The Roots of Health Inequality and the Value of Intra-Family Expertise

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Motivation

- Extensive evidence of a positive correlation between SES and health (see, e.g., Deaton, 2002; Currie, 2009; Chetty et al., 2016)
- Causal mechanisms behind gradient less well understood
  - Health at birth, access to care, health behaviors, ...
- This paper investigates the role of one possible underlying factor: **(unequal) access to health-related expertise**
  - Idea: If access to expertise improves health, then an unequal distribution of access to expertise generates health inequality
- Our aim is to investigate
  1. Whether access to health-related expertise improves health
  2. The importance of this channel in sustaining health inequality

Two empirical challenges

1. Access to health-related expertise is (i) hard to measure, and (ii) generally **not** randomly assigned.

   $\Rightarrow$ Zoom into particular measure of access to health expertise: **Informal access to health expertise through a family member who is a doctor or nurse**

Two empirical challenges

1. Access to health-related expertise is (i) hard to measure, and (ii) generally **not** randomly assigned.

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2. Need comprehensive data on detailed SES & health outcomes

   $\Rightarrow$ Swedish administrative data: tax records & inpatient, specialized outpatient, birth, and prescription drug records

The setting: Sweden

- Beyond availability of data, Sweden is a particularly attractive empirical context
  - Universal health insurance system $\Rightarrow$ no inequality in **access to health insurance**
  - Extensive social safety net
- Thus, in the Swedish setting, we "shut down" many often-hypothesized drivers of health inequality

This paper: What we do

1. Sweden as a "laboratory": shut down formal access channel
   - Examine whether there is any health-SES gradient left
2. Examine whether informal access to expertise, captured by a HP in the extended family, improves health outcomes
3. Examine implications of our findings for health inequality

