The Effect of Compulsory Schooling on Health

Evidence from Biomarkers

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Motivation

- Correlation between education (or SES in general) and health is ubiquitous finding (known since 150 years in medicine)
- Why focus on education?
  - If policy goal is to reduce inequality in health, education policy might be more useful than income redistribution
  - Easily blends into economic literature on returns to education
- Theoretical arguments for **direct** causal channel
  - Education raises productivity in health production just as in the labor market (Grossman 1972)
  - Education changes inputs into health production. i.e. health behavior (allocation effect, Rosenzweig & Schulz 1981)
  - Education changes time preferences (Fuchs 1982)
- Plus **indirect** effects via higher income, better occupational status, better housing, environment, peer effects
- Universal correlation strong indication but no prove of causality, of course
  - Unobserved heterogeneity: family background, family health, preferences, cognitive & non-cognitive skills
  - Reverse causation: sick children „choose“ less education

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Identification

- Controlling for unobserved heterogeneity
  - Sibling or twin fixed effects
- Use exogenous variation in education
  - Use instruments for education (e.g. proximity to next college, Vietnam draft lottery)
  - Exploit policy changes (e.g. abolition of school fees, compulsory schooling laws) in IV or Regression Discontinuity Design
- Relevant studies exploiting changes in compulsory schooling
  - Lleras-Muney (RES 2005): large effects of education on mortality in U.S. (IV>OLS)
  - Oreopoulos (AER 2006): large effects on SRH in U.K., U.S. and Canada (IV>OLS)
  - Clark & Royer (DP 2008): only weak evidence for effect on mortality, BMI, smoking, SRH in U.K.
  - Kemptner, Jürges & Reinhold (DP 2010), for Germany: significant effects on long-term illness, work disability for men (IV=OLS) but not for women (IV<OLS). Effects on BMI for both sexes, no effect of smoking.

Our Contribution

Our focus: blood content of inflammation markers

- Measures „objective“ health status, **not** on health perception
- Our indicators:
  - Fibrinogen
  - C-reactive protein
- Both are released into the blood stream in case of inflammation, markers of long-term environmental or psychosocial stress
- Correlated with subjective health and several lifestyle related variables (e.g. smoking, frequent physical exercise)
- High levels in either predict incidence of cardiovascular disease, diabetes
- In a sense we are looking at surrogate outcomes

Our Contribution

Our identification strategy: exploit mandatory schooling laws in England

- Our source of exogenous variation are two changes
  - In 1947 minimum school leaving age was raised from 14 to 15 for all children born April 1933 or later
  - In 1973 it was raised from 15 to 16 for all children born September 1957 or later
- Idea: Compare individuals born shortly before and after the policy change took effect and compare outcomes for these groups
- Note: we are not the first – and probably not the last – to exploit the English reform.

Data

- Health Surveys for England (HSE) 1993, 1994, 1998-2000 and 2003-2006
- English Longitudinal Study on Ageing (ELSA) 2006
- Full blood samples taken by nurses in nurse-visits
- Very important: Data contain information on birth date at the monthly level
- Sample restricted to individuals born 4 years before and after the discontinuity
- Individuals born between April 1929 and March 1937, and between September 1953 and August 1961

