Inequality in Health

Lecture VII: Policy Interventions Affecting Early Life Health

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Outline

How to Reach Us

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Introduction

Introduction

- Last week, we learnt that the **early life environment** is essential for later-life outcomes.
- The empirical literature has shown this using a number of **extreme events**:
  - Epidemics
  - Droughts
  - Wars, etc...
- These extreme events facilitate **identification** and make the relationship clear. But...
- ...policy-makers rarely consider introducing/avoiding epidemics, droughts, wars.
- If they did, later-life effects would be of **secondary importance**.
- What evidence do we have to guide **positive policies**?

Examples of Historical Interventions

- Federal tax reforms (1986-93) in the US (Hoynes et al., 2015):
  - Reduction in low birth weight incidence; increase in mean birth weight
- Environmental regulations (1998) in China (Tanaka, 2015):
  - Infant mortality rate decrease of 20%
- Health care reform (2001) in Thailand (Gruber et al., 2014):
  - Reduction in infant mortality inequalities between provinces
- Introduction of compulsory health insurance (1884) by Bismarck in the German Empire (Bauernschuster et al., 2017):
  - Significant reduction in child mortality

Infant Health

- **Infant mortality** (IMR) had started to decline in Western countries by the turn of the 20^{th} century.
- Declines in IMR associated with an increase in life expectancy of **30 years** in the course of the 20^{th} century (Cutler et al., 2006).
- IMR and child mortality still unnecessarily high in poor countries – 1 in 10 children dying before their 5^{th} birthday (1 in 143 in richer countries).
- In utero exposure to shocks have adult health impacts (see last lecture).
- Therefore also interventions during early childhood potentially have long-term health effects.

Long-Term Trends

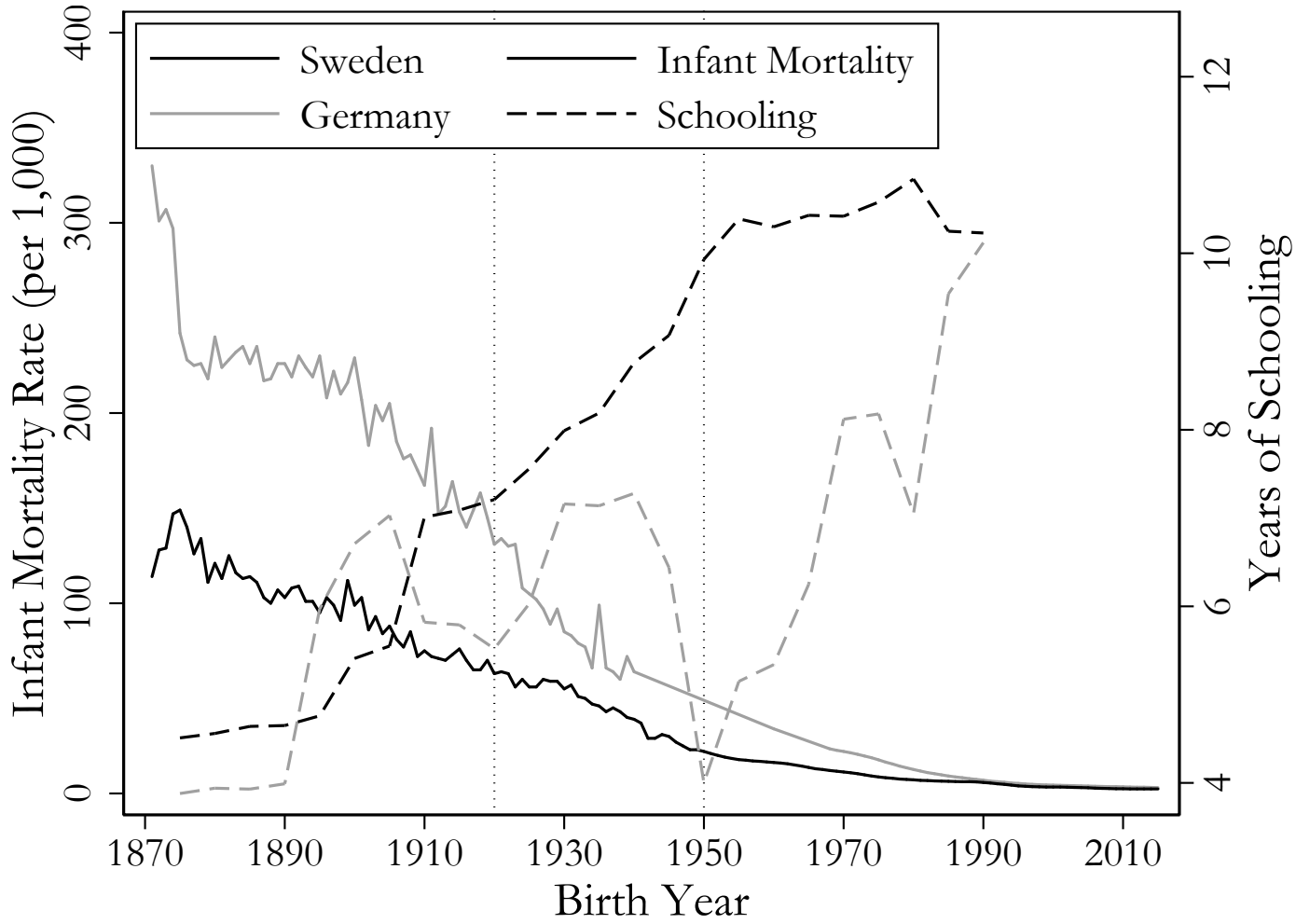


Figure 1. Long-Term Trends in Human Capital and Health, Sweden and Germany.

