How Early Health Affects Children’s Life Chances

David Figlio*
Director, Institute for Policy Research
Northwestern University
Sulzberger Lecture, Duke University, January 13, 2015

*Collaborative research with Sandra Black, Janet Currie, Josh Goodman, Jonathan Guryan, Krzysztof Karbownik, Claudia Persico and Jeffrey Roth
Long literature on effects of poor neonatal health on long-term outcomes

- A large literature documents the effects of neonatal health on many adult outcomes
  - Wages, disability, adult chronic conditions, human capital accumulation
- Twin-pair comparisons in Canada, Chile, China, Norway, United States show that the heavier twin is more likely to have better adult outcomes
- While the existing literature makes clear that there appears to be a permanent effect of poor neonatal health on socio-economic and health outcomes, it is important to know how neonatal health affects child development, whether public policies might be beneficial, and whether parental inputs and neonatal health are complements or substitutes
- To date, we know little about how neonatal health’s effects vary at different stages of development, or whether public policies (e.g., school quality) can help mitigate the relationship
A new data resource: Florida “registry” data

- We make use of the first, to our knowledge, large-scale dataset that
  - Links birth records to school records in a highly developed context
  - Includes annual assessment data for children to track children’s trajectories over time – important for observing whether birth weight effects open or close over time so that we might be able to pinpoint resources
  - To date, children born from 1992-2002 matched to school records
  - >14,000 twin pairs, >1.3 million singletons old enough for test scores
- Florida is a location with many desirable characteristics for study:
  - **Large**: Florida’s population of ~17M and ~200K births/year compares to Norway, Denmark, and Sweden combined
  - **Heterogeneous**: 45% of moms racial/ethnic minorities; 25% of moms foreign born
  - Politically and socially **representative** of the United States
  - **Excellent institutional conditions** for matching birth and school data
Distributions of birth weight

![Graph showing distributions of birth weight for different birth outcomes.](image)
Distribution of twin birth weight discordance
Since 1998, Florida tests students on the criterion-referenced Florida Comprehensive Assessment Test in reading and mathematics.

Initially tested in grades 4, 8, 10 in reading; 5, 8, 10 in math; from 2001 grades 3-10 in reading and math.

Nearly universal testing:
- Students with some disabilities are not tested.
- Though there are several makeup dates, it is possible to miss the test if a student is absent for a long period of time.
- Therefore, it is important to see whether there are differential rates of missing the test.

For ease of interpretation, we standardize scores at the state-by-grade level:
- Average performance in matched twins sample is a little higher than state average, due to higher SES of families with twins, and the fact that those remaining in Florida from birth through school are more stable.
Effects roughly constant over time in twin fixed effect models

Estimated effect of log birth weight on test scores, by grade (twin FE model)
Same-sex versus opposite-sex twin pairs

Estimated effect of log birth weight on test scores (same vs. opposite sex twins (twin FE model)

Coefficient estimate
"Imputed grade"

Same sex twins
Opposite sex twins
Twin fixed effects versus singletons

Estimated effect of log birth weight: twin FE, singletons, sibling FEs

Coefficient estimate

"Imputed" grade

3 4 5 6 7 8

0 0.1 0.2 0.3 0.4 0.5 0.6

Twin FE
Singletons
Singletons conditioning on gestation
Singletons | gestation, 847-3600g
Sibling FE| gestation, 847-3600g
Differences by groups, part 1

Coefficient on log birth weight, by subgroup, part I

- boys
- girls
- mom has no medical problems
- mom has medical problems
- mother white
- mother black
- mother non-Hispanic
- mother Hispanic

Legend:
- twins
- singletons | gestation
- siblings
Differences by groups, part 2

Coefficient on log birth weight, by subgroup, part II

- mother born in USA
- mother immigrant
- mother less than high school
- mother high school
- mother college graduate
- low income
- middle income
- top income

Legend:
- twins
- singletons | gestation
- siblings
Differences by groups, part 3

Coefficient on log birth weight, by subgroup, part III

- mother unmarried
- mother married
- mother age < 22
- mother age 22-29
- mother age 30-35
- mother age >35

- twins
- singletons | gestation
- siblings

Graph showing the coefficient on log birth weight for different subgroups.
Test performance and estimated birth weight effects across groups

Relationship between predicted groups average test scores and estimated birth weight effects (correlations)
Does school quality affect the birth weight gap?