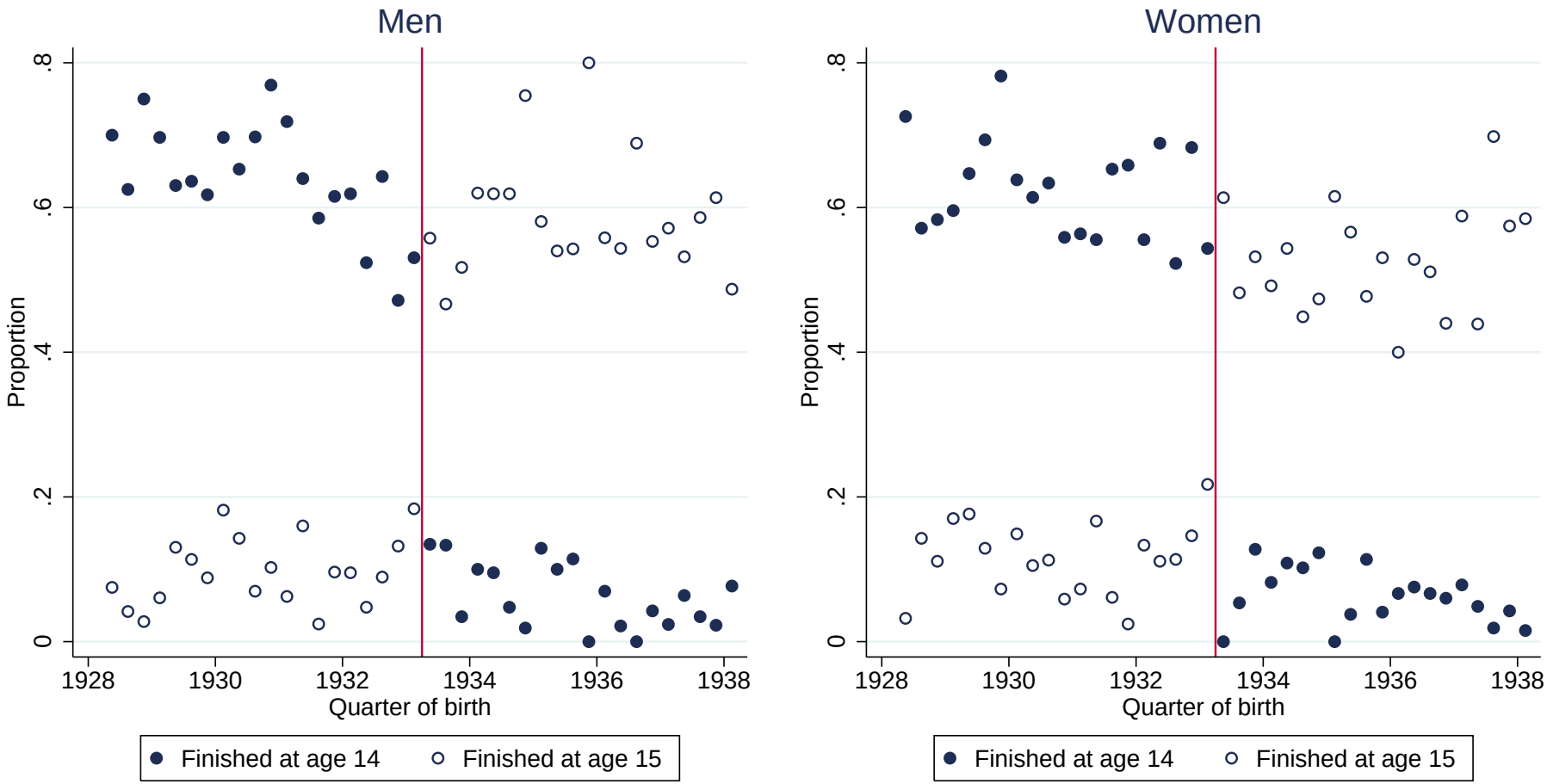
Sample description

	1947 reform cohorts		1973 reform cohorts	
	Men	Women	Men	Women
	(1)	(2)	(3)	(4)
Age at survey	66	67	41	42
Age left school	15.4	15.4	16.7	16.7
Poor Health (%)	37	35	18	19
Height (cm)	172	159	176	163
Ln(fibrinogen)	1.00	1.04	0.86	0.93
Ln(CRP)	0.63	0.66	0.12	0.14
N	2135	2240	3074	3409

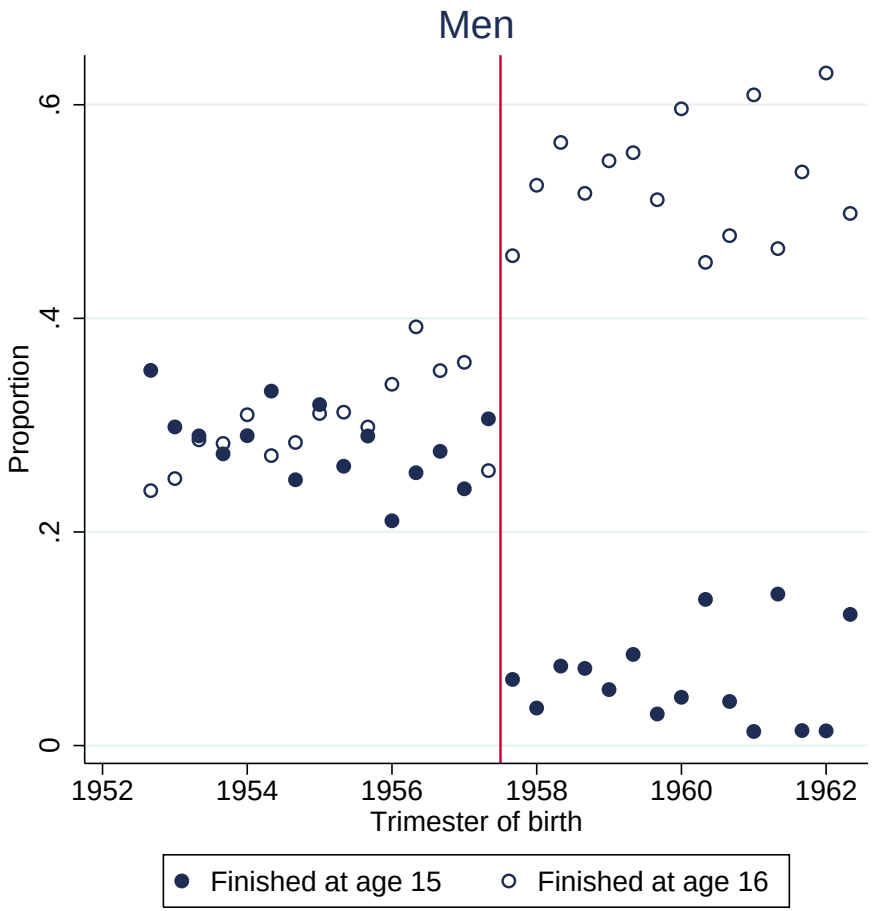
Average log fibrinogen and CRP levels, by self-rated health