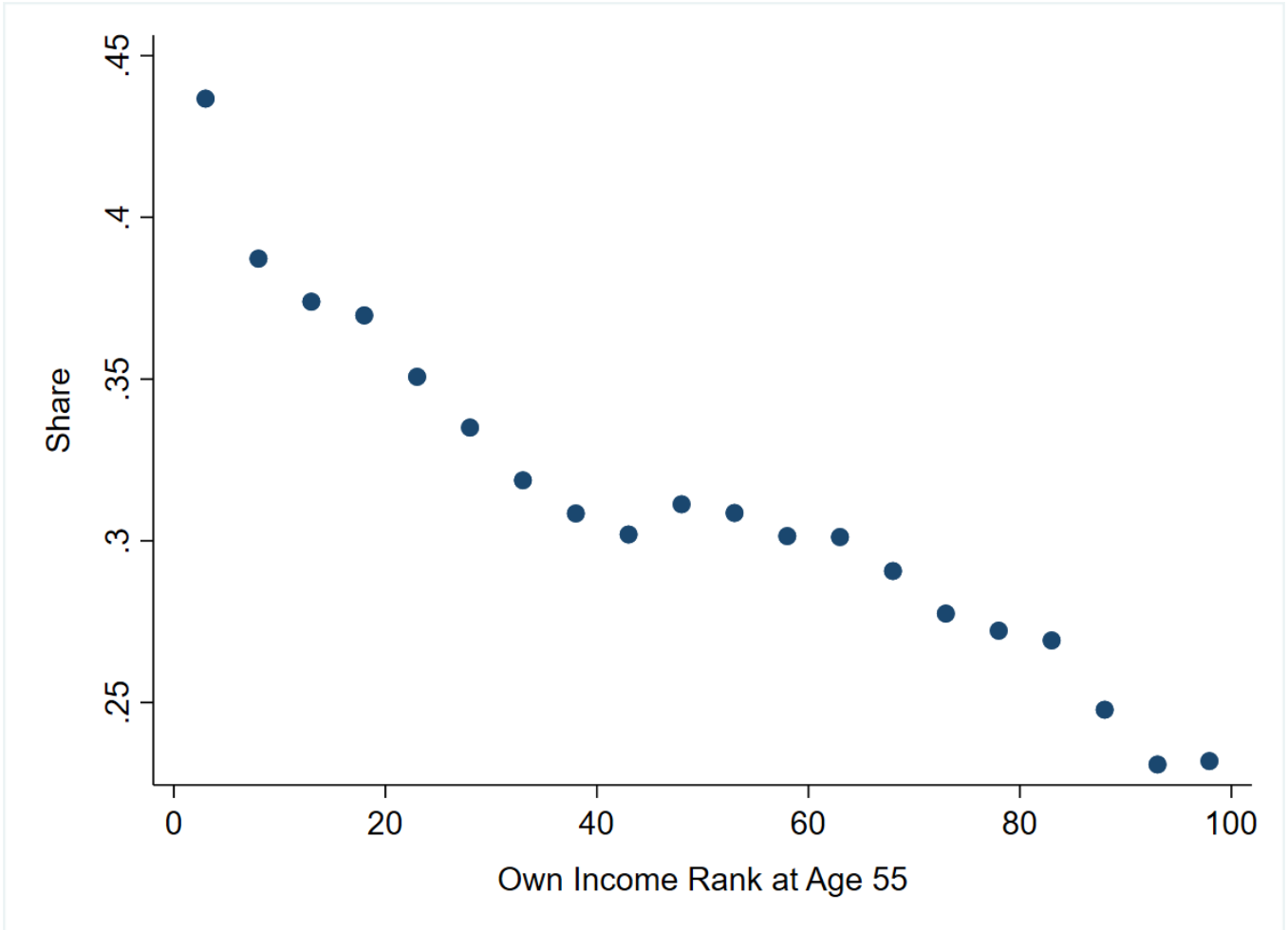
1. Health inequality in Sweden

2. Intra-family expertise and health

3. Implications for health-SES gradient

Swedish setting: mortality inequality

Figure: Whether individual **died by age 80**



Pre-tax work-related income. Individuals ranked within birth cohort and gender.
U.S. comparison: age-75 mortality gradient **equally steep** in Sweden and the U.S.

Swedish setting: inequality throughout life cycle

Despite universal health insurance and a generous social safety net:

