

Human Capital Development Before Age Five

Douglas Almond and Janet Currie

Columbia University

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Presentation outline

- 1 Introduction
- 2 Model
- 3 Methods
- 4 Empirical Literature on Prenatal Period
- 5 Empirical Literature on Ages 0 to 5
- 6 Policy Responses
- 7 Conclusions and Future Work

Motivation

- Active literature in economics over last five years
- Early childhood measures predict a non-trivial portion of adult outcomes
 - E.G., 1958 British Cohort Study: 20% of variation in wages at age 33 can be explained by child observables during early childhood (Currie & Thomas 1999)

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... but their effect (and health investments they embody) dwindles over time
 - No special role for early childhood ages
- We want to **leave open** whether there is indeed “fade out” of investments/experiences at early ages

Admitting early origins

Defining h as health or human capital at the completion of childhood

$$h = A[\gamma l_1 + (1 - \gamma)l_2], \quad (1)$$

- $l_1 \cong$ investments during childhood through age 5
- $l_2 \cong$ investments during childhood after age 5.
- γ can be greater than .5
- Perfect substitutability in equation (1) not uncommon assumption in economics, but problematic for early origins

Complementarity

Heckman suggests more flexible “developmental” technology:

$$h = A \left[\gamma I_1^\phi + (1 - \gamma) I_2^\phi \right]^{1/\phi}, \quad (2)$$

- Constant elasticity of substitution (CES) production function
 - Elasticity of substitution $1/(1 - \phi)$
- Perfect substitutability of investments still allowed (when $\phi = 1$)

Shocks in early-childhood health

- Holding other determinants of investments fixed, consider investment shock:

$$\bar{I}_1 + \mu_g$$

- Long-term damage from a negative μ_g is:

$$\frac{\delta h}{\delta \mu_g}$$

- Magnitude of damage can depend on levels of \bar{I}_1 and \bar{I}_2
- Relevant for empirical findings of heterogenous “early origins” damage
- “Biological” effect assumes no investment response

Remediation

Consider a change to second period investments after shock μ_g in early childhood:

- Effectiveness of remediation depends on ϕ, γ and \bar{I}_1
- Knowing $\frac{\delta h}{\delta \mu_g}$ to be **big** doesn't say much about effectiveness of remediation
- Optimal investment response also depends on utility function, e.g.:

$$U_p = (1 - \alpha)\log C_p + \alpha\log h$$

- Where C_p is the consumption of parents

Optimized investment response

$\Delta I_2^* \cdot \mu_g < 0$: **Compensation** helps offset damage

$\Delta I_2^* \cdot \mu_g > 0$: **Reinforcement** accentuates damage

- For $\phi > 0$, compensation optimal
- For $\phi < 0$, reinforcement optimal

To the extent there is a response, then missing the “biological” effect.

- Can understate total damage from μ_g by focussing exclusively on reduced form $\frac{\delta h}{\delta \mu_g}$

Empirical work on investment responses

- Early work arguably proxied for investments with later-life outcomes (e.g., years of schooling considered investment measure)
- Recent work has begun to consider explicit investment measures at younger ages
- No consensus on direction of response

Data constraints

Solutions to lack of large-sample longitudinal data:

- 1 Collect more data, but costly and time-consuming (have to wait for cohorts to become adults)
- 2 Add retrospective questions to existing data collections
- 3 Merge new information to existing datasets
 - E.G. Add ecological info to vital statistics data (e.g. pollution measures)
- 4 Merge administrative data from several sources using personal identifiers

Data constraints: power

- Looking for measures of both early childhood and adult outcomes
- Variable-rich datasets tend to have smaller sample sizes
- Less true in Norway
 - Effect of 1% increase in birth weight increases HS completion by .1 percentage points
 - Under reasonable assumptions will need a sample size of at least 4,000 to detect this
- Need to be creative to find suitable data

Biomedical Literature on Fetal Origins

- DJ Barker says mom an inconsistent buffer of adversity during pregnancy
- Insults experienced when development rapid have bigger effects
- Growth very rapid *in utero*
- “Brain sparing” mechanisms often studied in epidemiology and biomedicine
 - Fetal “trunk” gets lower priority when there’s a shortage
 - Causes chronic health conditions during adulthood (e.g. ischemic heart disease)
 - Effects may be latent during childhood

Birth weight and human capital

- All observational studies in economics
- Human capital assessed in later adolescence or adulthood
- Sign of effect fairly well established

low birth weight → low human capital

- Relationship persists in sibling and twins comparisons
- Strength of relationship more wide-ranging
 - Differing identification strategies across studies
 - Parental responses may be different in different contexts

Prenatal shocks and human capital

1 Prenatal infections

- \exists epidemiological literature finding effects of seasonal variation in infections during pregnancy on adult health
- 1957 "Asian Flu" just happened to coincide with pregnancy for 1958 British Birth Cohort
 - Kelly (2009) finds impacts on test scores
 - Independent of birth weight effect of flu
 - Doesn't detect an investment response

2 Prenatal economic shocks

3 Prenatal air pollution

- Particularly active economics literature

Prenatal pollution shocks

- Ambient pollution
 - Large effects on multiple measures of health at birth
 - Fewer studies of long-term effects
 - Data constraint
- Smoking
 - Large birth weight effects
 - Analysis of other outcomes, esp. long-term effects, relatively uncommon

Long-term effects of prenatal shocks often **BIG**

Example: 1918 Influenza Pandemic

- High school graduation rate falls **13-15%** for the children of influenza-infected moms (roughly one-in-three moms infected)
- Wages **5-9%** lower for children of infected



From 0 to 5

- What are the interesting questions?
- It is *not* interesting to show that it is possible for an event that occurs between 0 and 5 to have lifelong consequences (too easy to think of examples).
- So overarching question must be how important events at this stage are relative to events earlier or later?

