Child Disability and Sibling Mental Health

Janet Currie, Princeton University, NBER
N. Meltem Daysal, University of Copenhagen, CEBI, CESIfo, IZA
Mette Gørtz, University of Copenhagen, CEBI, IZA
Jonas Cuzulan Hirani, The Danish Center for Social Science Research (VIVE)

June 16, 2023

Motivation

- Sibling relationships unique.
  - Share genetic pool
  - Common environment
  - Siblings some of children's first peers.
  - Parents make investments in children taking into account child characteristics, sibsize, birth order, and sibling composition
- Growing research interest in psychology and social sciences

Developmental psychology

- Psychology: Core features of children's personality and intelligence shaped by direct and indirect interactions with siblings (Arnold et al. 1975)
- Theoretically, spillovers from growing up with disabled sibling can go in either direction
  - Protective effect, fostering maturity (McHale and Gamble 1989, Cicirelli 1976, Burton and Parks 1994)
  - Adverse effect, through distress and skewed intra-household allocation of resources (Farber and Ryckman 1965, Crocker 1981)
- Adverse (negative) effects seem to dominate empirically (Dew et al. 2008, Marquis et al. 2019)

Economic literature on sibling spillovers

- Economics: Growing literature on sibling *spillovers* of sick or disabled sibling
  - On human capital outcomes (Black et al. 2021, Daysal et al. 2022, Breining 2014, Fletcher and Wolfe 2008, Fletcher et al. 2012)
  - On labor market outcomes (Lovén, *Social Science and Medicine* 2017)
  - On mental health, mainly correlation studies (Lund et al. in *Lancet* 2013, Fisman et al. 2000, Caliendo et al. 2020, Marquis et al. 2019)
- Evidence that mental health problems affects career outcomes (Biasi et al. 2021)
- However, economic studies of sibling spillovers on mental health are lacking

Context: Denmark

- Child disability is a permanent health shock experienced by many families
- Denmark:
  - In 2011, 15% of all individuals aged 15–24 reported a longstanding health problem or a basic activity difficulty (Eurostat)
  - Around 30% of all economic resources for primary and lower secondary school were spent on special education (Egelund and Dyssegaard 2019)
- United States: during 2012–2013, 13% of all 3–21 year olds were supported by Disabilities Education Act (Black et al. 2021)

Research Question

$\Rightarrow$ **Research question:**

What is the causal effect of a disabled child on the mental health outcomes of other children in the family?

Conceptual Framework and Identification Challenges

- Disabled siblings may impact the mental health of other children in the family
  - directly (peer interactions, role modeling)
  - indirectly through shared household resources (parental time, attention, financial)
- Identifying the causal effects of a disabled child on siblings is complicated because siblings share many common traits and experiences

$\Rightarrow$ **DID design (following Black et al. 2020)**:
Focusing on families with 3+ children, we compare within-sibling variation in outcomes of first versus second-born siblings in families where the third-born *has* a disability, to within-sibling variation in outcomes of first versus second-born in families where the third-born is *not* disabled

Institutional Context

- Public health insurance covers all citizens
  - Insurance is tax-financed
  - Some co-payment for physical therapy, dental services, prescription drugs and psychological counselling
- Primary care by general practitioners (GPs): Initial contacts, can refer to specialist
- Mental health treatment (for children)
  - General practitioners (GPs)
  - Private practice psychologists
  - Private practice psychiatrists
  - Psychiatric wards in hospitals (0-17 and 18+)
  - Psychologists connected to schools

Data

- Administrative register data for entire Danish population from Statistics Denmark
  - Registers linked through unique identification number
  - Data are anonymized and accessed through secure servers for researchers
- Information on:
  - Population, family links, births and deaths
  - Socioeconomic variables such as education, employment, income
  - Health care use
    - Primary health care: Visits to private practitioner (GP) and private practice specialists (e.g. psychiatrist and psychological counselling)
    - Hospitalizations: Inpatient and outpatient - ICD10 classification
    - Prescription drugs bought at pharmacies - ATC code level

Analysis sample

- Subset of births occurring between 1988–1999 (around 800,000 births in total)
- Can follow all children in health registers, focus on from age 9-20
- Families with three-plus-children - around $1/6$ of all children from $3+$ families
- Singleton births in the first three deliveries (exluding twin- and triplet etc. births)
- Focus on cases where children have same mother and the first two children share the same father (share genes)
- Estimation sample: Around 65,300 children who are first- or second-born