Empirical Study: Infant Care in Sweden

Initiation of the Field Trial

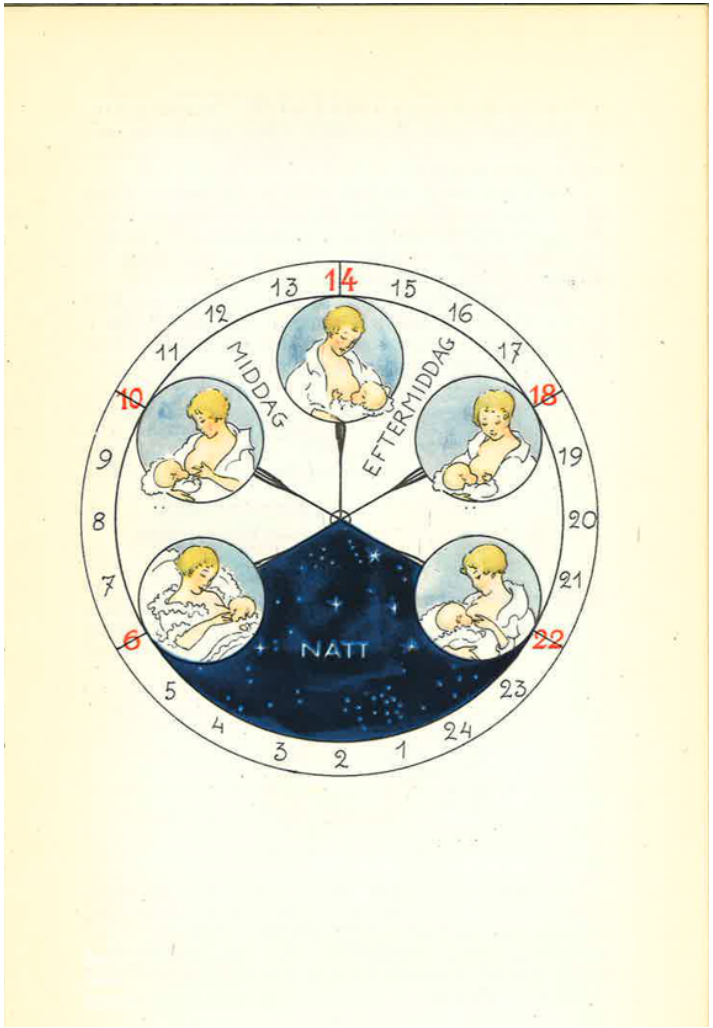
- Decreasing maternal and infant mortality at beginning of 20^{th} century.
- However, in the **1920s there were no further declines** in infant mortality and neonatal and maternal mortality increased.
- Less than 5% of women went to doctor before giving birth.
- This generated an intense public debate how to **improve conditions for expectant mothers and infants**.
- Solution $\rightarrow$ Swedish field trial.
  - **1 October 1931 - 30 June 1933**.
  - **7 health districts** received **free ante- and neonatal care**.
  - Districts quasi "randomly" chosen to reflect diversity in local conditions.

Activities

- **Three main activities**:
  1. Examination of babies at centers ⇒ follow-up if problems identified.
  2. Home visits to provide support and monitoring.
  3. Information campaigns: info on breastfeeding, diet, recognising developmental delays, cleanness and tidiness.
- Trial was so positively evaluated (no systematic evaluation) that similar scheme was rolled out in **1937 in all parts of Sweden**.
- Norway (Bütikofer et al., 2018) and Denmark (Hjort et al., 2017; Wüst, 2012) rolled out similar programs from 1936 and 1937.

Activities

Figure 2. Advice on appropriate feeding of infants from leaflet provided within the infant care intervention.



Identification – Aided by Programme Features

- Districts selected "randomly" to be representative of Sweden.
- Universal coverage. About **2,600 infants** enrolled.
- Announcement as **trial** limits fertility and migration responses.
- Narrow window of eligibility limits confounding unobserved trends.

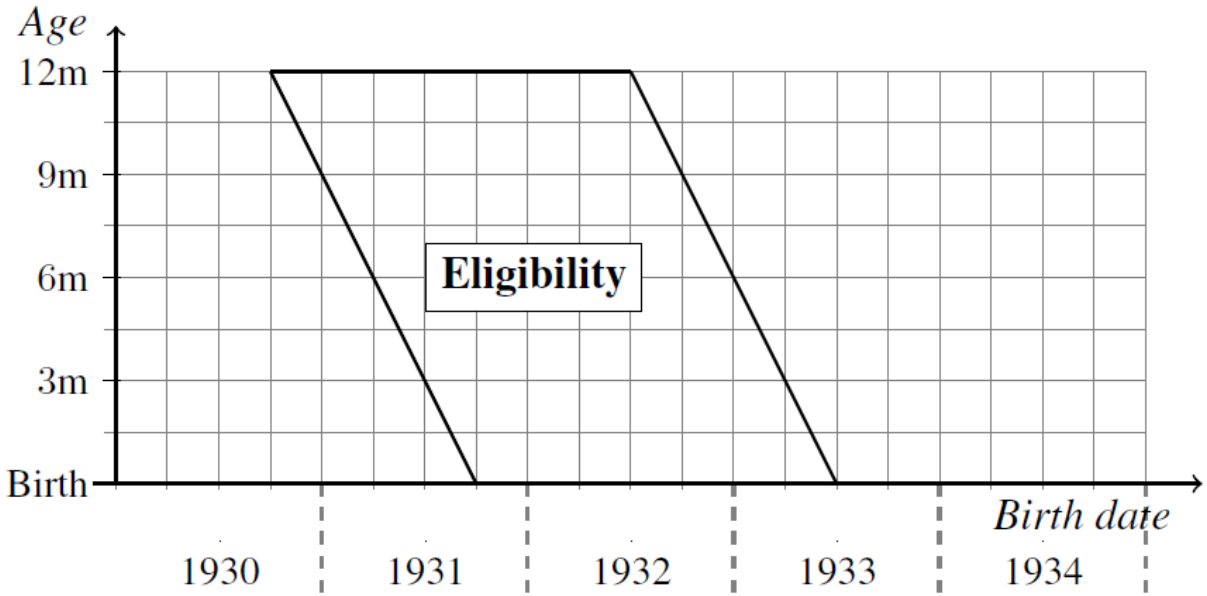


Figure 3. Eligibility by birth date.