Additional questions -

- How much of adult disparity can be explained by events from 0-5?
- What are the connections between health and cognition (or are they mostly separate processes)?
- What is the role of third factors (e.g. parent education and income?) in mitigating effects of shocks?
- How do parents respond to shocks?

Identification Issues:

- Not possible to define sharp cutoffs after which influences will not matter.
- Difficult to distinguish prenatal and postnatal exposures.
- Many possible early childhood events/influences and many possible outcome measures which may be bundled – which are important? Which can be separately identified?

Some findings:

- Reductions in disease environment in early childhood associated with better health and higher cognitive test scores in developed countries (even given negatively selected survivors).
- The *occurrence* of negative health shocks is strongly linked to SES internationally. Cumulative effects of negative health shocks widen gaps in health as children age. May also be linked to lower educational and labor market attainment (an active research area).

More findings...

- Mental health is really important relative to physical health. Big effects and high prevalence.
- Parent's mental health (only moms really studied) also important.
- Mom's employment extensively and wrong-headedly studied. Production function approach suggests that it is the combination of inputs that matters, so what is substituted for mom's time and quality of mom's time is important.

Returning to overarching question:

- We know a lot more than 10 years ago.
- Factors from -1 to 5 have significant long-term effects on many children.
- Prenatal effects are generally large relative to many post-natal effects that have been documented (especially since it is not clear how many conditions/events that are noticed post-natally have prenatal roots).

So can we do anything about it?

- Second half of the paper reviews literature on remediation.
- We discuss:
 - Cash
 - Near cash
 - Early intervention
 - Health insurance

1st half depressing. 2nd half surprisingly hopeful

- There are many interventions which appear to have positive effects.
- With appropriate intervention it may be possible to undo or prevent many of the harmful consequences of negative prenatal and early life events.

Evidence re: Cash

- Some recent studies suggest that relatively modest transfers of cash to low-income U.S. households (around \$10,000) would have educationally meaningful effects on test scores and behavior problems.
- Some suggestion that girls benefit more in terms of health and behavior. Boys benefit more in terms of test scores?
- Then why is so much aid in-kind? Politics. Paternalism. In-kind programs may be the only way to reach children in the most dysfunctional households.

Evidence re: Cash

- Some evidence that cash transfers as small as around \$10,000 may be enough to produce educationally meaningful differences in test scores (especially for boys), and in behavior and health (especially for girls).

Cash vs. In-Kind

Then why is so much aid delivered in kind?

- Politics
- Paternalism
 - In kind may be the only way to reach the children who are most at risk.

Near Cash: Housing and Food Stamps

- MPC food out of food stamps slightly higher than out of cash. Cash transfer associated with FSP (now SNAP) has had positive impacts on child outcomes.
- Housing programs also have had positive effects. Note, reducing crowding seems to benefit boys. Taking kids out of poor neighborhoods seems to benefit girls.

Early Intervention

- Many programs are effective
 - Quality preschool programs (effects bigger for girls?)
 - WIC (effects unlikely to be driven by selection)
 - Nurse home visiting (randomized controlled trials)
- Other programs are ineffective
 - Home visiting with para professionals (randomized controlled trials)
 - Average child care programs
 - Early Head Start?

An Economic Approach...

- ... may be useful in understanding the different results
- Can get positive results with different combinations of inputs
- Need more research from this perspective.

Public Health Insurance

- Causes children to get more care when replaces no insurance. But more is not always better! (e.g. hospitalizations, C-sections).
- Causes children to get less care when it crowds out more generous private insurance policies.
 - Crowd out likely to increase over time (familiarity, increasing cost private HI)

Health is a stock

- Not a flow, so may be hard to see immediate effects in terms of better health, but some evidence that coverage from birth is associated with better health and higher test scores.
- Note, HI typically does not address major threats to health including injuries, toxic exposures, poor nutrition, poor parenting/abuse/neglect.

Summary and Conclusions

- This is an exploding area of research
- Economists bring a lot to the table in terms of both empirical methods and a simple theoretical framework for interpreting results.
- Substantively, what happens from -1 to 5 is at least as important for future outcomes as what happens thereafter.

Many questions for Future Work

- Which shocks matter most and at which ages?
- Why do effects differ for boys and girls?
- What are the interactions between shocks to health and shocks to cognition?
- What is the least cost way to improve outcomes?
- How can Economists interact constructively with people from other disciplines (e.g. to use biomarkers?, conduct RCTs?)