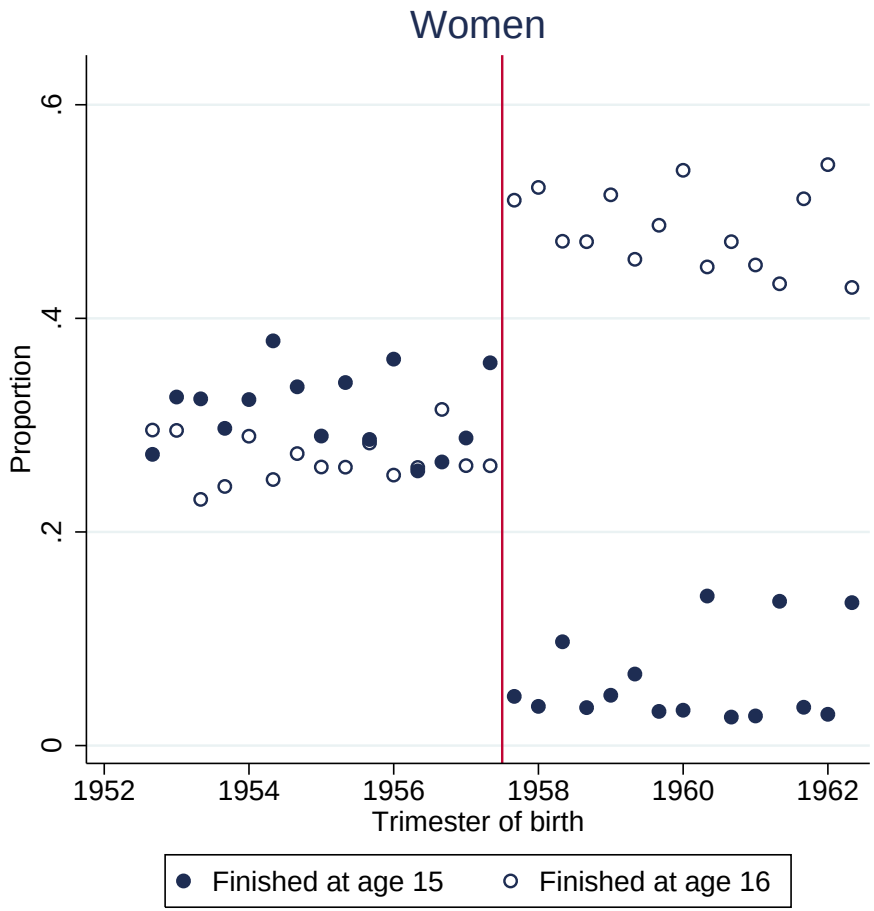
	1947 reform cohorts				1973 reform cohorts			
	Men		Women		Men		Women	
	Fib	CRP	Fib	CRP	Fib	CRP	Fib	CRP
Self-rated health								
Poor	1.05	0.81	1.08	0.80	0.91	0.37	1.01	0.47
Good	0.98	0.55	1.02	0.61	0.85	0.06	0.92	0.06
Difference	-0.07	-0.26	-0.06	-0.19	-0.06	-0.31	-0.09	-0.41
abs. t-value	6.4	5.6	5.6	4.2	5.6	5.0	8.4	6.3