Fact 1 Health inequality at the **end of life**

- Mortality

Fact 2 Health inequality in **adulthood**

- Heart attacks, heart failure, diabetes, lung cancer ▸ Figure

Fact 3 Health inequality in **childhood to adolescence**

- HPV vaccination, inpatient stays ▸ Figure

Fact 4 Health inequality **very early in life**

- Tobacco exposure before birth ▸ Figure

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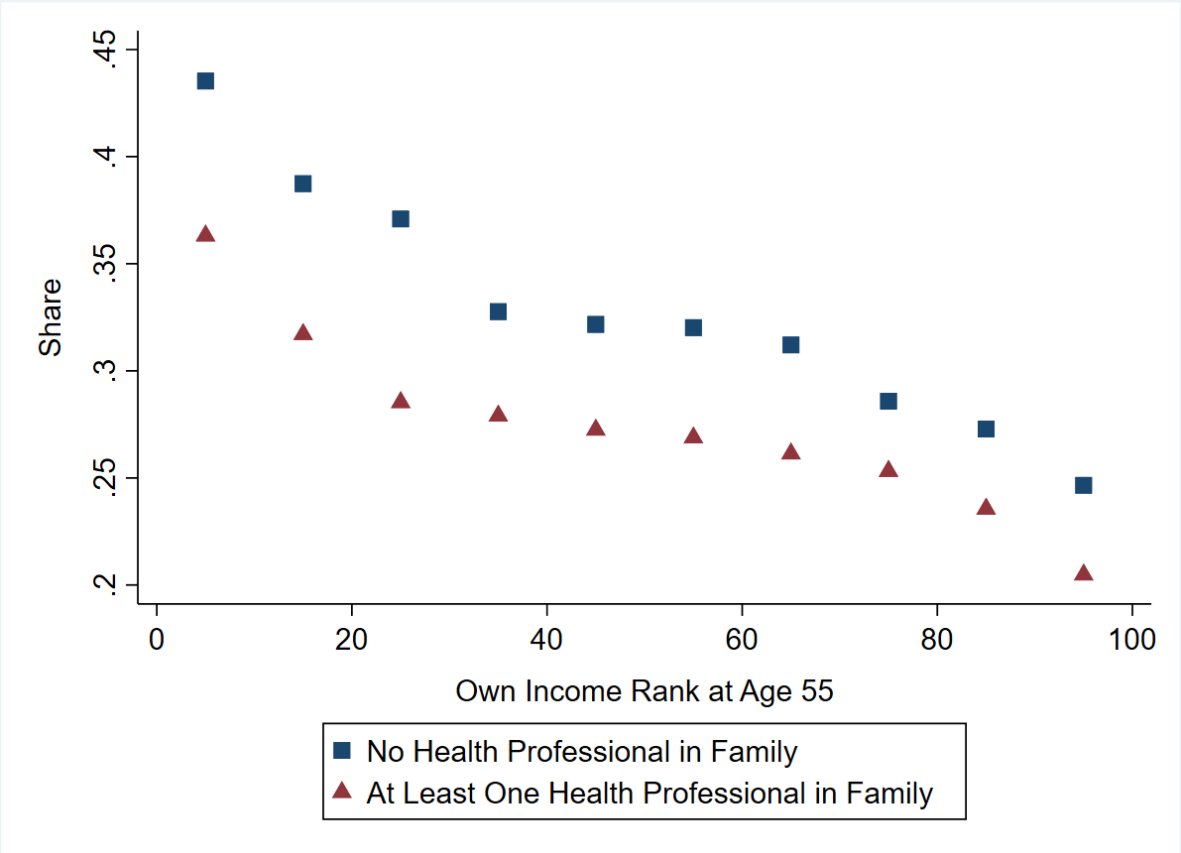
Mortality