- Since 1999, Florida has graded schools on an A (best) to F (worst) basis
  - Initially based mainly on average proficiency rates on the criterion-referenced Florida Comprehensive Assessment Test
  - From 2002 based on a combination of average proficiency rates and average student-level test score gains from year to year
- We measure “school quality” in three ways:
  - State-awarded school grade
  - Average FCAT performance level
  - Average FCAT gain score
Does school quality affect the birth weight gap?

Coefficient on log birth weight, by measure of school quality

- A or below
- B
- C or below
- Below median proficiency
- Above median proficiency
- Below median growth
- Above median growth

Legend:
- twins
- singletons | gestation
- siblings
Results appear invariant to method of grading schools

Coefficient on log birth weight, running Florida data through other state school grading systems

- New York top
- New York middle
- New York bottom
- Louisiana top
- Louisiana middle
- Louisiana bottom
- Indiana top
- Indiana middle
- Indiana bottom

Legend:
- twins
- singletons | gestation
- siblings
Conclusions from birth weight analysis

- There exists considerable evidence that birth weight has persistent effects into adulthood, but the time from birth to 18 has been largely a black box.
- This work represents the first systematic attempt to study the period from age 5 through school.
- We find that birth weight gaps are present for all groups studied, and persist regardless of family SES or school quality – suggesting that poor neonatal health plays a long-term role throughout schooling.
  - Smaller twins/siblings from high SES families tend to do very well, but not quite as well as larger twins/siblings from the same families!
  - Birth weight gaps appear to be stable throughout schooling.
  - Pattern persists despite parental attempts to provide different experiences to their different children in early childhood.
Does children’s health affect siblings?

- Important to understand if and how siblings could affect one another, but notoriously hard to identify these spillovers causally
  - Genetic/health/behavioral unobservables that could run in families
  - Common shocks to children in the same family
  - Reallocation of resources within family
- Prevalence of disability and its potential detrimental effects on all family members
- Policy relevant
  - Social costs
  - Family costs
  - Potential for interventions
If we could run an experiment

- Randomly allocate a health shock (disability) to a younger sibling in some families and not others
  - Or to older sibling, conditional on the younger sibling already born
  - The shock needs to be orthogonal to the older (younger) sibling

- Compare outcomes on reference children in treated v. untreated families

- Second best – look for plausibly exogenous variation in the presence of disability
  - Events inducing such variation are rare and “fully exogenous” disabilities are rarely-occurring
  - Need for registry data to gain power and deal with standard peer effects problems
What we do

- Focus on three children families where the third-born child is disabled v. not disabled

- Identification: compare first born and second born child in families where the third child is disabled or not
  - Essentially a difference in difference
  - A first born will spend smaller fraction of his life in the presence of disabled sibling
  - This approach does not identify the main disability effect

- Use sibling fixed effects to address shared genetics and environment as well as any time invariant household characteristics
  - If disabilities run in families, worse outcomes for sibling of disabled v. non-disabled may not be causal
  - Need three child families to take out family effects
  - Threat to validity – trending in family behavior
Data

- 13,242 sibling-pairs born between 1994 and 2002 in part of Florida and attending Florida public schools
  - We compare 3,105 pairs where the third sibling is disabled to 10,137 pairs where the third sibling is not disabled

- Treatment: third-born sibling disability recorded in schooling data
  - Split disabilities into cognitive v. behavioral v. physical
  - We use only the first two siblings in regressions

- Outcomes: math and reading test scores, absenteeism, suspensions

- Controls: gender, year and month of birth, maternal marital status, education and age
### Main results – effects of younger sibling disability on older siblings academic achievement

