest increases are in the use of psychiatric visits and mental health medications but there are also significant increases in the use of counselling services. The fact that first-born children are less affected by the birth of a third-born with a disability suggests that it is family stress during the early years of childhood that matters.

The overall effects are driven by households in which mothers have less than a high school education. These families experience the largest declines in both mothers' and fathers' employment, worsening paternal mental health, and reductions in wealth. These households also have a higher likelihood of having another child and experience a greater likelihood of relationship dissolution. In contrast, college-educated mothers have no labor-market penalties and no significant effects on family formation. Spillover effects and parental responses also intensify with disability severity. The paternal mental health penalty and maternal employment losses are largest for episodic and unpredictable disabilities, where the absence of a stable caregiving routine may make it harder for families to adapt. These patterns suggest that both resource constraints and changes in the intra-household allocation of time and resources contribute to parental stress which in turn worsens child mental health.

Finally, the evidence suggests that public support can mitigate these spillovers. In the pre-reform period, mothers experienced employment losses roughly twice as large as in the post-reform period, wealth declines of nearly 14% of the control group mean, and a greater likelihood

of relationship dissolution, consistent with financial strain placing greater stress on couples. These larger parental penalties in the pre-reform period are mirrored in the sibling spillover effects: the estimated increase in any mental health service use is twice as large among families whose third-born child was born before the 1998 expansion in benefits as among those born after it. These results are consistent with the view that income support and caregiving relief can attenuate the family-wide consequences of childhood disability.

These results speak to the importance of stressful events in early childhood in the development of childhood mental health conditions. They also point to a potentially important source of growing inequality in child mental health by socioeconomic status. Families with lower socio-economic status are not only more likely to have a child with a disability, but also experience larger parental employment and wealth losses when they do, with larger spillover effects on sibling mental health. These patterns suggest that disability may be an under-appreciated channel through which socioeconomic disadvantage is transmitted and amplified across generations. Given that the Danish welfare system is among the most generous in the world when it comes to supporting the families of children with disabilities, these results further suggest that the effects of such household stressors and their contribution to inequality could be much larger in countries that do not have these supports.

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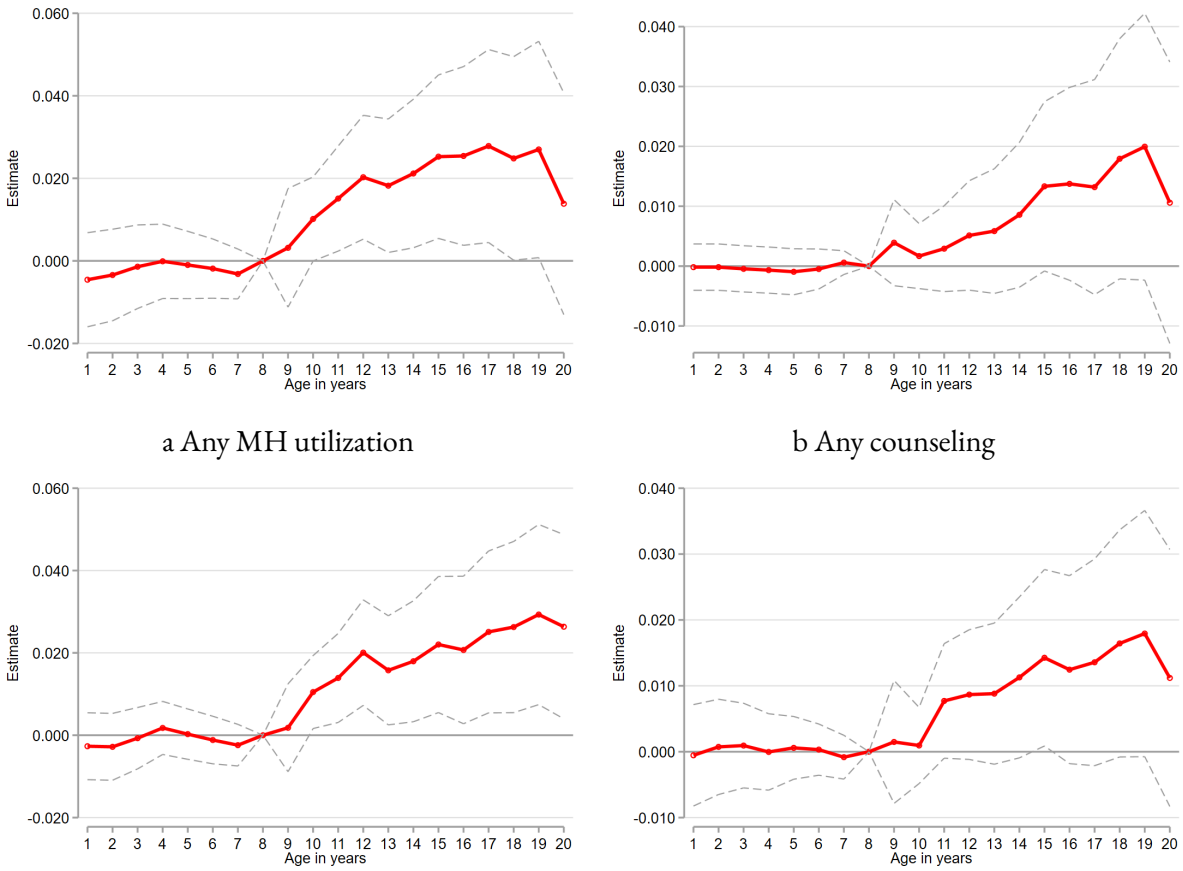



a Any MH utilization

b Any counseling

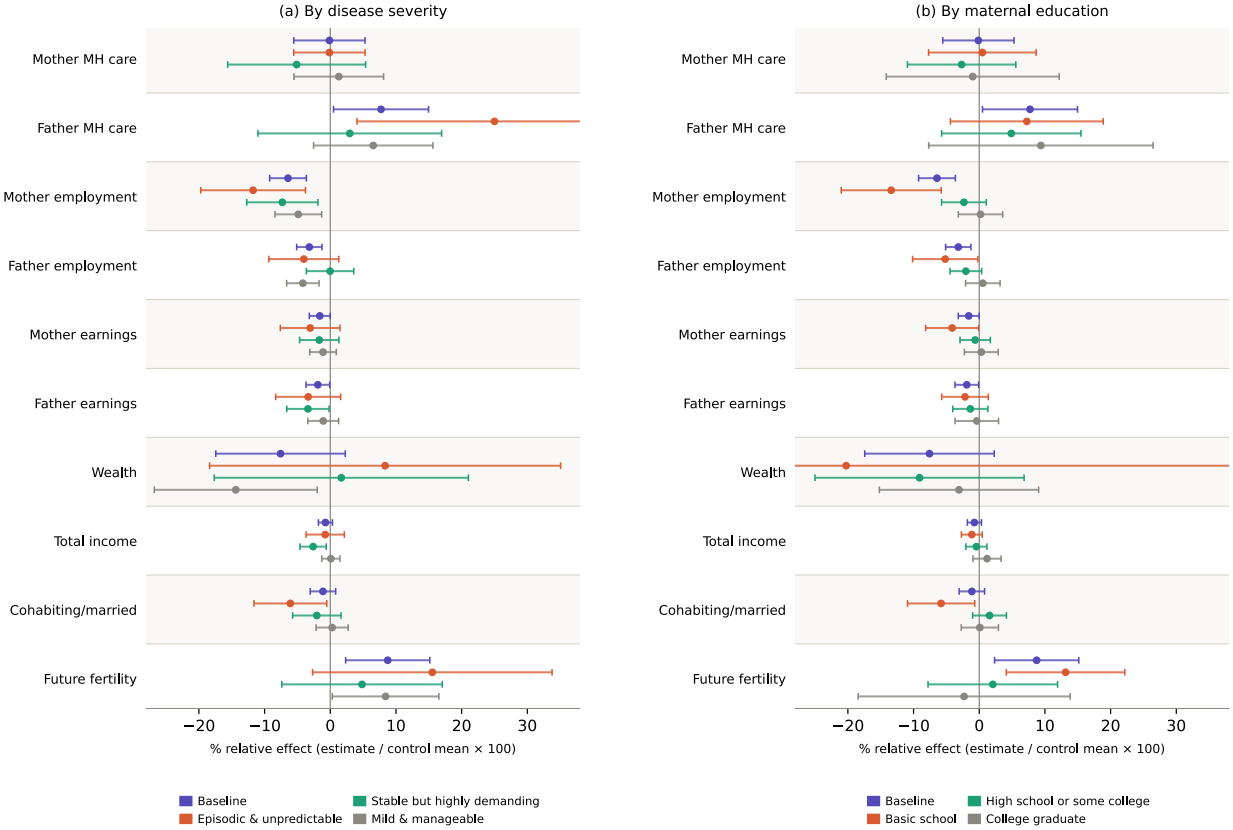
c Any Psychiatric visit

d Any MH prescription

Figure 1: Event studies showing the evolution of differences in mental health utilization between first and second born children in families with third-born with a disability

*Notes:* The figure plots coefficients from event-study models using cumulative indicators for whether the child had used the mental health service indicated in each panel by each age from birth through age 20. The specification includes indicators for having a disabled third-born sibling, being second-born, age indicators, and the full set of interactions between second-born status, age, and third-born disability status. Age 8 is the omitted category. The plotted coefficients show, at each age, the difference in cumulative mental health care utilization between second- and first-born children in families with a disabled third-born child, relative to the corresponding birth-order difference in families without a disabled third-born child. The sample is restricted to sibling pairs whose outcomes can be observed from birth through age 20, which requires both siblings to be born in 1995 or later.