Construction of Control Group

- Treated districts were selected in a quasi-random fashion; **eligibility** based on **birth date**.
- **7 treated health districts** contained 2 cities and 57 rural parishes.
- Identify 2 control cities and 57 control parishes using Mahalanobis matching estimator.

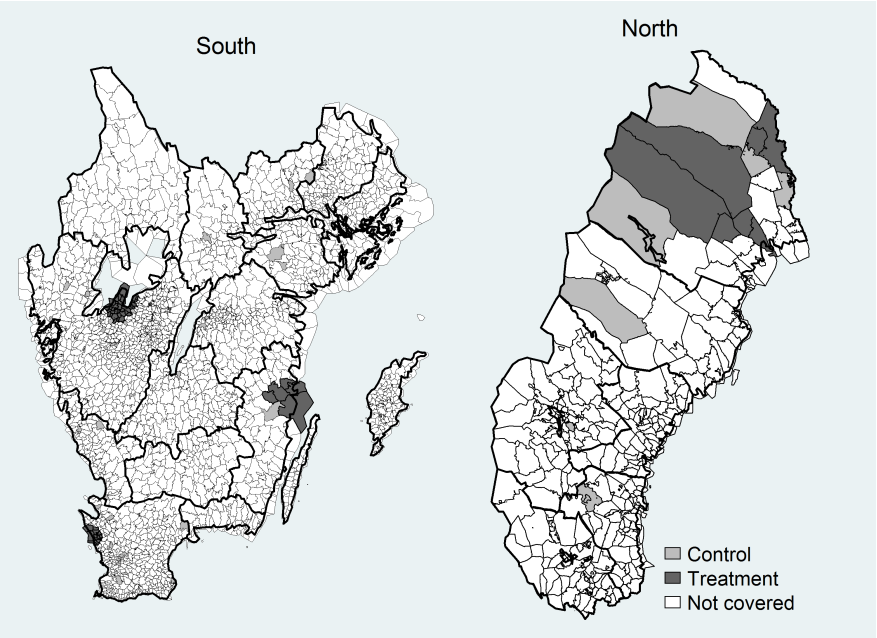


Figure 4. Municipalities containing treated and control districts

Research Questions

- Determining the impact of the intervention **over the life course**.
- Main outcomes:
  - **Mortality** until ages 1, 5, 40, and 75.
  - **Performance in school** and **education**.
  - **Labour market** performance and **life-cycle earnings**.
- Understanding the process **connecting** early-life health with adult outcomes.

Individual-Level Data

- Church records on all newborns digitised for **birth cohorts 1930-1934**.
- Data for **25,000 children** across the treated and control regions.
  - Various **background characteristics**: marital status, age, birth date and gender of child, death date.
  - Parental profession $\Rightarrow$ HISCO classification to control for SES.
- Information on **academic performance** and **sickness absence** from exam catalogues.
- Digitised for all treated and control regions (15,500 individuals).
- Missing data likely to be missing at random.
- **Grades 1 and 4** when children are between 7 and 11 years old.
- **4 subjects**: math, writing, reading and speaking, religion.

Long-term Outcomes

- **1970 population and household census**.
- Merged to individual-level data from church records (**20,900 individuals**).
- Outcome variables:
  - **Education higher than primary school**
  - Income
  - Working fulltime/parttime
  - Occupation/public sector employment.
- Administrative **mortality data** from death certificates.
- Outcome variables:
  - Mortality by different ages.
  - Cause of death

Empirical Strategy: Main Specification

- Difference-in-differences approach:

$$y_{icj} = \alpha + \beta T_c + \gamma D_j + \delta D_j T_c + \kappa_c + \varepsilon_{icj}$$

y_{icj} survival outcome of child i born on date c in parish j

T_c (theoretical) duration in months of eligibility if born on day c

D_j treatment status of parish j

κ quarter of birth times year of birth fixed effects

- δ estimates the intent-to-treat (ITT) effect, i.e., the effect – for each additional month of eligibility – of making the service available.

Empirical Strategy: Additional Specification

A richer specification may account for **diverging trends**, e.g.

- Changes in the composition of births possibly related to the intervention
- Regional variation over time due to other interventions.

$$y_{icj} = \alpha + \beta T_c + \gamma_j + \tau_j c + \delta D_j T_c + \lambda X_i + \kappa_c + \varepsilon_{icj}$$

γ_j parish-fixed effects

$\tau_j c$ parish-specific linear trends

X_i individual covariates

Results: Mortality

Table 1. Infant and future survival chances (basic specification). Source: Bhalotra et al. (2017)

	d_{0-1}	d_{0-5}	d_{0-40}	d_{0-75}
ITT	-0.1414**	-0.0872	-0.1295*	-0.2972**
	(0.061)	(0.057)	(0.076)	(0.143)
AITT	-1.0889	-0.6716	-0.9979	-2.2891
Pre-Mean	6.617	8.257	11.221	36.535

Standard errors clustered at the parish level. d_{0-x} denotes mortality before age x. AITT is the intent-to-treat effect for the average eligible individual (i.e., the product of the DID point estimates and the average eligibility period conditional on enrollment). Pre-Mean represents the mortality rate for children born before the start of the eligibility period (starting 2 October 1930). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Design-Based Inference

- In the results above, the coefficient of interest is compared to a theoretical distribution to evaluate significance.
- Alternative: conduct inference based on the **research design**.
- Each parish is matched to a similar **control parish**.
- $\Rightarrow$ **Randomise treatment status** within each pair, estimate coefficient δ.
- Repeat these steps 5,000 times $\Rightarrow$ **empirical distribution** of coefficient.
- Compare **actual estimates** to this distribution.