<table>
<thead>
<tr>
<th></th>
<th>(1) OLS</th>
<th>(2) Clean records</th>
<th>(3) Diff-in-Diff</th>
<th>(4) Clean records</th>
<th>(5) Fixed Effects</th>
<th>(6) Clean records</th>
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<td><strong>Sibling disability</strong></td>
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<td>Exposure*Disabled</td>
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<td>-0.014**</td>
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<td>Observations</td>
<td>134,854</td>
<td>127,762</td>
<td>134,854</td>
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<td>134,854</td>
<td>127,762</td>
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**Panel A: All families**

<table>
<thead>
<tr>
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<tr>
<td>Exposure*Disabled</td>
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<td>Exposure to 3rd child</td>
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<td>-0.035***</td>
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<td>3rd disabled</td>
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<td>Observations</td>
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<td>73,481</td>
<td>77,262</td>
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**Panel B: Families where all children have the same father**

Note: # FE in columns (5) and (6) is 12,964 and 12,880 in Panel A and 7,275 and 7,233 in Panel B
Fixed effects results by the type of disability: behavioral, cognitive and physical

<table>
<thead>
<tr>
<th>(1) Sibling disability</th>
<th>(2) Behavioral</th>
<th>(3) Cognitive</th>
<th>(4) Physical</th>
<th>(5) Behavioral</th>
<th>(6) Cognitive</th>
<th>(7) Physical</th>
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<td>Panel A: All families</td>
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<td>111,264</td>
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<td>Panel B: Families where all children have the same father</td>
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<tr>
<td>Exposure*Disabled</td>
<td>0.012</td>
<td>-0.001</td>
<td>-0.033***</td>
<td>0.004</td>
<td>-0.006</td>
<td>-0.036***</td>
</tr>
<tr>
<td>Exposure to 3rd child</td>
<td>-0.006</td>
<td>-0.009</td>
<td>-0.008</td>
<td>-0.005</td>
<td>-0.006</td>
<td>-0.006</td>
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<td>Observations</td>
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<td>62,846</td>
<td>68,586</td>
<td>60,818</td>
<td>59,879</td>
<td>65,260</td>
</tr>
</tbody>
</table>

**Behavioral:** Emotionally handicapped, specific learning disability, severely emotionally disturbed, autistic

**Cognitive:** Educable mentally handicapped, trainable mentally handicapped, language impaired, intellectual disability, profoundly mentally handicapped, developmentally delayed

**Physical:** Orthopedically impaired, speech impaired, deaf or hard of hearing, visually impaired, hospital/homebound, dual-sensory impaired, deaf, traumatic brain injury
Sibling spillover conclusions

- Using a credible identification strategy we document evidence of spillovers across siblings
  - Siblings in families where the third child is disabled do worse than siblings in families without disability
  - Siblings exposed to the disabled child longer do worse than their older brothers and sisters
- Most of the effect is driven by detrimental effects of physical disabilities
- We do not find much evidence for heterogeneity but our estimates are imprecise
- We find stronger effects for reading than mathematics
- Our results are not driven by a major concern that is instability of family prior to the third child’s birth
- Policy implications?
The promise of early intervention

- Just because we see that it is difficult to move the needle doesn’t mean that the needle can’t be moved
- My research from Florida suggests that early interventions can be highly valuable
- The case of autism spectrum disorders: Children can receive services through Florida’s Early Steps Program
- Once children receive a diagnosis in an Early Steps office (16 statewide), they can receive services in their local community
- Using empirical strategies that deal with differential selection into early intervention, we find that children who receive early interventions for autism have dramatically better outcomes despite being relatively disadvantaged to start!
Effects of early intervention for autism

- Children who receive early services for autism:
  - 15 percentage points more likely to start school on time
  - 30 percentage points less likely to be suspended in school
  - Half a standard deviation better test scores

- The upshot: Providing high-quality services to children in early life can pay huge dividends down the road

- Want more information? Consider attending my talk tomorrow