Treatment variable

Treatment - Child disability of 3rd born: having a somatic disability by age 5

- Measure at age 5 because most important disabilities have been found by then
- Disabilities diagnosed later in life are more likely to be endogenous
- Disabilities through objective measurement in health registers:
  - All children are automatically enrolled in the pediatric examination program at GP
  - Preventive health examinations at the age of 5 weeks, 5 months, and annually until age 5 (Gørtz et al. 2020)
  - More than 90% of children attend the first three preventive examinations (Mathiesen et al. 2016)
  - Home visiting program by nurses from children leave hospital to age 1 additional effective screening (Wüst 2022)

Outcome Variables

Outcomes - mental health spillovers to siblings or birth order 1 and 2 - defined according to the treatment pathways:

- Counseling from a GP or a private psychologist prior to age 20
- Contacting a private psychiatrist or psychiatric hospital prior to age 20
- Using psychoanaleptics or psycholeptics prior to age 20
- Focus on two ATC groups
  - N05: Psychoanaleptics, including anti-anxiety medication (N05B)
  - N06: Psycholeptics, including antidepressants (N06A) and psychostimulants (N06B), e.g. ADHD medication

Evidence on the Key Identification Assumption

- Identification assumption: the difference in the MH outcomes of first- and second-born siblings in treated families would be similar to the difference in the difference in non-treated families

$\Rightarrow$ **Key concern: worsening outcomes in families where an eventually disabled third child is born**

Empirical Strategy

$$Y_{if} = \delta_0 + \delta_1 SB_{if} + \delta_2 (D_f x SB_{if}) + \delta_3 X_{if} + \alpha_f + \epsilon_{if}$$

Y_{if} measure of mental health outcome for child i=1,2 living in family f
SB_{if} indicator for third-born child being disabled
D_f indicator for second-born child
α_f family fixed effect
X_{if} gender, year and month of birth

$\Rightarrow \delta_2$ is primary parameter of interest:
Difference in outcomes of siblings more (second-born) or less (first-born) exposed to the third-born in families with and without a disability, netting out time-invariant differences between treated and non-treated families

Data

Table 1: Descriptive statistics by treatment status

	(1) 3rd disabled	(2) 3rd not disabled	(3) t-test (1) vs (2)
Immigrant	0.133	0.113	-2.62
Married/cohabiting at first birth	0.946	0.950	.61
Mother age at first birth	25.145	25.372	2.72
Mother basic school only	0.32	0.282	-3.54
Mother highschool or vocational training	0.458	0.467	.810
Mother bachelor or equivalent	0.189	0.217	3.11
Mother master or PhD	0.033	0.034	.16
Spacing 1st to 2nd	2.478	2.466	-.51
Spacing 1st to 3rd	5.951	5.865	-2.02
Spacing 2nd to 3rd	3.473	3.399	-1.97
Number of families	2034	32356	

Baseline results

Table 2: Baseline results: More vs less exposed sibling

	(1) Any psychiatric drug	(2) Any contact to psychiatrist	(3) Any counselling
3rd observed disabled age 5	0.0284*	0.0321**	0.0291**
	(0.0147)	(0.0143)	(0.0148)
Number of observations	65356	65364	65364
Mean of dependent variable	.1149	.1026	.131

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Baseline results

Table 3: Baseline results: Exposure measured in years

	(1) Any psychiatric drug	(2) Any contact to psychiatrist	(3) Any counselling
3rd observed disabled age 5	0.0112**	0.0109**	0.0129**
	(0.00553)	(0.00543)	(0.00570)
Number of observations	65356	65364	65364
Mean of dependent variable	.1149	.1026	.131

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Unconfoundedness

Test for unconfoundedness by pre-determined factors: Regress early child characteristics on indicator for having 3rd born sibling being disabled.

- by birth outcomes
- by socioeconomic outcomes
- by health outcomes in first year of life

At birth

By SES

By health

Results: Effects by mode of contact to psychiatric ward in hospitals

Table 4: Effect by mode of contact in psychiatric ward in hospital

	(1) Phych. Ward in hosp. (PW)	(2) PW ER	(3) PW Inpatient	(4) PW Outpatient
3rd observed disabled age 5	0.0282**	0.000975	0.00245	0.0280**
	(0.0134)	(0.00695)	(0.00633)	(0.0129)
Number of observations	65364	65364	65364	65364
Mean of dependent variable	.0868	.0227	.0166	.0788

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level, and stated in parentheses. Outcomes are indicator variables taking the value 1 if the individual has any of the stated contacts to psychiatric hospital care in the age range 9-20. Column (1) is any contact to psychiatric hospital, column (2) is any emergency room (ER) contacts, column (3) is any inpatient care, while column (4) is any outpatient care. Columns (2)-(4) are thus sub-elements of (1).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- Results driven by effects on *outpatient* hospital visits, not emergency room (ER) or inpatient visits

Results: Effect by drug type

Table 5: Estimation results by drug type

	(1) N06	(2) N05	(3) N06A	(4) NO6 - NO A	(5) N06B	(6) N05A	(7) N05B	(8) N05C
3rd observed disabled age 5	0.0267**	0.0100	0.0186	0.0111	0.0111	0.0104	0.00204	0.00475
	(0.0127)	(0.0115)	(0.0115)	(0.00770)	(0.00770)	(0.00783)	(0.00728)	(0.00742)
Number of observations	65356	65356	65356	65356	65356	65356	65356	65356
Mean of dependent variable	.0872	.0583	.0673	.0276	.0276	.0278	.0204	.023

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level, and stated in parentheses.