Randomisation Inference: Results

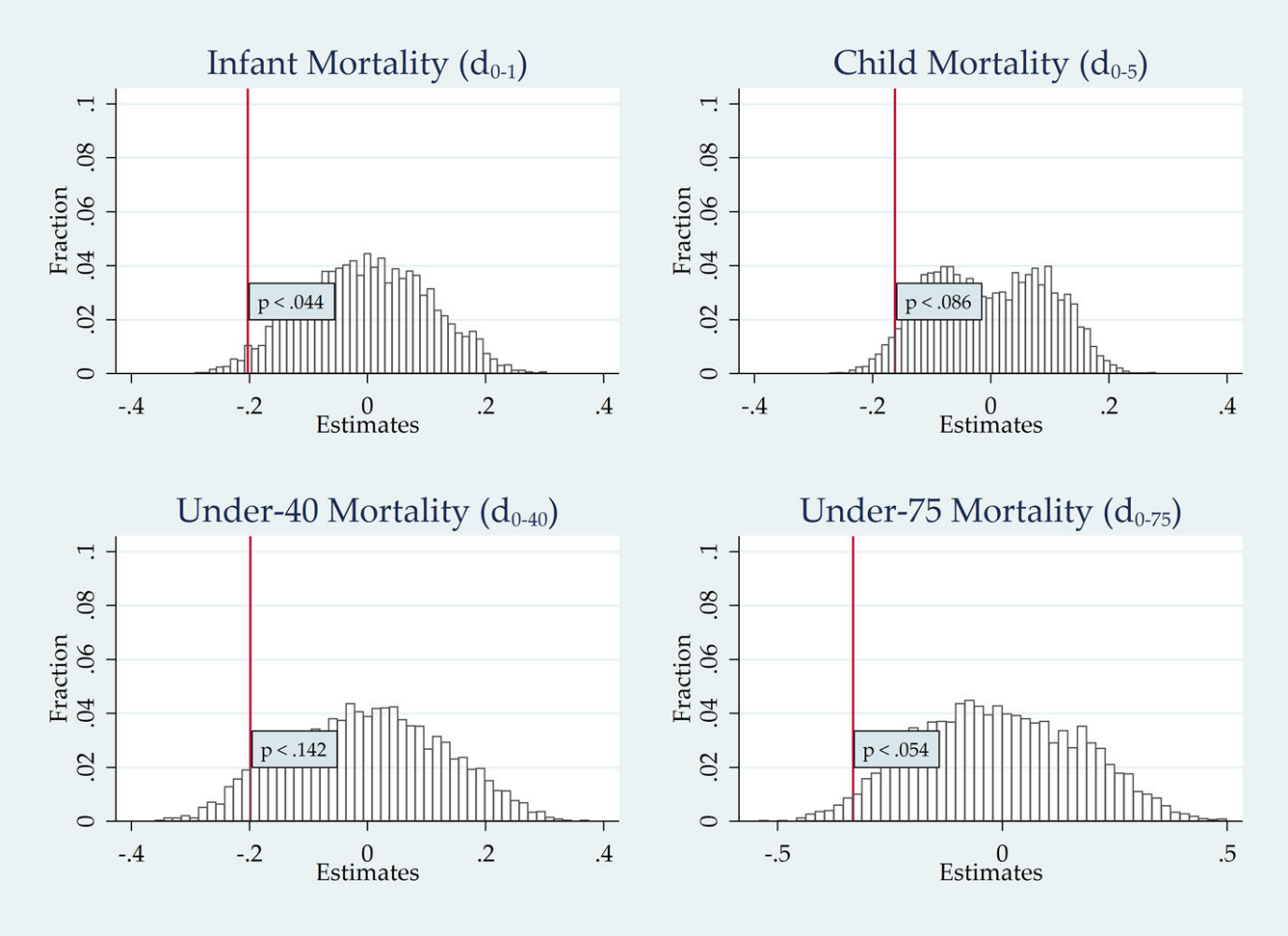


Figure 5. Randomisation inference based on 5,000 permutations of treatment status. Source: Bhalotra et al. (2017).

Treatment Effect Heterogeneity

- Impacts of the intervention are significantly larger for **out-of-wedlock** births.
- Children of **young mothers** benefited more; however, this effect is not persistent beyond the age of 5.
- There is **no** significant difference in effects by **child sex**.

Adult Death Causes

Table 2. Adult results by death cause. Source: Bhalotra et al. (2017)

	All-cause	Infect	External	Cancer	Cardio
Mortality between ages 50 and 75					
ITT	-0.3527***	-0.0433*	-0.0339	-0.2835**	-0.0958
	(0.134)	(0.022)	(0.044)	(0.134)	(0.091)
AITT	-2.7165	-0.3337	0.2608	-2.1842	-0.7381
Pre-Mean	26.249	0.210	1.579	7.373	7.778
Average age at death	65.008	68.392	60.636	64.911	64.951

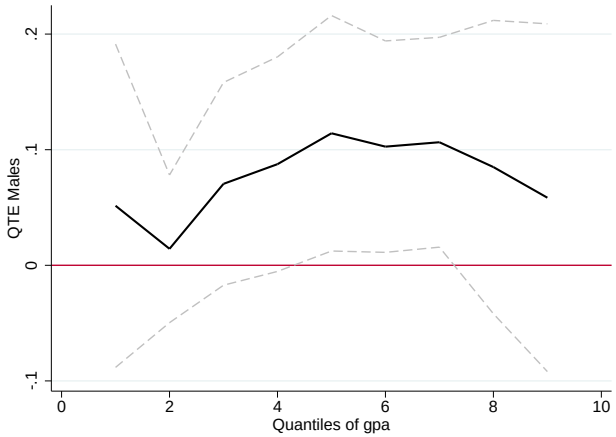
Standard errors clustered at the parish level. AITT is the intent-to-treat effect for the average eligible individual. Pre-Mean represents the rates for children born before the start of the eligibility period (starting 2 October 1930). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Education and Labour Market Outcomes

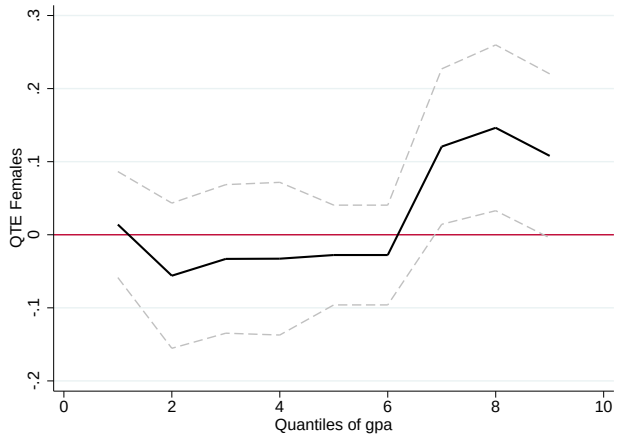
Table 3. DID Estimates: Education and Earnings.