Figure 2: Heterogeneous Effects of a Disabled Third-Born Child on Parental Outcomes




*Notes:* Each panel displays point estimates and 95% confidence intervals for the coefficient on the interaction term *After birth of third child* × *Third child disabled*, expressed as a percentage of the subgroup control group mean.

Table 1: Descriptive Statistics by Third-Born Child's Disability Status

| | Third born: disabled (1) | Third born: not disabled (2) | $p$-value (3) | Std diff. (4) |
|---|---|---|---|---|
| *Family Background Characteristics* | | | | |
| Mother is immigrant | 0.14 | 0.12 | 0.00 | −0.065 |
| Father is immigrant | 0.16 | 0.14 | 0.00 | −0.073 |
| Parents are cohabiting | 0.95 | 0.95 | 0.36 | 0.011 |
| Mother's age | 25.21 | 25.42 | 0.00 | 0.058 |
| Father's age | 28.16 | 28.24 | 0.14 | 0.018 |
| Mother has basic school | 0.31 | 0.27 | 0.00 | −0.074 |
| Mother has college degree | 0.23 | 0.26 | 0.00 | 0.052 |
| Father has basic school | 0.30 | 0.27 | 0.00 | −0.066 |
| Father has college degree | 0.21 | 0.23 | 0.01 | 0.031 |
| Mother is unemployed | 0.14 | 0.13 | 0.00 | −0.047 |
| Father is unemployed | 0.10 | 0.08 | 0.00 | −0.055 |
| Mother's income | 161,704 | 167,066 | 0.00 | 0.044 |
| Father's income | 232,742 | 246,840 | 0.00 | 0.084 |
| Mother receives counseling | 0.038 | 0.027 | 0.00 | −0.060 |
| Mother has a psychiatric visit | 0.090 | 0.055 | 0.00 | −0.040 |
| Mother uses MH medication | 0.050 | 0.041 | 0.00 | −0.042 |
| Father receives counseling | 0.017 | 0.012 | 0.00 | −0.048 |
| Father has a psychiatric visit | 0.074 | 0.058 | 0.14 | −0.020 |
| Father uses MH medication | 0.043 | 0.037 | 0.030 | −0.029 |
| *Characteristics of First- and Second-Born Children* | | | | |
| Female | 0.52 | 0.53 | 0.71 | 0.021 |
| Gestation age in weeks | 39.74 | 39.80 | 0.00 | 0.039 |
| Birth weight in grams | 3496.21 | 3522.18 | 0.00 | 0.048 |
| 5 minute APGAR | 9.81 | 9.84 | 0.028 | 0.030 |
| 1st year hospitalization | 0.33 | 0.29 | 0.00 | −0.087 |
| 2nd year hospitalization | 0.48 | 0.43 | 0.00 | −0.11 |
| Spacing 1st to 2nd | 2.61 | 2.59 | 0.063 | −0.022 |
| Spacing 2nd to 3rd | 4.18 | 4.049 | 0.00 | −0.069 |
| Observations | 7,708 | 113,102 | 120,810 | 120,810 |

*Notes:* This table presents the means of observable characteristics by treatment status. Column (1) focuses on the subset of the analysis sample where the third child is diagnosed with a physical disability by age 5; while column (2) is restricted to the subset of the analysis sample where the third born child does not have a diagnosed physical disability by age 5. Column (3) presents $p$-values for the test of equality of the means between columns (1) and (2) and Column (4) provides standardized differences between the first two columns. The standardized difference is defined as $\frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{1}{2}(s_A^2 + s_B^2)}}$, where $\bar{X}_A$, $\bar{X}_B$ are group means and $s_A^2$, $s_B^2$ are variances. This provides a scale-invariant measure of the magnitude of imbalance; differences below 0.25 are commonly interpreted as indicating acceptable balance. Income is reported in 2015 prices. Parental age, educational attainment and marital/cohabiting status are measured at the time of the first birth, while household labor market outcomes and mental health care utilization are measured in the year before the first birth. Mental health care utilization of parents is measured in the year before the third birth as these data are available starting in 1995.

Table 2: Effects of Exposure to a Disabled Younger Sibling on Child Mental Health

| | (1) | (2) | (3) |
|---|---|---|---|
| *A. Any Mental Health Care Utilization* | | | |
| 3rd sibling disabled × 2nd born | 0.0286*** | 0.0286*** | 0.0284*** |
| | (0.00909) | (0.00909) | (0.00910) |
| Control group mean | 0.221 | 0.221 | 0.221 |
| *B. Any Counseling Service* | | | |
| 3rd sibling disabled × 2nd born | 0.0166** | 0.0166** | 0.0170** |
| | (0.00797) | (0.00797) | (0.00797) |
| Control group mean | 0.153 | 0.153 | 0.153 |
| *C. Any Psychiatric Visit* | | | |
| 3rd sibling disabled × 2nd born | 0.0238*** | 0.0235*** | 0.0231*** |
| | (0.00722) | (0.00722) | (0.00722) |
| Control group mean | 0.102 | 0.102 | 0.102 |
| *D. Any Mental Health Prescription* | | | |
| 3rd sibling disabled × 2nd born | 0.0168** | 0.0166** | 0.0161** |
| | (0.00677) | (0.00677) | (0.00677) |
| Control group mean | 0.089 | 0.089 | 0.089 |
| Birth characteristics | | X | X |
| Parental characteristics | | | X |
| Number of observations | 120,810 | 120,810 | 120,810 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents the estimate of the coefficient on the interaction term between the indicator for the second-born child and the indicator for the third-born child having a disability from a separate regression using the outcome indicated in the panel heading. All specifications include family fixed effects, and indicators for child gender, year and month of birth. The specification in Column (2) adds infant birth weight, gestational age, and 5-minute Apgar score. The specification in Column (3) further controls for parental characteristics in the year before the birth of each child: age, gross personal income, indicators for marital/cohabitation status, educational attainment (basic school only, college graduate), and employment status. The reported mean of the outcome is calculated among first-born children in families with a disabled third child. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 3: Effects of Exposure to a Disabled Younger Sibling on Predetermined Characteristics

| | Birth weight | Log BW | Low BW | Gestation weeks | Preterm | APGAR 5 | Hosp. contact 1y | Hosp. contact 2y |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *A. Predetermined Health Outcomes of First- and Second-Born Children* | | | | | | | | |
| 3rd sibling disabled × 2nd born | −8.832 | −0.00252 | −0.00152 | −0.0226 | 0.00111 | −0.00583 | 0.00553 | 0.0115 |
| | (9.141) | (0.00302) | (0.00414) | (0.0342) | (0.00437) | (0.0230) | (0.0103) | (0.0108) |
| Control group mean | 3,420 | 8.123 | 0.044 | 39.646 | 0.049 | 10.218 | 0.319 | 0.456 |

| *B. Predetermined Time-Varying Parental Characteristics* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Married | Basic school only | | College graduate | | Income | | |
| | | Mother | Father | Mother | Father | Mother | Father | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | |
| 3rd sibling disabled × 2nd born | 0.00156 | −0.000558 | −0.00534* | −0.00364 | −0.0105*** | -2,492.6 | -2,012.2 | |
| | (0.00425) | (0.00233) | (0.00279) | (0.00356) | (0.00333) | (1779.0) | (2471.9) | |
| Control group mean | 0.947 | 0.305 | 0.300 | 0.233 | 0.258 | 161,610 | 232,979 | |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents the estimate of the coefficient on the interaction term between the indicator for the second-born child and the indicator for the third-born child having a disability from a separate regression using the outcome indicated in the column heading. Panel A focuses on child characteristics at birth or during the first two years of life. Panel B examines effects on parental characteristics, measured in the year before the birth of each child. All specifications include family fixed effects, and indicators for child gender, year and month of birth. The reported mean of the outcome is calculated among first-born children in families with a disabled third child. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 4: Robustness Checks

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Measuring exposure in years* | | | | |
| 3rd sibling disabled × exposure | 0.00992*** | 0.00620** | 0.00763*** | 0.00552** |
| | (0.00321) | (0.00287) | (0.00255) | (0.00235) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *C. Excluding households where the first- or second-born children have a physical disability* | | | | |
| 3rd sibling disabled × 2nd born | 0.0310*** | 0.0169* | 0.0250*** | 0.0175** |
| | (0.0102) | (0.00904) | (0.00806) | (0.00751) |
| Control group mean | 0.214 | 0.155 | 0.097 | 0.083 |
| Number of observations | 102,310 | 102,310 | 102,310 | 102,310 |
| *D. Excluding households where either parent uses mental health care services before the third birth* | | | | |
| 3rd sibling disabled × 2nd born | 0.0321*** | 0.0182** | 0.0298*** | 0.0219*** |
| | (0.0106) | (0.00926) | (0.00838) | (0.00774) |
| Control group mean | 0.213 | 0.148 | 0.096 | 0.082 |
| Number of observations | 88,932 | 88,932 | 88,932 | 88,932 |
| *E. Excluding third-born children with a mental health diagnosis* | | | | |
| 3rd sibling disabled × 2nd born | 0.0300*** | 0.0173** | 0.0235*** | 0.0155** |
| | (0.00918) | (0.00804) | (0.00727) | (0.00680) |
| Control group mean | 0.217 | 0.151 | 0.101 | 0.088 |
| Obs. | 120,184 | 120,184 | 120,184 | 120,184 |
| *F. Requiring the birth spacing between second and third born children to be at most 5 years* | | | | |
| 3rd sibling disabled × 2nd born | 0.0276*** | 0.0144* | 0.0227*** | 0.0174** |
| | (0.00946) | (0.00826) | (0.00745) | (0.00698) |
| Control group mean | 0.216 | 0.150 | 0.099 | 0.084 |
| Obs. | 118,576 | 118,576 | 118,576 | 118,576 |
| *G. Eliminating the constraint of maximum nine-year spacing between the second and third child* | | | | |
| 3rd sibling disabled × 2nd born | 0.0259*** | 0.0151** | 0.0202*** | 0.0149** |
| | (0.00879) | (0.00769) | (0.00698) | (0.00653) |
| Control group mean | 0.224 | 0.156 | 0.105 | 0.091 |
| Number of observations | 128,604 | 128,604 | 128,604 | 128,604 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates. In Panel B, we replace the indicator for second-born in the interaction term with the birth spacing between first and second-born children. Panels C-E re-estimate the baseline model after: excluding households where either the first- or the second-born sibling has a physical disability, excluding households where either parent uses mental health care services before the third birth, and excluding third-born children with a mental health diagnosis. Panels E-F re-estimate the baseline model imposing different birth spacing requirements between the second and third-born children. All specifications include family fixed effects, year and month of birth fixed effects, child characteristics (gender, birth weight, gestational age, 5-minute Apgar score) and parental characteristics in the year before the birth of each child (age, gross personal income, indicators for marital/cohabitation status, educational attainment and employment status). Income is reported in 2015 prices. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 5: Effects of Exposure to a Disabled Younger Sibling on Child's Physical Health