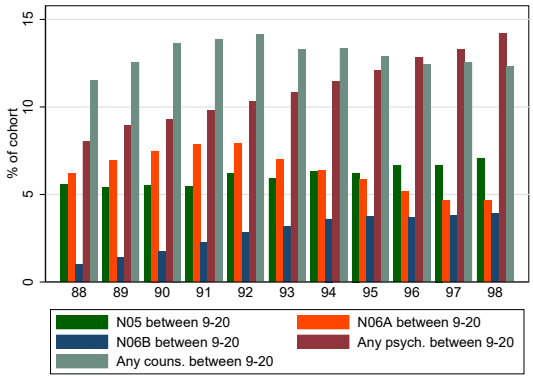
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- Main effect coming from ATC group N06
  - Psycholeptics, including antidepressants (N06A) and psychostimulants (N06B), e.g. ADHD medication
  - Substantial effect - around 30% of baseline mean
  - Statistically strongest effect from N06 outside A (e.g. ADHD medication)

Concern: Trends over time/cohorts in mental diagnoses and medication?

- Question: Are results due to trends in attention towards mental disease among youth?

Figure 1: Outcomes within age-range 9-20 by cohort (1988-1999)



Heterogeneity

- By mother's education
- By sibship gender composition

By maternal education

By sibship gender

Conclusion

- We find evidence of spillover effects from having a disabled (3rd-born) sibling to mental health outcomes of sibling 2 versus 1.
- Substantial positive effects on psychiatric drug use (25%), any contact to psychiatrist (31%) and any counselling (22%).
- Effects on psychiatric drug use driven by ATC group N06, largest effects (marginally significant) on N06B (ADHD drugs)
- Increase in visits to psychiatric ward in hospital mainly driven by *outpatient* visits
- Heterogeneity:
  - Effects somewhat higher if mother only has basic education level
  - Effects somewhat larger for children in families where the first-born is a girl and the second-born a boy

Next steps

- Data
  - Add more years (2019-2021)
  - Add more outcomes - well-being in school for sub-sample of children)
- Empirical method
  - Sibling FE design only captures difference in outcomes across siblings, likely to be lower bound if both siblings affected (Black et al. 2021).
  - Possible next step:
    - Move from 3-child to 2-child families
    - Use event study design with matched control group

Additional material

Additional material

Unconfoundedness - birth outcomes

Table 6: Unconfoundedness by birth outcomes

	(1) APGAR 5	(2) Birthweight (g)	(3) Low birthweight	(4) ln(birthweight)	(5) Gestation weeks
3rd observed disabled age 5	-0.0115	-16.99	-0.000157	-0.00529	-0.0404
	(0.0432)	(18.04)	(0.00835)	(0.00586)	(0.0694)
Number of observations	62608	64456	64456	64456	64039
Mean of dependent variable	9.84	3507.73	.03	8.15	39.69

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

back

Unconfoundedness - socioeconomic characteristics

Table 7: Unconfoundedness by socioeconomic outcomes

	(1) Maternal income	(2) Paternal income	(3) Cohabiting/married parents
3rd observed disabled age 5	-813.3	-449.2	0.00557
	(3395.1)	(4777.6)	(0.00826)
Number of observations	64953	65040	65130
Mean of dependent variable	160983.79	260535.87	.9500

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

back

Unconfoundedness by early hospital contacts

Table 8: Unconfoundedness by early hospital contacts, first year of life

	(1)	(2)	(3)	(4)	(5)	(6)
	Any hospital contact	Bronchitis	Head wound	Med obs	Injury/poisoning	Other convulsion
3rd observed disabled age 5	0.00805	0.00366	-0.000707	0.00465	-0.00298	0.0000303
	(0.0143)	(0.00434)	(0.00212)	(0.00621)	(0.00509)	(0.00228)
Number of observations	65364	65364	65364	65364	65364	65364
Mean of dependent variable	.1307	.008	.0017	.0146	.014	.0031