	Women				Men			
	N	Mean	(1)	(2)	N	Mean	(3)	(4)
Top GPA	6,465	0.227	0.1000*	0.1243*	6,607	0.116	0.0400	0.0275
			(0.058)	(0.070)		(0.033)	(0.028)	
GPA	6,465	0.098	0.0410	0.0617	6,607	-0.200	0.1213**	0.1084
			(0.048)	(0.053)		(0.056)	(0.070)	
Secondary	8,071	0.198	0.0353**	0.0350**	8,301	0.172	-0.0468	-0.0289
			(0.016)	(0.014)		(0.029)	(0.021)	
Top Income 1970	10,301	0.244	0.0655**	0.0788**	10,619	0.210	-0.0445	-0.0361
			(0.026)	(0.031)		(0.034)	(0.029)	
Log Income	10,301	8.990	0.1204*	0.1947**	10,619	10.222	-0.0596	-0.0464
			(0.068)	(0.074)		(0.036)	(0.033)	
Log Pensions (age 71)	8,284	11.609	0.0293	0.0711***	7,680	11.995	-0.0400**	-0.0400*
			(0.021)	(0.018)		(0.017)	(0.022)	
Parish FE			✓	✓			✓	✓
QOB×YOB FE			✓	✓			✓	✓
SES Effects			✓	✓			✓	✓
School Reforms			✓	✓			✓	✓
Parish Trends				✓				✓

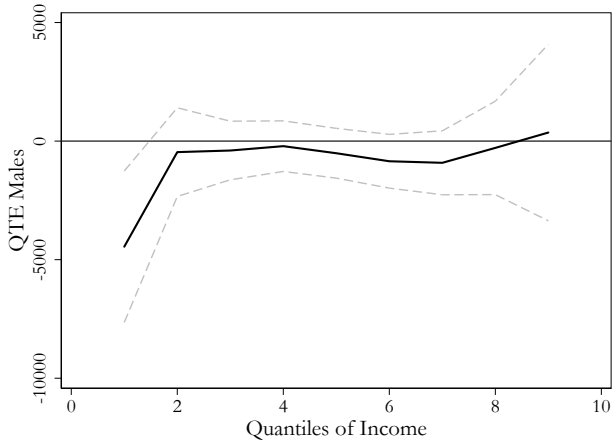
Results: Grade Point Average



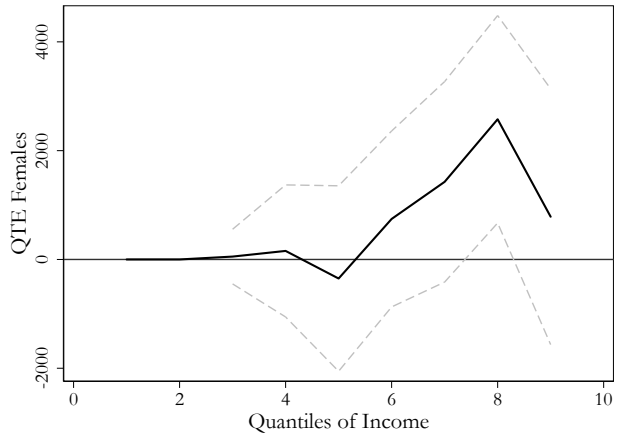
(a) QTE GPA Males



(b) QTE GPA Females



(c) QTE Income Males



(d) QTE Income Females

Mediation Analysis

- Mediation analysis generally requires second **randomisation**.
- We will return to methods later on.
- In this study: Gelbach's (2016) method – purely **descriptive**.
- Estimate two equations

$$Y = T\tau_{base} + X\lambda + \epsilon$$
$$Y = T\tau_{full} + Z\beta + X\lambda + \upsilon$$

  where Z are potential mediators.
- The difference $\hat{\delta} = \hat{\tau}_{base} - \hat{\tau}_{full}$ captures the impact of the mediators on the estimated effect.
- One variable's contribution: $\hat{\delta}_k = \hat{\Gamma}_k \hat{\beta}_k$.