| | Likelihood of a contact: | | | Number of contacts: | | | |
|---|---|---|---|---|---|---|---|
| | Inpatient | Outpatient | ER | Inpatient | Outpatient | ER | GP contacts |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 3rd disbaled sibling × 2nd born | −0.0000991 | −0.00881 | −0.00266 | −0.00485 | 0.0316 | −0.0779 | −0.0572 |
| | (0.0110) | (0.00974) | (0.00932) | (0.0673) | (0.0830) | (0.0633) | (0.379) |
| Control group mean | 0.396 | 0.745 | 0.753 | 1.002 | 3.007 | 2.816 | 35.391 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each column represents a separate regression with the outcome indicated in the column headings. All specifications include family fixed effects, year and month of birth fixed effects, child characteristics (gender, birth weight, gestational age, 5-minute Apgar score) and parental characteristics in the year before the birth of each child (age, gross personal income, indicators for marital/cohabitation status, educational attainment and employment status).The reported mean of the outcome is calculated among first-born children in families with a disabled third child. Standard errors are clustered at the family level. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 6: Effects of Exposure to a Disabled Younger Sibling on Child Mental Health Based on Matching Methods

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Effects Based on Matching Methods, Second-Born Children in Families with 3+ children* | | | | |
| Disabled sibling | 0.0273*** | 0.0162** | 0.0218*** | 0.00921 |
| | (0.00786) | (0.00684) | (0.00607) | (0.00563) |
| Control group mean | 0.208 | 0.147 | 0.096 | 0.089 |
| Number of observations | 42,722 | 42,722 | 42,722 | 42,722 |
| *C. Effects Based on Matching Methods, First-Born Children in Families with 3+ children* | | | | |
| Disabled sibling | 0.00281 | 0.000120 | 0.0154*** | 0.000788 |
| | (0.00781) | (0.00669) | (0.00588) | (0.00539) |
| Control group mean | 0.202 | 0.141 | 0.085 | 0.080 |
| Number of observations | 39,192 | 39,192 | 39,192 | 39,192 |
| *D. Effects Based on Matching Methods, Children in Families with 3+ children* | | | | |
| Disabled sibling | 0.0153*** | 0.00836* | 0.0187*** | 0.00510 |
| | (0.00554) | (0.00479) | (0.00423) | (0.00390) |
| Control group mean | 0.205 | 0.144 | 0.091 | 0.085 |
| Number of observations | 81,914 | 81,914 | 81,914 | 81,914 |
| *E. Effects Based on Matching Methods, Families with 2+ children* | | | | |
| Disabled sibling | 0.0206*** | 0.0144*** | 0.0121*** | 0.00735*** |
| | (0.00302) | (0.00264) | (0.00224) | (0.00211) |
| Control group mean | 0.213 | 0.153 | 0.091 | 0.085 |
| Number of observations | 967,923 | 967,923 | 967,923 | 967,923 |

*Notes:* Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates using Equation (1). Panels B–E present coefficients on the indicator for the having a disabled younger sibling from a matching model estimated in the sample described in the panel heading. The reported mean of the outcome is calculated among children in families without a disabled child. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 7: Heterogeneous Effects of Exposure to a Disabled Younger Sibling by Disease Severity

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Effects of Episodic and Unpredictable Disabilities* | | | | |
| 3rd sibling disabled × 2nd born | 0.0415 | 0.0295 | 0.0188 | 0.0346* |
| | (0.0271) | (0.0232) | (0.0225) | (0.0195) |
| Control group mean | 0.238 | 0.149 | 0.130 | 0.100 |
| Number of observations | 114,044 | 114,044 | 114,044 | 114,044 |
| *C. Effects of Stable but Highly Demanding Disabilities* | | | | |
| 3rd sibling disabled × 2nd born | 0.0476*** | 0.0160 | 0.0362** | 0.0362*** |
| | (0.0177) | (0.0155) | (0.0142) | (0.0132) |
| Control group mean | 0.211 | 0.155 | 0.096 | 0.076 |
| Number of observations | 115,072 | 115,072 | 115,072 | 115,072 |
| *D. Effects of Mild and Manageable Disabilities* | | | | |
| 3rd sibling disabled × 2nd born | 0.0181 | 0.0155 | 0.0178** | 0.00370 |
| | (0.0113) | (0.00996) | (0.00889) | (0.00845) |
| Control group mean | 0.221 | 0.153 | 0.099 | 0.092 |
| Number of observations | 117,796 | 117,796 | 117,796 | 117,796 |
| *E. Effects of Disabilities Diagnosed at Different Ages* | | | | |
| Disabled (0–4) × 2nd born | 0.0281*** | 0.0165** | 0.0228*** | 0.0159** |
| | (0.00911) | (0.00798) | (0.00722) | (0.00678) |
| Disabled (5–9) × 2nd born | −0.0132 | −0.0167 | −0.0112 | −0.00876 |
| | (0.0138) | (0.0125) | (0.0104) | (0.0101) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *F. Effects of Poor Health at Birth* | | | | |
| 3rd sibling poor health × 2nd born | 0.0103 | 0.0111 | 0.0186* | −0.00301 |
| | (0.0122) | (0.0108) | (0.00955) | (0.00968) |
| Control group mean | 0.249 | 0.162 | 0.109 | 0.118 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each Panel has 4 regressions using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates. Panels B-D examine the effects of disabilities with differing severity, based on a classification guided by a physician. Panel E re-estimates the baseline model after including an interaction term for the second-born child and an indicator for the third-born child having a disability diagnosis between the ages of 5–9. Panel F replaces the indicator for the third-born child having a disability by age 5 with an indicator for the third-born child having poor health at birth, defined as the third-born having a birth weight below 2,500 grams or gestational age below 37 weeks or five minutes Apgar score below 6. All specifications include family fixed effects, year and month of birth fixed effects, child characteristics and parental characteristics in the year before the birth of each child. The reported mean of the outcome is calculated among first-born children in treated families. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 8: Heterogeneous Effects of Exposure to a Disabled Younger Sibling by Mother's Education

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Basic School* | | | | |
| 3rd sibling disabled × 2nd born | 0.0344* | 0.0179 | 0.0362** | 0.0263* |
| | (0.0179) | (0.0159) | (0.0149) | (0.0139) |
| Control group mean | 0.272 | 0.186 | 0.134 | 0.114 |
| Number of observations | 33,076 | 33,076 | 33,076 | 33,076 |
| *C. High School or Some College* | | | | |
| 3rd sibling disabled × 2nd born | 0.0294** | 0.0207* | 0.0163 | 0.0133 |
| | (0.0131) | (0.0113) | (0.0102) | (0.00970) |
| Control group mean | 0.202 | 0.138 | 0.094 | 0.081 |
| Number of observations | 57,074 | 57,074 | 57,074 | 57,074 |
| *D. College Graduate* | | | | |
| 3rd sibling disabled × 2nd born | 0.0197 | 0.0101 | 0.0189 | 0.00931 |
| | (0.0175) | (0.0158) | (0.0133) | (0.0123) |
| Control group mean | 0.189 | 0.138 | 0.075 | 0.070 |
| Number of observations | 30,660 | 30,660 | 30,660 | 30,660 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates. Panels B–D present results by mother's education, measured at the time of the first birth. All specifications in Panels A–D include family fixed effects, year and month of birth fixed effects, child characteristics (gender, birth weight, gestational age, 5-minute Apgar score) and parental characteristics in the year before the birth of each child (age, gross personal income, indicators for marital/cohabitation status, educational attainment and employment status). The reported mean of the outcome is calculated among first-born children in treated families. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table 9: Effects of a Disabled Third-Born Child on Parental Outcomes

| | Any MH care | | Employment | | Earnings | | Wealth | Total income | Cohabiting/ Married | Future Fertility |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mother | Father | Mother | Father | Mother | Father | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| After the birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After the birth of 3rd child × 3rd child disabled | −0.000442 | 0.0170** | −0.0514*** | −0.0276*** | -3,633.1** | -6,767.6** | -32,699.4 | -3,306.0 | −0.00850 | 0.0188*** |
| | (0.00930) | (0.00812) | (0.0114) | (0.00850) | (1,847.4) | (3,284.5) | (21,712.6) | (2,452.9) | (0.00751) | (0.00703) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 99,116 | 99,116 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 |