Effect of 1947 reform on school leaving age



Effect of 1973 reform on school leaving age





OLS Results

	Poor health		log(fibrin.)		log(CRP)	
	1947 Coh.	1973 Coh.	1947 Coh.	1973 Coh.	1947 Coh.	1973 Coh.
	(1)	(2)	(3)	(4)	(5)	(6)
			Men – no controls			
Age left school	-0.053*	-0.032*	-0.019*	-0.018*	-0.102*	-0.074*
	(0.006)	(0.004)	(0.003)	(0.003)	(0.018)	(0.020)
			Men – with controls			
Age left school	-0.048*	-0.030*	-0.015*	-0.016*	-0.102*	-0.073*
	(0.006)	(0.004)	(0.003)	(0.003)	(0.019)	(0.020)
Observations	2735	3074	2737	3074	1611	1630
			Women – no controls			
Age left school	-0.058*	-0.033*	-0.015*	-0.021*	-0.075*	-0.110*
	(0.005)	(0.004)	(0.003)	(0.003)	(0.017)	(0.018)
			Women – with controls			
Age left school	-0.054*	-0.033*	-0.011*	-0.020*	-0.070*	-0.106*
	(0.005)	(0.004)	(0.003)	(0.003)	(0.017)	(0.018)
Observations	2909	3409	2911	3410	1749	1848

Cluster corrected standard errors in parentheses, $*p < 1\%$

Control variables: birth month cohort, season of birth, height, and survey year

Fuzzy Regression Discontinuity Design

- Probability of treatment (higher school-leaving age) is discontinuous function of treatment determining variable (date of birth)
- Use dummy variable for being born April 1933 or after as binary instrument
- The data show a lot of always-takers, but also some never-takers (partial non-compliance), thus only able to identify LATE
- Identifying assumption: unobservable characteristics related to health can be represented by some smooth function of birth year.
- Put differently: (Conditional on covariates) no other health relevant change occurred at the cutoff birthdate

RDD Results

	Poor health		log(fibrin.)		log(CRP)	
	1947 Coh.	1973 Coh.	1947 Coh.	1973 Coh.	1947 Coh.	1973 Coh.
	(1)	(2)	(3)	(4)	(5)	(6)
Men						
First stage	0.32*	0.32*	0.33*	0.32*	0.40*	0.39*
	(0.09)	(0.1)	(0.09)	(0.1)	(0.14)	(0.13)
First-stage F	14.23	10.55	14.67	10.55	8.03	9.43
FRD parameter	0.05	-0.08	-0.03	0.01	-0.12	-0.18
	(0.09)	(0.1)	(0.06)	(0.05)	(0.23)	(0.25)
Observations	2735	3074	2737	3074	1611	1630
Women						
First stage	0.41*	0.31*	0.41*	0.31*	0.49*	0.2
	(0.11)	(0.09)	(0.11)	(0.09)	(0.15)	(0.14)
First-stage F	14.59	10.95	14.53	11.09	10.24	1.95
FRD parameter	-0.12	0.11	0.04	-0.01	-0.37	-0.09
	(0.08)	(0.08)	(0.04)	(0.05)	(0.24)	(0.49)
Observations	2909	3409	2911	3410	1749	1848

Cluster corrected standard errors in parentheses, $*p < 1\%$

Controlling for year and month of birth, survey year and height

Robustness Checks

- Modify the bandwidth of birth cohorts
- Modify specification of birth cohort trend
  - Local linear (as shown)
  - Global polynomial with various bandwidths and polynomial orders
- Restrict to most affected individuals (left school at 14/15 or 15/16, respectively)
- Neither does change substantive results
- Only for men in the 1947 cohort, we sometimes find a significant positive effect on self-rated health

Summary and Discussion

- Strong correlation, but weak evidence for causal effect of education on self-rated health, even weaker for biomarkers
- However, RD confidence intervals contain OLS-estimates
- Overall, results are only partially in line with previous literature
  - In line with Clark & Royer 2008 (Mortality, SRH, BMI, Blood pressure)
  - Contrasting to Oreopoulos 2006, Silles 2009 (SRH), Lleras-Muney 2005 (Mortality)
- Should we be surprised? (After all, what has been learned in this additional year of schooling?)
  - First reform has been shown to be associated with higher earnings (Oreopoulos 2006, Devereux & Hart 2008)
  - Skills rewarded on labor market not relevant for health production?
  - Higher earnings not effective for health outcomes?

Summary and Discussion

- On mediators: what „explains“ the causal effect – if we find one?
- Establishing the mechanism by which causality is transmitted is not simple (Green et al. 2010)
  - Causal link between M and H needs to be established independently
  - Nearly impossible to find (natural) experiments that do not manipulate other potential mediators
  - Potential heterogeneity in the effect of E on M and M on H – same complier subpopulation?