Results: Female Schooling

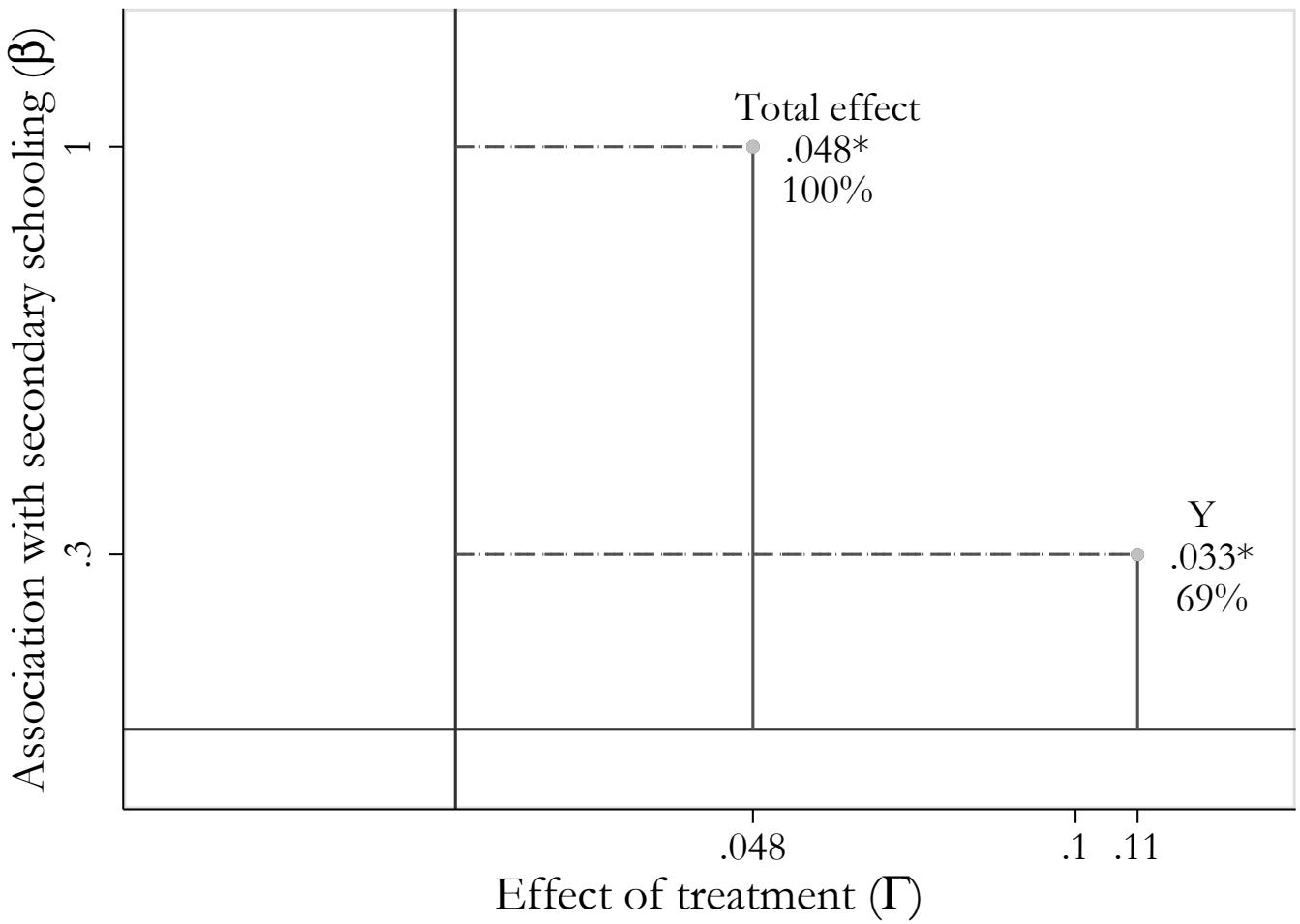


Figure 7. Mediation Analysis: Secondary Schooling.

Results: Female Earnings

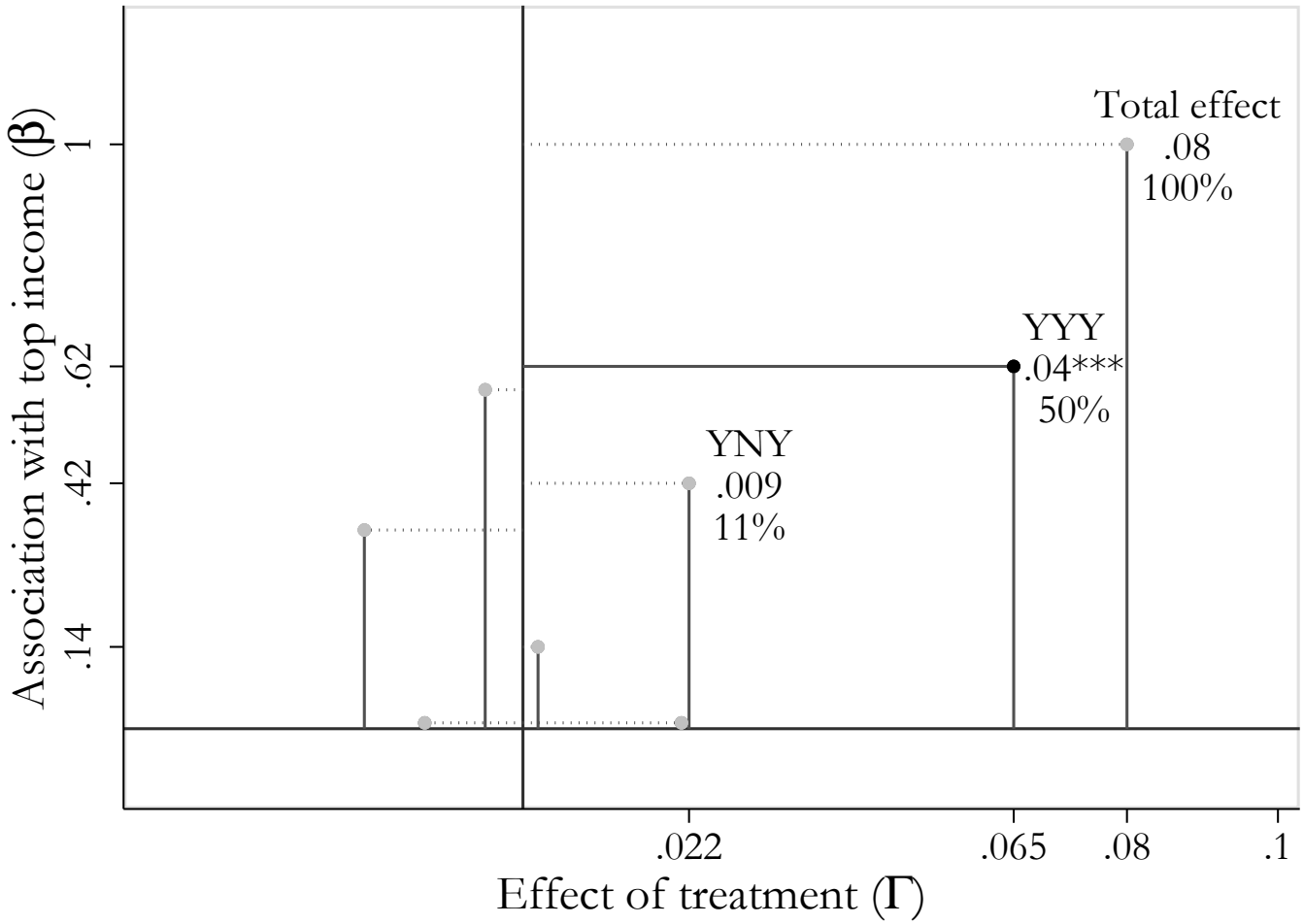


Figure 8. Mediation Analysis: Labour Market Earnings.