*Notes:* This table presents the effects of having a disabled third-born child on the mother's mental health, labor market and family formation outcomes. The results are based on a difference-in-difference model comparing the change in outcomes 6–10 years in columns (1)-(8) and 0–10 years in columns (9)-(10) after the birth of the third child relative to the year before the birth of the third child, between households where the third child has a disability or not. Third-born child's disability status is based on receiving a diagnosis by age 5. The reported mean of the outcome is calculated among families without a disabled third child in the year before the third birth. Earnings are reported in 2015 prices. Robust standard errors are in parenthesis. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

# Child Disability and Effects on Sibling Mental Health

*Online Appendix*

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Jonas Cuzulan Hirani *VIVE*

# A1 Description of Disabilities

**A. Physical disability conditions included in Black et al. (2021)**

- Neoplasms: C00-C99, D32-D33, D39-D40, D42-D43, D46
- Anaemias: D50-D64
- Coagulation defects, purpura and other hemorrhagic conditions: D65-D69
- Diabetes mellitus: E10-E14
- Disorders of porphyrin and bilirubin metabolism: E80
- Epilepsy and status epilepticus: G40-G41
- Cerebral palsy and other paralytic syndromes: G80-G83
- Visual impairments: H54
- Hearing impairments: H90-H91
- Crohn disease: K50
- Juvenile arthritis: M08-M09
- Nervous system malformations: Q00-Q07
- Eye, ear, face and neck malformations:Q10-Q18
- Circulatory system malformations: Q20-Q28
- Respiratory system malformations: Q30-Q34
- Clef lip and palate: Q35-Q37
- Genital organs malformations: Q50-Q56
- Urinary system malformations: Q60-Q64
- Musculoskeletal system malformations: Q65-Q79
- Other malformations: Q80-Q89
- Other chromosomal abnormalities : Q90-Q99

**B. Additional conditions from the List of Compassionate Allowances Conditions**

- Huntington's disease: G10
- Other specified degenerative diseases of nervous system: G318
- Metachromatic Leukodystrophy: E752E
- Other specified myopathies: G7289
- Alpers Disease: G318A
- Alpha Mannosidosis, Fucosidosis Type I: E771

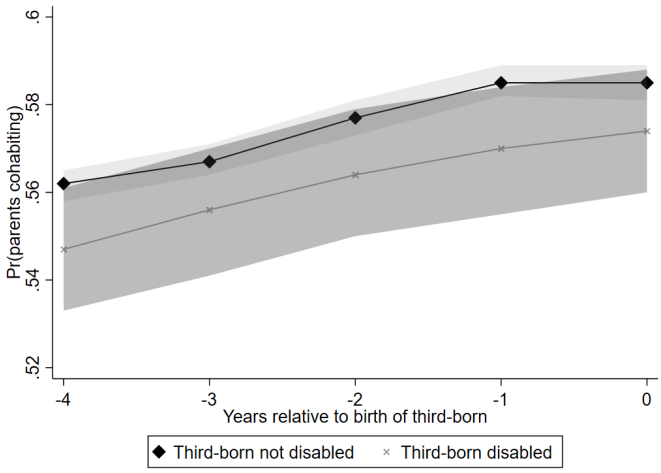
- Amyotrophic lateral sclerosis: G122A
- Ataxia Telangiectasia: G113
- Batten disease: E754
- Beta Thalassemia Major: D561
- Bilateral Optic Atrophy: H472
- Childhood Ataxia: E752
- Cerebrotendinous Xanthomatosis: E755
- Chronic Idiopathic Intestinal Pseudo Obstruction: K598
- Creutzfeldt-Jakob disease: A810
- Disorders of arteries and arterioles: I778
- Early-onset Alzheimer's Disease: G300,G308,G309
- Farber's disease: E756
- Fatal Familial Insomnia: A818B
- Fibrodysplasia Ossificans Progressiva: M611
- Friedreich's Ataxia: G111
- Frontotemporal Dementia: G310
- Fukuyama Congenital Muscular Dystrophy : G710
- Giant Cell Myocarditis: I428
- Galactosialidosis: E889
- Giant Axonal Neuropathy: G600
- Glutaric Acidemia - Type II: E713
- Heart Transplant Graft Failure: T862
- Heart Transplant wait-list: Z941
- Hemophagocytic Lymphohistiocytosis - Familial Type: D761
- Hepatopulmonary syndrome: K768
- Hepatorenal Syndrome: K767
- Histiocytosis: J848
- Hutchinson-Gilford Progeria Syndrome: E348
- Hypocomplementemic Urticarial Vasculitis Syndrome : M359
- Hypophosphatasia: E833

- I Cell Diseas: E770
- Idiopathic Pulmonary Fibrosis: J841
- Intracranial Hemangiopericytoma: M850
- Disorder of carbohydrate metabolism: E749
- Muscular dystrophy: G710
- Neuronal ceroid lipofuscinosis: E754
- Jervell and Lange-Nielsen Syndrome: I458
- Joubert Syndrome: G111
- Kufs disease: E75
- Lesch-Nyhan syndrome: E791
- Lowe Syndrome: E720
- Malignant Multiple Sclerosis: G35
- Marshall-Smith Syndrome : C870
- Menkes Disease: E830
- Metachromatic leukodystrophy: E752
- MPS I: E760
- MPS II: E761
- Multiple System Atrophy: G903
- Nephrogenic Systemic Fibrosis: L908
- NFU-1 Mitochondrial Disease: E884
- Obliterative Bronchiolitis: J449
- Ohtahara Syndrome: G403
- Ornithine Transcarbamylase (OTC) Deficiency: E724
- Paraneoplastic Pemphigus : L108
- Pearson Syndrome: D640
- Malignant Mesothelioma: C450
- Pompe disease: E740
- Progressive Bulbar Palsy: G122
- Progressive multifocal leukoencephalopathy: A812
- Progressive supranuclear ophthalmoplegia: G231

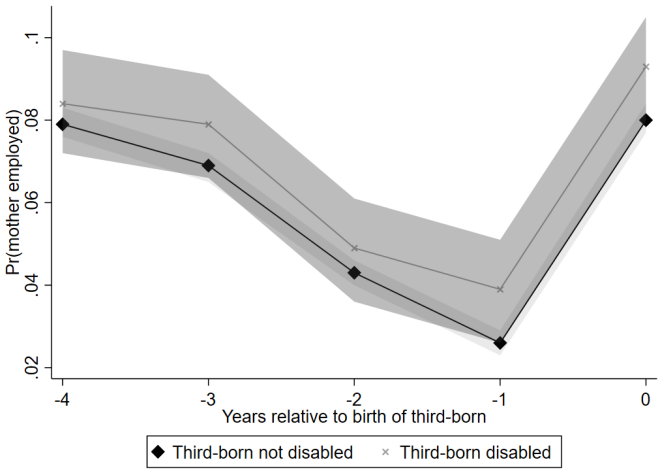
- Retinopathy of Prematurity: H351
- Severe Combined Immunodeficiency: D819
- Smith Lemli Opitz Syndrome: E787
- Spinal Muscular Atrophy: G12
- Spinocerebellar Ataxia: G119
- Stiff Person Syndrome: G258
- Subacute Sclerosing Panencephalitis: A811
- Tabes Dorsalis: A521
- Myotonic disorders: G711
- Ullrich Congenital Muscular Dystrophy: G712
- Usher Syndrome Type I: H355
- A Ventricular Assist Device: Z958
- Wolman disease: E780
- X-Linked Lymphoproliferative Disease: D823

**C. Additional conditions from the Global Burden of Disease Study**

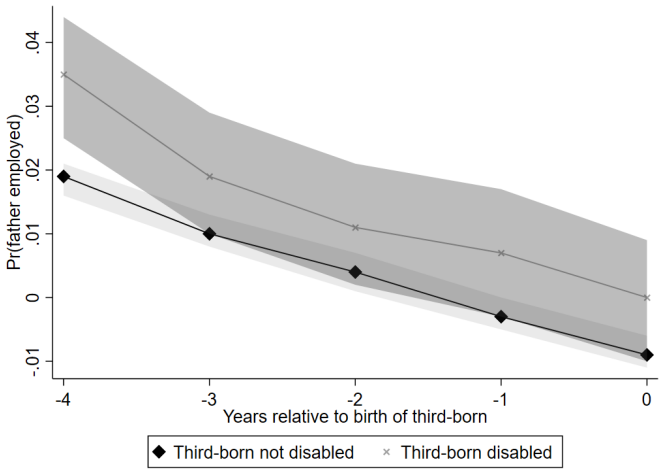
- Blindness, both eyes: H540
- Blindness, one eye, low vision other eye: H541
- Encephalopathy: G934



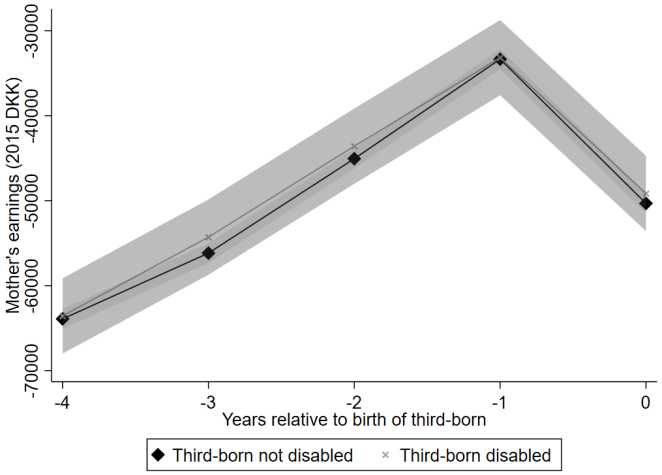

a Parents' marital/cohabitation status



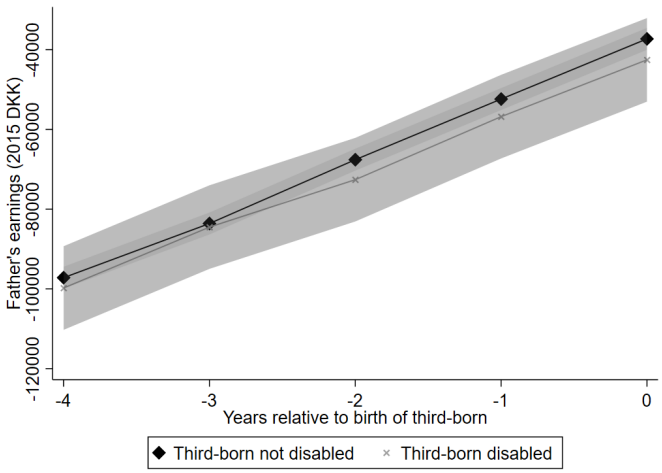

b Mother's employment status




c Father's employment status




d Mother's earnings




e Father's earnings

Figure A1: Trajectories of parental characteristics before the third-birth

*Notes:* These figures show pre-third-birth trajectories for a set of parental and family characteristics. For each characteristic, we residualize the characteristic with respect to parents' immigrant status, marital/cohabitation status, highest education, parental age fixed effects, and third-born birth-year fixed effects, and then plot the residualized means and confidence intervals separately for treatment and control families by years relative to the third birth.