The table presents results of difference-in-differences models with family fixed effects and controls for year and month of birth as well as the child's gender. Standard errors are clustered at the family level and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

back

Heterogeneity by mother's education

Table 9: Heterogeneity: Maternal level of education

	(1) Basic school	(2) High school/vocational	(3) Bachelor or above
Any psychiatrist	0.0505*	0.0193	0.0282
	(0.0283)	(0.0202)	(0.0265)
Mean of dependent variable	.1455	.0917	.0741
Number of observations	18614	30480	16270
Any counselling	0.0357	0.0234	0.0295
	(0.0299)	(0.0202)	(0.0292)
Mean of dependent variable	.1588	.1258	.1091
Number of observations	18614	30480	16270
Any psych drug	0.0329	0.0224	0.0322
	(0.0289)	(0.0215)	(0.0261)
Mean of dependent variable	.1616	.1046	.0808
Number of observations	18614	30474	16268

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Mother's education is measured at the time of the first birth. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

back

Heterogeneity by sibling gender composition

Table 10: Heterogeneity in sibling gender composition

	(1) Girl-Girl	(2) Girl-Boy	(3) Boy-Boy	(4) Boy-Girl
Any psychiatrist	0.0144	0.0679**	0.0391	0.00887
	(0.0285)	(0.0302)	(0.0269)	(0.0286)
Mean of dependent variable	.1108	.1056	.0973	.0979
Number of observations	15890	15058	19344	15072
Any counselling	0.00882	0.0435	0.0273	0.0398
	(0.0340)	(0.0291)	(0.0242)	(0.0316)
Mean of dependent variable	.1833	.1367	.0805	.135
Number of observations	15890	15058	19344	15072
Any psych. drug	0.0245	0.0483	0.0250	0.0186
	(0.0299)	(0.0309)	(0.0257)	(0.0322)
Mean of dependent variable	.1273	.1216	.1005	.1137
Number of observations	15890	15052	19344	15070

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

back

Heterogeneity by mother's education

Table 11: Heterogeneity: Maternal level of education (Any psych. drug 9-20)

	(1) Basic school	(2) High school/vocational	(3) Bachelor or above
3rd observed disabled age 5	0.0329	0.0224	0.0322
	(0.0289)	(0.0215)	(0.0261)
Number of observations	18614	30474	16268
Mean of dependent variable	.1616	.1046	.0808

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Mother's education is measured at the time of the first birth. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity by mother's education

Table 12: Heterogeneity: Maternal level of education (Any psychiatrist 9-20)

	(1) Basic school	(2) High school/vocational	(3) Bachelor or above
3rd observed disabled age 5	0.0505*	0.0193	0.0282
	(0.0283)	(0.0202)	(0.0265)
Number of observations	18614	30480	16270
Mean of dependent variable	.1455	.0917	.0741

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Mother's education is measured at the time of the first birth. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity by mother's education

Table 13: Heterogeneity: Maternal level of education (Any couns 9-20)

	(1) Basic school	(2) High school/vocational	(3) Bachelor or above
3rd observed disabled age 5	0.0357	0.0234	0.0295
	(0.0299)	(0.0202)	(0.0292)
Number of observations	18614	30480	16270
Mean of dependent variable	.1588	.1258	.1091

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender. Mother's education is measured at the time of the first birth. Standard errors are clustered at the family level, and stated in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity by sibling gender composition

Table 14: Heterogeneity in gender (Any psychiatrist 9-20)

	(1) Girl-Girl	(2) Girl-Boy	(3) Boy-Boy	(4) Boy-Girl
3rd observed disabled age 5	0.0144	0.0679**	0.0391	0.00887
	(0.0285)	(0.0302)	(0.0269)	(0.0286)
Mean of dependent variable	.1108	.1056	.0973	.0979
Number of observations	15890	15058	19344	15072
Number of families	7945	7529	9672	7536

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity by sibling gender composition

Table 15: Heterogeneity in gender (Any counselling 9-20)

	(1) Girl-Girl	(2) Girl-Boy	(3) Boy-Boy	(4) Boy-Girl
3rd observed disabled age 5	0.00882	0.0435	0.0273	0.0398
	(0.0340)	(0.0291)	(0.0242)	(0.0316)
Mean of dependent variable	.1833	.1367	.0805	.135
Number of observations	15890	15058	19344	15072
Number of families	7945	7529	9672	7536

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Heterogeneity by sibling gender composition

Table 16: Heterogeneity in gender (Any psych. drug 9-20)

	(1) Girl-Girl	(2) Girl-Boy	(3) Boy-Boy	(4) Boy-Girl
3rd observed disabled age 5	0.0245	0.0483	0.0250	0.0186
	(0.0299)	(0.0309)	(0.0257)	(0.0322)
Mean of dependent variable	.1273	.1216	.1005	.1137
Number of observations	15890	15052	19344	15070
Number of families	7945	7526	9672	7535

The table presents results of difference-in-differences models with familiy fixed effects and controls for year and month of birth as well as the child's gender.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$