Results: Female Occupation

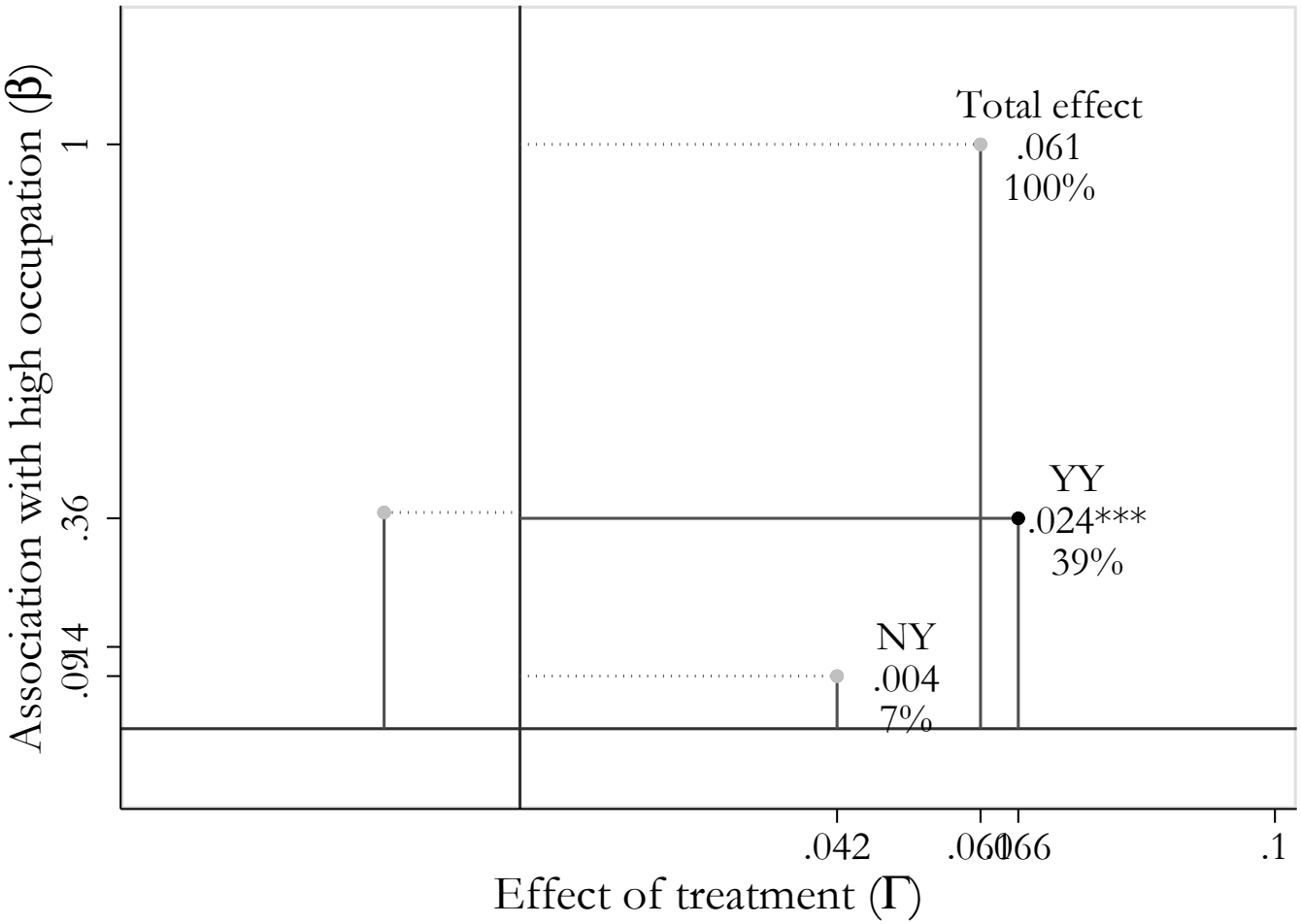
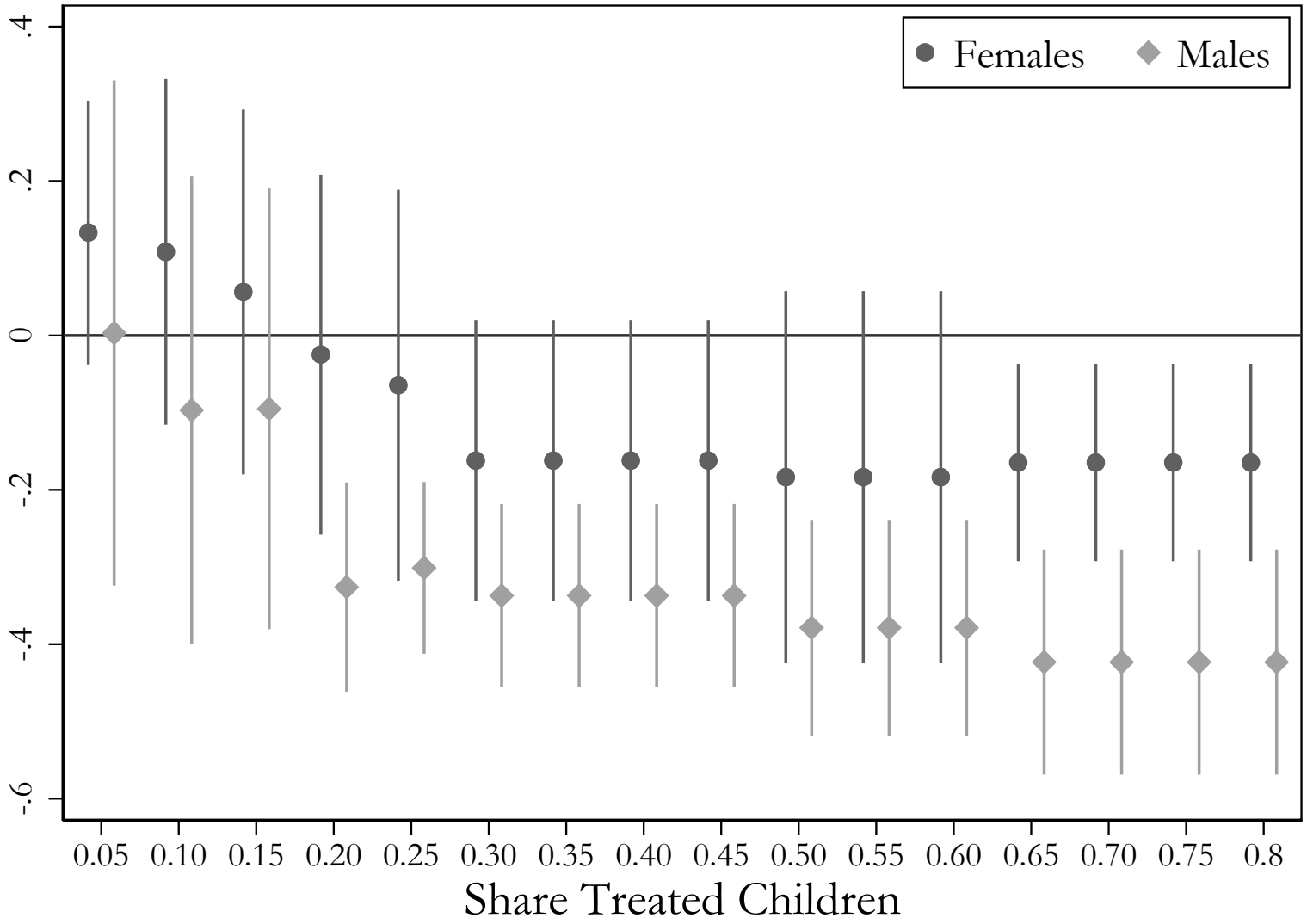