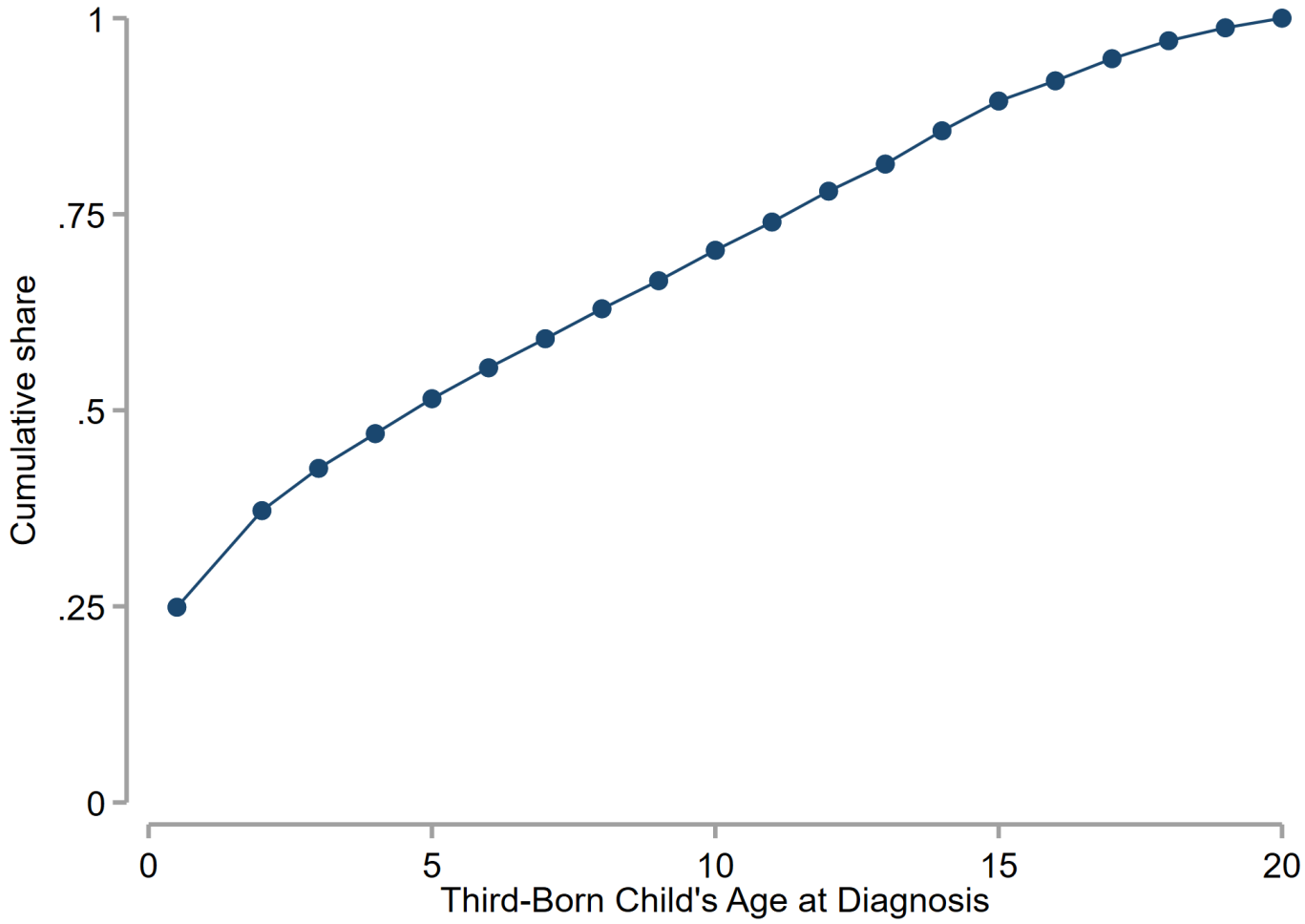



Figure A2: Cumulative Density of Third-Born Child's Age at Diagnosis

*Notes:* The figure plots the age at first diagnosis among third-born children in our estimation sample of three-sibling families, where the first- and second-born children were born between 1988 and 1999. The corresponding third-born cohorts are 1990 to 2008, so not all third-born children can be followed to age 20. The diagnoses included are the physical disability diagnoses listed in Appendix A1.

Table A1: Effects of Exposure to a Disabled Younger Sibling on Child Mental Health, All Estimates

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| Second born | -0.00334 | -0.00657 | -0.00165 | 0.00240 |
| | (0.00592) | (0.00519) | (0.00449) | (0.00433) |
| 3rd disabled sibling × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Birth weight (in grams) | -0.00000708 | 0.00000544 | -0.00000119 | -0.00000986*** |
| | (0.00000493) | (0.00000434) | (0.00000380) | (0.00000370) |
| Parents are cohabiting | -0.0277*** | -0.00740 | -0.0149* | -0.0185** |
| | (0.00988) | (0.00883) | (0.00810) | (0.00779) |
| Mother has basic school | -0.0212 | 0.0222 | -0.0259* | -0.0212 |
| | (0.0183) | (0.0161) | (0.0154) | (0.0140) |
| Mother is college graduate | 0.00193 | 0.00456 | 0.00394 | -0.0000533 |
| | (0.0103) | (0.00916) | (0.00774) | (0.00724) |
| Father has basic school | -0.00801 | -0.0227 | 0.00235 | -0.0139 |
| | (0.0202) | (0.0186) | (0.0163) | (0.0157) |
| Father is college graduate | -0.0293** | -0.0106 | -0.0212** | -0.0159* |
| | (0.0115) | (0.0102) | (0.00850) | (0.00823) |
| Mother is unemployed | 0.00487 | 0.00240 | 0.00462 | 0.00424 |
| | (0.00582) | (0.00515) | (0.00455) | (0.00443) |
| Father is unemployed | 0.0138* | 0.0156** | 0.00502 | -0.00106 |
| | (0.00762) | (0.00666) | (0.00581) | (0.00573) |
| Child gender girl | 0.0791*** | 0.105*** | 0.00524** | 0.0147*** |
| | (0.00327) | (0.00291) | (0.00244) | (0.00242) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each column represents a separate regression with the outcome indicated in the column heading and the covariates indicated in the rows. The regression models also include indicators for child gestational age, and 5-minute Apgar score; parental age and income decile in the year before the birth of each child, and fixed effects for child birth year, birth month, and family. The reported mean of the outcome is calculated among first-born children in families with a disabled third child. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A2: Difference-in-Difference Tabulations

| | 2nd born<br>(1) | 1st born<br>(2) | Difference<br>(3) |
|---|---|---|---|
| *A. Any MH Care Utilization Service* | | | |
| 3rd sibling disabled by age 5 | 0.265 | 0.221 | 0.0449*** |
| | (0.442) | (0.415) | (0.00976) |
| 3rd sibling not disabled by age 5 | 0.233 | 0.217 | 0.0168*** |
| | (0.423) | (0.412) | (0.00248) |
| Difference | 0.0321*** | 0.00398 | 0.0321*** |
| | (0.00706) | (0.00686) | (0.00733) |
| *B. Any Counseling Service* | | | |
| 3rd sibling disabled by age 5 | 0.176 | 0.153 | 0.0234*** |
| | (0.381) | (0.360) | (0.00844) |
| 3rd sibling not disabled by age 5 | 0.160 | 0.152 | 0.00796*** |
| | (0.366) | (0.359) | (0.00216) |
| Difference | 0.0166*** | 0.00123 | 0.0166*** |
| | (0.00611) | (0.00597) | (0.00633) |
| *C. Any Psychiatric Visit* | | | |
| 3rd sibling disabled by age 5 | 0.145 | 0.102 | 0.0428*** |
| | (0.352) | (0.302) | (0.00747) |
| 3rd sibling not disabled by age 5 | 0.113 | 0.0943 | 0.0186*** |
| | (0.316) | (0.292) | (0.00181) |
| Difference | 0.0317*** | 0.00746 | 0.0317*** |
| | (0.00531) | (0.00488) | (0.00582) |
| *D. Any Mental Health Prescription* | | | |
| 3rd sibling disabled by age 5 | 0.117 | 0.0887 | 0.0280*** |
| | (0.321) | (0.284) | (0.00691) |
| 3rd sibling not disabled by age 5 | 0.101 | 0.0904 | 0.0110*** |
| | (0.302) | (0.287) | (0.00175) |
| Difference | 0.0153*** | −0.00167 | 0.0153*** |
| | (0.00505) | (0.00477) | (0.00533) |
| height | | | |
| Number of observations (families) | | 120,810 (60,405) | |

*Notes:* This table presents the results of difference-in-differences models with no covariates included. Each panel focuses on a different mental health outcome. Within each panel, the first two rows correspond to families with and without a disabled third child, respectively, while the first two columns correspond to second- and first-born children, respectively. The third column and the third row of each panel presents *t*-test differences in the corresponding group. Difference-in-differences estimates are presented in the bottom right corner of each panel. Standard errors are adjusted for clustering at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A3: Heterogeneous Effects of Exposure to a Disabled Younger Sibling by Birth Spacing between the First Two Births

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Below Median Spacing* | | | | |
| Disabled sibling | 0.0220* | 0.0147 | 0.0240** | 0.0139 |
| | (0.0129) | (0.0110) | (0.0102) | (0.00961) |
| Control group mean | 0.216 | 0.144 | 0.104 | 0.088 |
| Number of observations | 60,464 | 60,464 | 60,464 | 60,464 |
| *C. Above Median Spacing* | | | | |
| Disabled sibling | 0.0357*** | 0.0220* | 0.0217** | 0.0179* |
| | (0.0129) | (0.0115) | (0.0103) | (0.00956) |
| Control group mean | 0.225 | 0.162 | 0.100 | 0.090 |
| Number of observations | 60,346 | 60,346 | 60,346 | 60,346 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates. Panels B-C present estimates after splitting the sample into two groups based on the median spacing between the first- and second-born children. The reported mean of the outcome is calculated among children in families without a disabled child. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A4: Descriptive Statistics by Having a Younger Sibling with a Random de Novo or Chromosomal Mutation

| | Sibling not disabled (1) | Sibling disabled (2) | p-value (3) |
|---|---|---|---|
| *A. Downs Syndrome* | | | |
| Mother is immigrant | 0.075 | 0.045 | 0.185 |
| Father is immigrant | 0.088 | 0.060 | 0.245 |
| Parents are cohabiting | 0.959 | 0.948 | 0.525 |
| Mother's age | 25.091 | 25.485 | 0.139 |
| Father's age | 28.095 | 28.493 | 0.299 |
| Mother has basic school | 0.251 | 0.224 | 0.465 |
| Mother has college degree | 0.219 | 0.269 | 0.167 |
| Father has basic school | 0.258 | 0.239 | 0.606 |
| Father has college degree | 0.198 | 0.157 | 0.228 |
| Female | 0.515 | 0.485 | 0.490 |
| 5 minute APGAR | 9.820 | 9.856 | 0.671 |
| Gestation age in weeks | 39.681 | 39.813 | 0.418 |
| Birth weight in grams | 3439.347 | 3548.421 | 0.026 |
| Maternal age at birth of disabled child | 30.168 | 31.119 | 0.000 |
| *Number of observations* | 232,498 | 134 | 232,632 |
| | | | |
| *B. Random de novo or chromosomal mutations* | | | |
| Mother is immigrant | 0.075 | 0.055 | 0.235 |
| Father is immigrant | 0.088 | 0.063 | 0.171 |
| Parents are cohabiting | 0.959 | 0.945 | 0.302 |
| Mother's age | 25.092 | 25.134 | 0.833 |
| Father's age | 28.095 | 28.177 | 0.777 |
| Mother has basic school | 0.251 | 0.261 | 0.739 |
| Mother has college degree | 0.219 | 0.223 | 0.900 |
| Father has basic school | 0.258 | 0.286 | 0.333 |
| Father has college degree | 0.198 | 0.164 | 0.183 |
| Female | 0.515 | 0.462 | 0.104 |
| 5 minute APGAR | 9.820 | 9.847 | 0.662 |
| Gestation age in weeks | 39.681 | 39.693 | 0.923 |
| Birth weight in grams | 3439.450 | 3528.824 | 0.015 |
| Maternal age at birth of disabled child | 30.168 | 30.437 | 0.142 |
| *Number of observations* | 232,261 | 238 | 232,499 |

*Notes:* This table presents the means of observable characteristics by disability status. Parental age, educational attainment and marital/cohabiting status are measured at the time of first birth. Birth characteristics for the focal child. Column (1) focuses on the subset of the analysis sample where the third child is not diagnosed with the disability; while column (2) is restricted to the subset of the analysis sample where the third born child is diagnosed with the disability. Column (3) presents *p*-values for the test of equality of the means between columns (1) and (2).

Table A5: Effects of Children with Random Genetic Mutations on Sibling Mental Health

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Effects of Having a Sibling with Downs Syndrome* | | | | |
| Disabled sibling | 0.0744* | 0.0507 | 0.0411 | 0.0229 |
| | (0.0389) | (0.0349) | (0.0299) | (0.0280) |
| Control group mean | 0.235 | 0.165 | 0.107 | 0.098 |
| Number of disabled children | 107 | 107 | 107 | 107 |
| Number of observations | 232,632 | 232,632 | 232,632 | 232,632 |
| *B. Effects of Having a Sibling with a random de novo or chromosomal mutation* | | | | |
| Disabled sibling | 0.0886*** | 0.0496* | 0.0474** | 0.0424* |
| | (0.0299) | (0.0264) | (0.0230) | (0.0227) |
| Control group mean | 0.235 | 0.165 | 0.106 | 0.098 |
| Number of disabled children | 194 | 194 | 194 | 194 |
| Number of observations | 232,499 | 232,499 | 232,499 | 232,499 |

*Notes:* Each cell presents estimates from a separate regression using the outcome indicated in the column heading. The results represent the effects of a sibling diagnosed with Downs syndrome (B) or random de novo and chromosomal mutations (C) based on an OLS specification that controls for maternal age fixed effects, birth order, number of children in the family, birth year of both the child and the affected sibling and spacing between the two siblings. The reported mean of the outcome is calculated among children in families without a disabled child. Standard errors are clustered at the family level. Significance levels: * $p<0.1$ ** $p<0.05$ *** $p<0.01$.

Table A6: Robustness to Controlling for Birth Spacing

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Estimates* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Controlling for birth spacing* | | | | |
| 3rd sibling disabled × 2nd born | 0.0279*** | 0.0166** | 0.0230*** | 0.0158** |
| | (0.00911) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |

*Notes:* Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates using Equation (1). Panel B checks robustness to including birth spacing controls. For the first-born child, we assign spacing as the gap between the first- and second-born children, while for the second-born child, we assign spacing as the gap between the second- and third-born children. The reported mean of the outcome is calculated among first-born children in treated families. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A7: Effects of Exposure to a Disabled Younger Sibling on Child Mental Health at Ages 0–9

| | Any MH Utilization | Any Counseling | Any Psychiatric Visit | Any MH Prescription |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| 3rd sibling disabled X 2nd born | −0.00279 | −0.00156 | −0.00262 | −0.000628 |
| | (0.00786) | (0.00273) | (0.00577) | (0.00504) |
| Control group mean | 0.028 | 0.004 | 0.018 | 0.008 |
| Obs. | 29,562 | 29,562 | 29,562 | 29,562 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. All specifications include family fixed effects, year and month of birth fixed effects, child characteristics (gender, birth weight, gestational age, 5-minute Apgar score) and parental characteristics in the year before the birth of each child (age, gross personal income, indicators for marital/cohabitation status, educational attainment and employment status). Income is reported in 2015 prices. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A8: Heterogeneous Effects of Exposure to a Disabled Younger Sibling by Second-Born Child's Birth Cohort

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Second-born before 1994* | | | | |
| 3rd sibling disabled × 2nd born | 0.0451*** | 0.0403*** | 0.0191 | 0.0170 |
| | (0.0155) | (0.0136) | (0.0119) | (0.0115) |
| Control group mean | 0.196 | 0.122 | 0.093 | 0.083 |
| Number of observations | 43190 | 43190 | 43190 | 43190 |
| *C. Second-born 1994 or after* | | | | |
| 3rd sibling disabled × 2nd born | 0.0204* | 0.00531 | 0.0255*** | 0.0158* |
| | (0.0113) | (0.00987) | (0.00907) | (0.00840) |
| Control group mean | 0.233 | 0.169 | 0.106 | 0.091 |
| Number of observations | 77620 | 77620 | 77620 | 77620 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates. Panel B splits the sample into families where the second-born is born before 1994 and Panel C where the second-born is born in 1994 or after. The reported mean of the outcome is calculated among children in families without a disabled child. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A9: Disease Severity and Hospital Contacts at Ages 0-5

| | Episodic and unpredictable (1) | Stable but highly demanding (2) | Mild and manageable (3) | Non-disabled third-borns (4) |
|---|---|---|---|---|
| Number of hospitalizations, total | 7.3928 | 13.1127 | 5.9830 | 1.9416 |
| Number of inpatient hospitalizations | 3.3397 | 7.1959 | 2.2356 | 0.6591 |
| Number of outpatient hospitalizations | 3.3312 | 5.5381 | 3.0758 | 0.6589 |
| Number of emergency hospitalizations | 1.4352 | 1.0437 | 1.0055 | 0.7890 |
| Number of observations | 471 | 985 | 2,347 | 56,551 |

*Notes:* This table presents descriptive statistics on hospital contacts between ages 0 and 5 for different groups of children defined by disability status and disease severity.