Figure 9. Mediation Analysis: High-Ranking Occupation.

Why Females?

- Utilisation?
  - We find **no gender differences** at extensive and intensive margins.
- Mortality?
  - Bhalotra et al (2017): **No gender differences** in mortality.
- Returns to education?
  - Female **returns to education** were consistently **higher**.
- Labour demand?
  - Labour demand for qualified females **expanded rapidly** (welfare state) but not for males.

Skill Acquisition: Secondary Schooling



Growth in Labor Market Opportunities

Table 4. Treatment Effect Heterogeneity by Bartik Instrument for Skilled Workers, Adult Index

	Females (N=10,301)		Males (N=10,619)	
	(1)	(2)	(3)	(4)
Treated × Duration Eligibility	0.0732***	0.0758***	-0.0129	-0.0126
	(0.022)	(0.021)	(0.017)	(0.017)
Treated × Own Skilled Bartik	0.0072	0.0035	0.0373**	0.0373**
	(0.052)	(0.052)	(0.018)	(0.018)
Own Skilled Bartik	0.0404	0.0447	-0.0006	-0.0002
	(0.040)	(0.039)	(0.008)	(0.008)
Duration Eligibility × Own Skilled Bartik	-0.0311**	-0.0313**	-0.0211*	-0.0218*
	(0.014)	(0.014)	(0.013)	(0.013)
Treated × Duration Eligibility × Own Skilled Bartik	0.0577***	0.0583***	0.0148	0.0173
	(0.018)	(0.018)	(0.018)	(0.019)
Treated × Other Skilled Bartik		0.0231		0.0318
		(0.017)		(0.041)
Other Skilled Bartik		-0.0319***		-0.0145
		(0.010)		(0.022)
Duration Eligibility × Other Skilled Bartik		0.0160		0.0006
		(0.014)		(0.009)
Treated × Duration Eligibility × Other Skilled Bartik		-0.0100		-0.0007
		(0.019)		(0.012)
Parish FE	✓	✓	✓	✓
QOB×YOB FE	✓	✓	✓	✓
SES Effects	✓	✓	✓	✓
School Reforms	✓	✓	✓	✓
Parish Trends	✓	✓	✓	✓

Summary of Results

- The intervention is associated with significant **reductions in mortality** for all age thresholds.
- The effect does not **fade over time** but is rather persistent

$\Rightarrow$ Consistent with infancy being a critical stage of development and with programme-driven learning within mothers that persists over time.

- Moderate gains in school performance translate into large gains in earnings for females.

Further Studies

- Several studies evaluate similar interventions in Denmark and Norway.
- Hjort et al. (2017):
  - The authors estimate the effects of a Danish home visting programme in 1937.
  - They find higher survival rates during ages 45 to 64, fewer hospital nights, as well as a reduction in cardiovascular disease diagnoses.
- Bütikofer et al. (2015):
  - This study evaluates an intervention in Norway from 1936 to 1955.
  - The results indicate positive effects on education and earnings of affected children.
  - Further, a reduction in health risks at age 40 is found.

Summary and Conclusions

Summary and Conclusions

- A growing literature evaluates the long-term health of early-childhood interventions.
- Several studies confirm shocks during childhood to have old-age impacts on health.
- Relatively low-cost home visiting programmes in Scandinavia during the 1930s were found to not only decrease infant mortality but also reduce deaths at old-age due to cardiovascular diseases or cancer.
- The conclusions of these studies might be important for today's developing countries.