Table A10: Distribution of Disability Conditions by Mother's Education

| | Basic | High School | College Graduate |
|---|---|---|---|
| %Disabled | 3.56 | 3.12 | 2.93 |
| Congenital malformations and deformations of the muscoskeletal system | 29.42 | 32.25 | 32.07 |
| Congenital malformations of genital organs | 15.05 | 15.51 | 18.04 |
| Congenital malformations of circulatory system | 13.35 | 15.90 | 13.70 |
| Epilepsy and status epilepticus | 10.71 | 7.81 | 8.69 |
| Congenital malformations of eye, ear, face and neck | 9.35 | 7.81 | 6.12 |
| Hearing loss | 7.74 | 7.53 | 5.35 |
| Congenital malformations, other | 6.04 | 5.17 | 5.68 |
| Coagulation defects, purpura and other haemorrhagic conditions | 4.51 | 4.66 | 5.68 |
| Congenital malformations of urinary system | 4.34 | 5.17 | 4.90 |
| Cerebral palsy and other paralytic syndromes | 5.78 | 3.99 | 3.56 |
| Anaemia | 3.83 | 3.82 | 2.56 |
| Chromosomal abnormalities, not elsewhere classified | 2.47 | 3.20 | 3.79 |
| Clef lip palate | 2.72 | 3.60 | 2.23 |
| Neoplasma | 3.15 | 2.81 | 1.89 |
| Congenital malformations of respiratory system | 2.47 | 2.92 | 2.00 |
| Congenital malformations of nervous system | 2.13 | 2.13 | 2.34 |
| Juvenile arthritis | 1.45 | 1.63 | 2.56 |
| Diabetes | 1.62 | 1.24 | 1.22 |
| Visual impairment including blindness | 0.94 | 0.51 | 0.67 |
| Crohn disease | 0.00 | 0.34 | 0.00 |

*Notes:* This table presents the share of third born siblings disabled by age 5 by diagnosis and by mothers' education measured at the time of the first birth in the main analysis sample.

Table A11: Test Scores and Mental Health

| | Danish | Math | Any MH Utilization | Any Counseling | Any Psychiatric Visit | Any MH Prescription |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *A. Baseline effects on test scores and mental health among test-takers* | | | | | | |
| 3rd sibling disabled × 2nd born | −0.0368** | −0.0226 | 0.0211** | 0.0135 | 0.0205*** | 0.0183*** |
| | (0.0180) | (0.0182) | (0.00977) | (0.00869) | (0.00732) | (0.00685) |
| *B. Models with test score/mental health controls* | | | | | | |
| 3rd sibling disabled × 2nd born | −0.0341* | −0.0185 | 0.0197** | 0.0128 | 0.0195*** | 0.0174** |
| | (0.0180) | (0.0182) | (0.00973) | (0.00869) | (0.00728) | (0.00681) |
| Control group mean | 0.083 | 0.114 | 0.202 | 0.153 | 0.082 | 0.071 |
| Number of observations | 10,1674 | 10,0568 | 99,906 | 99,906 | 99,906 | 99,906 |

*Notes:* Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A difference-in-differences estimates using 9th grade test scores as the outcome (Columns 1-2) and mental health outcomes among test-takers (Columns 3-6). In Panel B, we estimate models that include cross-outcomes as controls, i.e. when we examine the effects on test scores we include mental health outcomes as covariates (and vice versa). All specifications include family fixed effects, year and month of birth fixed effects, child characteristics (gender, birth weight, gestational age, 5-minute Apgar score) and parental characteristics in the year before the birth of each child (age, gross personal income, indicators for marital/cohabitation status, educational attainment and employment status). Income is reported in 2015 prices. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A12: Heterogeneous Effects by Maternal Grandmothers' Presence

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Full Sample - Grandmother Lives in a Different Municipality* | | | | |
| 3rd sibling disabled × 2nd born | 0.0379*** | 0.0185* | 0.0272*** | 0.0214** |
| | (0.0125) | (0.0109) | (0.00995) | (0.00931) |
| Control group mean | 0.221 | 0.157 | 0.101 | 0.092 |
| Number of observations | 66,738 | 66,738 | 66,738 | 66,738 |
| *B. Full Sample - Grandmother Lives in the Same Municipality* | | | | |
| 3rd sibling disabled × 2nd born | 0.0225 | 0.0183 | 0.0255** | 0.0181 |
| | (0.0157) | (0.0140) | (0.0126) | (0.0119) |
| Control group mean | 0.242 | 0.167 | 0.112 | 0.092 |
| Number of observations | 41,350 | 41,350 | 41,350 | 41,350 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A and B presents results by the presence of grandmothers. All specifications include family fixed effects, year and month of birth fixed effects, child characteristics (gender, birth weight, gestational age, 5-minute Apgar score) and parental characteristics in the year before the birth of each child (age, gross personal income, indicators for marital/cohabitation status, educational attainment and employment status). The reported mean of the outcome is calculated among first-born children in treated families. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A13: Effects of a Disabled Third-Born Child on Parental Outcomes by Disability Type

| | Any MH care | | Employment | | Earnings | | Wealth | Total income | Divorce | Fertility |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mother | Father | Mother | Father | Mother | Father | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *A. Full sample* | | | | | | | | | | |
| After birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After birth of 3rd child × 3rd child disabled | −0.000442 | 0.0170** | −0.0514*** | −0.0276*** | -3,633.1** | -6,767.6** | -32,699.4 | -3,306.0 | −0.00850 | 0.0188*** |
| | (0.00930) | (0.00812) | (0.0114) | (0.00850) | (1,847.4) | (3,284.5) | (21,712.6) | (2,452.9) | (0.00751) | (0.00703) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 99,116 | 99,116 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Episodic and unpredictable* | | | | | | | | | | |
| After birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After birth of 3rd child × 3rd child disabled | 0.00918 | 0.0550** | −0.0939*** | −0.0348 | -6,952.1 | -12,024.1 | 36,040.5 | -3,457.9 | −0.0462** | 0.0334* |
| | (0.0267) | (0.0235) | (0.0325) | (0.0235) | (5,272.6) | (9,024.7) | (58,858.4) | (6,672.7) | (0.0215) | (0.0200) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 93,400 | 93,400 | 114,044 | 114,044 | 114,044 | 114,044 | 114,044 | 114,044 | 114,044 | 114,044 |
| *C. Stable but highly demanding* | | | | | | | | | | |
| After birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After birth of 3rd child × 3rd child disabled | −0.0172 | 0.00653 | −0.0583*** | −0.000214 | -3,808.3 | -12,160.6** | 7,262.2 | -11,730.8** | −0.0156 | 0.0104 |
| | (0.0180) | (0.0157) | (0.0221) | (0.0159) | (3,472.1) | (5,880.6) | (42,612.1) | (4,575.4) | (0.0143) | (0.0134) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 94,286 | 94,286 | 115,072 | 115,072 | 115,072 | 115,072 | 115,072 | 115,072 | 115,072 | 115,072 |
| *D. Mild and manageable* | | | | | | | | | | |
| After birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After birth of 3rd child × 3rd child disabled | 0.00435 | 0.0144 | −0.0389*** | −0.0361*** | -2,517.5 | -3,851.7 | -62,130.4** | 383.0 | 0.00217 | 0.0181** |
| | (0.0117) | (0.0102) | (0.0145) | (0.0109) | (2,346.8) | (4,287.3) | (27,311.3) | (3,159.9) | (0.00948) | (0.00890) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 96,638 | 96,638 | 117,796 | 117,796 | 117,796 | 117,796 | 117,796 | 117,796 | 117,796 | 117,796 |

*Notes:* This table presents the effects of having a disabled third-born child on parental outcomes, separately by the type of disability of the third child. The results are based on a difference-in-difference model comparing the change in outcomes after the birth of the third child relative to the year before the birth, between households where the third child has a disability of the relevant type or no disability at all. Third-born child's disability status is based on receiving a diagnosis by age 5. Panel A reports estimates for the full sample, while Panels B–D split the disabled group by disability type: episodic and unpredictable, stable but highly demanding, and mild and manageable. The reported mean of the outcome is calculated among families without a disabled third child in the year before the third birth. Earnings, wealth, and total income are reported in 2015 prices. Robust standard errors are in parentheses. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A14: Effects of a Disabled Third-Born Child on Parental Outcomes by SES

| | Any MH care | | Employment | | Earnings | | Wealth | Total income | Cohabiting/ Married | Future Fertility |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mother | Father | Mother | Father | Mother | Father | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *A. Full Sample* | | | | | | | | | | |
| After the birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After the birth of 3rd child × 3rd child disabled | −0.000442 | 0.0170** | −0.0514*** | −0.0276*** | -3,633.1** | -6,767.6** | -32,699.4 | -3,306.0 | −0.00850 | 0.0188*** |
| | (0.00930) | (0.00812) | (0.0114) | (0.00850) | (1,847.4) | (3,284.5) | (21,712.6) | (2,452.9) | (0.00751) | (0.00703) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 99,116 | 99,116 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Mother's education: basic school* | | | | | | | | | | |
| After birth of 3rd child | 0.359*** | 0.227*** | 0.251*** | 0.619*** | 65,873.1*** | 71,315.2*** | -262,595.7*** | 113,707.5*** | −0.210*** | 0.315*** |
| | (0.00480) | (0.00429) | (0.00610) | (0.00494) | (825.4) | (1,277.9) | (7,337.3) | (866.8) | (0.00410) | (0.00375) |
| After birth of 3rd child × 3rd child disabled | 0.00207 | 0.0205 | −0.0828*** | −0.0392** | -5,893.1** | -5,397.8 | -4,207.2 | -4,059.9 | −0.0356** | 0.0414*** |
| | (0.0181) | (0.0168) | (0.0240) | (0.0192) | (2,950.2) | (4,518.8) | (23,101.6) | (2,898.2) | (0.0160) | (0.0145) |
| Control group mean | 0.433 | 0.283 | 0.618 | 0.757 | 143,081 | 249,560 | 20,768 | 358,612 | 0.613 | 0.315 |
| Number of observations | 26,320 | 26,320 | 33,076 | 33,076 | 33,076 | 33,076 | 33,076 | 33,076 | 33,076 | 33,076 |
| *C. Mother's education: high school or some college* | | | | | | | | | | |
| After birth of 3rd child | 0.269*** | 0.169*** | 0.679*** | 0.840*** | 93,980.9*** | 117,875.4*** | -224,781.1*** | 162,305.9*** | −0.133*** | 0.194*** |
| | (0.00328) | (0.00280) | (0.00348) | (0.00257) | (679.2) | (1,270.9) | (8,494.1) | (940.1) | (0.00265) | (0.00242) |
| After birth of 3rd child × 3rd child disabled | −0.00847 | 0.0101 | −0.0197 | −0.0182* | -1,442.1 | -4,991.1 | -38,771.3 | -1,953.7 | 0.0124 | 0.00401 |
| | (0.0133) | (0.0112) | (0.0147) | (0.0110) | (2,750.5) | (5,030.8) | (34,637.1) | (3,704.2) | (0.0104) | (0.00976) |
| Control group mean | 0.316 | 0.207 | 0.845 | 0.894 | 233,496 | 368,601 | 426,619 | 453,179 | 0.792 | 0.194 |
| Number of observations | 47,456 | 47,456 | 57,074 | 57,074 | 57,074 | 57,074 | 57,074 | 57,074 | 57,074 | 57,074 |
| *D. Mother's education: college graduate* | | | | | | | | | | |
| After birth of 3rd child | 0.234*** | 0.149*** | 0.821*** | 0.883*** | 114,203.3*** | 156,698.0*** | 42,502.9*** | 208,617.2*** | −0.0888*** | 0.147*** |
| | (0.00425) | (0.00361) | (0.00382) | (0.00299) | (960.0) | (1,955.2) | (13,051.2) | (1,495.5) | (0.00314) | (0.00295) |
| After birth of 3rd child × 3rd child disabled | −0.00265 | 0.0168 | 0.00172 | 0.00509 | 950.1 | -1,692.0 | -27,077.2 | 6,397.6 | 0.000788 | −0.00338 |
| | (0.0180) | (0.0156) | (0.0156) | (0.0124) | (4,009.4) | (7,638.6) | (54,351.4) | (5,893.8) | (0.0124) | (0.0121) |
| Control group mean | 0.268 | 0.179 | 0.906 | 0.926 | 305,997 | 452,245 | 878,621 | 538,858 | 0.859 | 0.147 |
| Number of observations | 25,340 | 25,340 | 30,660 | 30,660 | 30,660 | 30,660 | 30,660 | 30,660 | 30,660 | 30,660 |

*Notes:* This table presents the effects of having a disabled third-born child on the mother's mental health, labor market and family formation outcomes. The results are based on a difference-in-difference model comparing the change in outcomes 6–10 years in columns (1)-(8) and 0–10 years in columns (9)-(10) after the birth of the third child relative to the year before the birth of the third child, between households where the third child has a disability or not. Third-born child's disability status is based on receiving a diagnosis by age 5. Panel A presents the estimates for the full sample, while Panels B–D present effects by mother's education, measured at the time of the first birth. The reported mean of the outcome is calculated among families without a disabled third child in the year before the third birth. Earnings are reported in 2015 prices. Robust standard errors are in parenthesis. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A15: Effects of a Disabled Third-Born Child on Parental Outcomes: By Year of Third Birth

| | Any MH care | | Employment | | Earnings | | Wealth | Total income | Divorce | Fertility |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mother | Father | Mother | Father | Mother | Father | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| *A. Full sample* | | | | | | | | | | |
| After birth of 3rd child | 0.283*** | 0.179*** | 0.599*** | 0.791*** | 91,506.3*** | 115,135.0*** | -166,841.6*** | 160,923.0*** | −0.143*** | 0.215*** |
| | (0.00230) | (0.00199) | (0.00270) | (0.00202) | (468.1) | (864.9) | (5,611.3) | (648.0) | (0.00187) | (0.00173) |
| After birth of 3rd child × 3rd child disabled | −0.000442 | 0.0170** | −0.0514*** | −0.0276*** | -3,633.1** | -6,767.6** | -32,699.4 | -3,306.0 | −0.00850 | 0.0188*** |
| | (0.00930) | (0.00812) | (0.0114) | (0.00850) | (1,847.4) | (3,284.5) | (21,712.6) | (2,452.9) | (0.00751) | (0.00703) |
| Control group mean | 0.336 | 0.220 | 0.799 | 0.865 | 227,437 | 357,610 | 431,722 | 449,355 | 0.760 | 0.215 |
| Number of observations | 99,116 | 99,116 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Third sibling born before 1998* | | | | | | | | | | |
| After birth of 3rd child | 0.279*** | 0.186*** | 0.512*** | 0.775*** | 88,613.8*** | 117,741.2*** | 341,361.3*** | 145,433.5*** | −0.153*** | 0.240*** |
| | (0.00473) | (0.00407) | (0.00475) | (0.00350) | (697.6) | (1,297.3) | (7,347.0) | (910.4) | (0.00298) | (0.00298) |
| After birth of 3rd child × 3rd child disabled | 0.0223 | 0.00797 | −0.0838*** | −0.0335** | -5,528.1* | -3,019.3 | -44,945.9* | -3,994.4 | −0.0211* | 0.0195 |
| | (0.0200) | (0.0170) | (0.0211) | (0.0155) | (2,852.3) | (5,179.6) | (26,401.5) | (3,768.4) | (0.0126) | (0.0126) |
| Control group mean | 0.300 | 0.204 | 0.771 | 0.862 | 189,818 | 316,500 | 322,598 | 390,246 | 0.769 | 0.240 |
| Number of observations | 22,004 | 22,004 | 43,698 | 43,698 | 43,698 | 43,698 | 43,698 | 43,698 | 43,698 | 43,698 |
| *C. Third sibling born in or after 1998* | | | | | | | | | | |
| After birth of 3rd child | 0.285*** | 0.177*** | 0.649*** | 0.800*** | 93,159.2*** | 113,645.7*** | -457,265.5*** | 169,774.9*** | −0.137*** | 0.201*** |
| | (0.00264) | (0.00228) | (0.00322) | (0.00245) | (618.0) | (1,139.1) | (7,327.0) | (872.0) | (0.00239) | (0.00211) |
| After birth of 3rd child × 3rd child disabled | −0.00646 | 0.0195** | −0.0415*** | −0.0258** | -2,894.1 | -8,452.9** | 9,939.2 | -4,075.2 | −0.00289 | 0.0202** |
| | (0.0105) | (0.00922) | (0.0134) | (0.0101) | (2,376.8) | (4,193.8) | (28,475.6) | (3,151.7) | (0.00932) | (0.00845) |
| Control group mean | 0.356 | 0.230 | 0.815 | 0.866 | 248,936 | 381,103 | 494,084 | 483,134 | 0.756 | 0.201 |
| Number of observations | 77,112 | 77,112 | 77,112 | 77,112 | 77,112 | 77,112 | 77,112 | 77,112 | 77,112 | 77,112 |

*Notes:* This table presents the effects of having a disabled third-born child on parental outcomes, split by the year of the third birth. The results are based on a difference-in-difference model comparing the change in outcomes after the birth of the third child relative to the year before the birth, between households where the third child has a disability or not. Third-born child's disability status is based on receiving a diagnosis by age 5. Panel A reports estimates for the full sample, while Panels B and C split the sample by whether the third child was born before 1998 or in/after 1998. The reported mean of the outcome is calculated among families without a disabled third child in the year before the third birth. Earnings, wealth, and total income are reported in 2015 prices. Robust standard errors are in parentheses. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.

Table A16: Heterogeneous Effects of Exposure to a Disabled Younger Sibling by Welfare Generosity

| | Any MH Utilization (1) | Any Counseling (2) | Any Psychiatric Visit (3) | Any MH Prescription (4) |
|---|---|---|---|---|
| *A. Baseline Results* | | | | |
| 3rd sibling disabled × 2nd born | 0.0284*** | 0.0170** | 0.0231*** | 0.0161** |
| | (0.00910) | (0.00797) | (0.00722) | (0.00677) |
| Control group mean | 0.221 | 0.153 | 0.102 | 0.089 |
| Number of observations | 120,810 | 120,810 | 120,810 | 120,810 |
| *B. Third-born before 1998* | | | | |
| 3rd sibling disabled × 2nd born | 0.0402** | 0.0329** | 0.0217* | 0.0200* |
| | (0.0157) | (0.0137) | (0.0121) | (0.0117) |
| Control group mean | 0.195 | 0.123 | 0.093 | 0.079 |
| Number of observations | 43,694 | 43,694 | 43,694 | 43,694 |
| *C. Third-born 1998 or after* | | | | |
| 3rd sibling disabled × 2nd born | 0.0213* | 0.00793 | 0.0230** | 0.0140* |
| | (0.0112) | (0.00980) | (0.00901) | (0.00832) |
| Control group mean | 0.233 | 0.168 | 0.106 | 0.093 |
| Number of observations | 77,112 | 77,112 | 77,112 | 77,112 |

*Notes:* This table presents the results of difference-in-differences models based on Equation (1). Each cell presents estimates from a separate regression using the outcome indicated in the column heading. Panel A reproduces the baseline difference-in-differences estimates. Panels B-C split the sample by whether the third-born child was born before or after the reform and re-estimate the sibling spillover effects. The reported mean of the outcome is calculated among first-born children in treated families. Standard errors are clustered at the family level. Significance levels: * p<0.1 ** p<0.05 *** p<0.01.