Figure: Died by age 80



In "family": health professional's spouse, parents, parents-in-law, children, children-in-law, siblings, aunts and uncles, grandparents, and cousins.

Mortality

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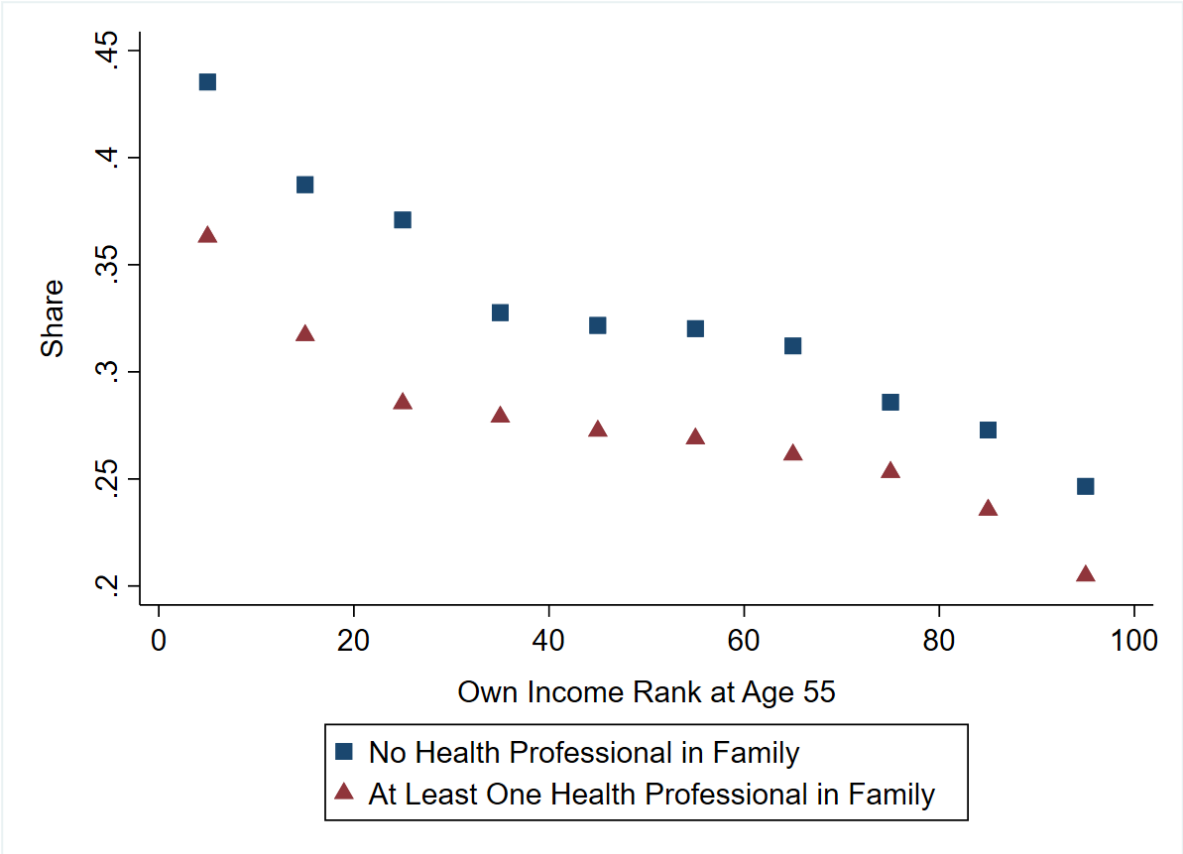
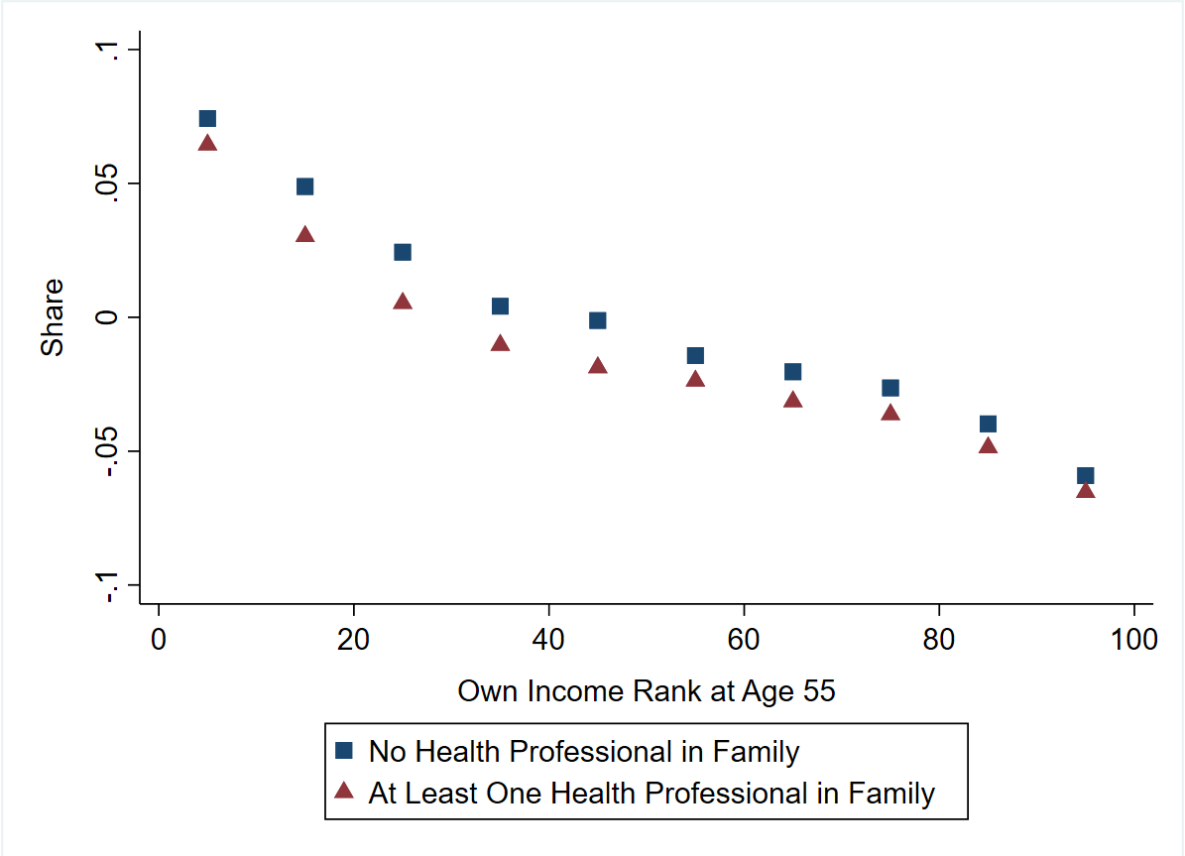


In "family": health professional's spouse, parents, parents-in-law, children, children-in-law, siblings, aunts and uncles, grandparents, and cousins.

Roughly **half of this difference persists** when controlling for rich set of observables

Lifestyle-related diseases in adulthood

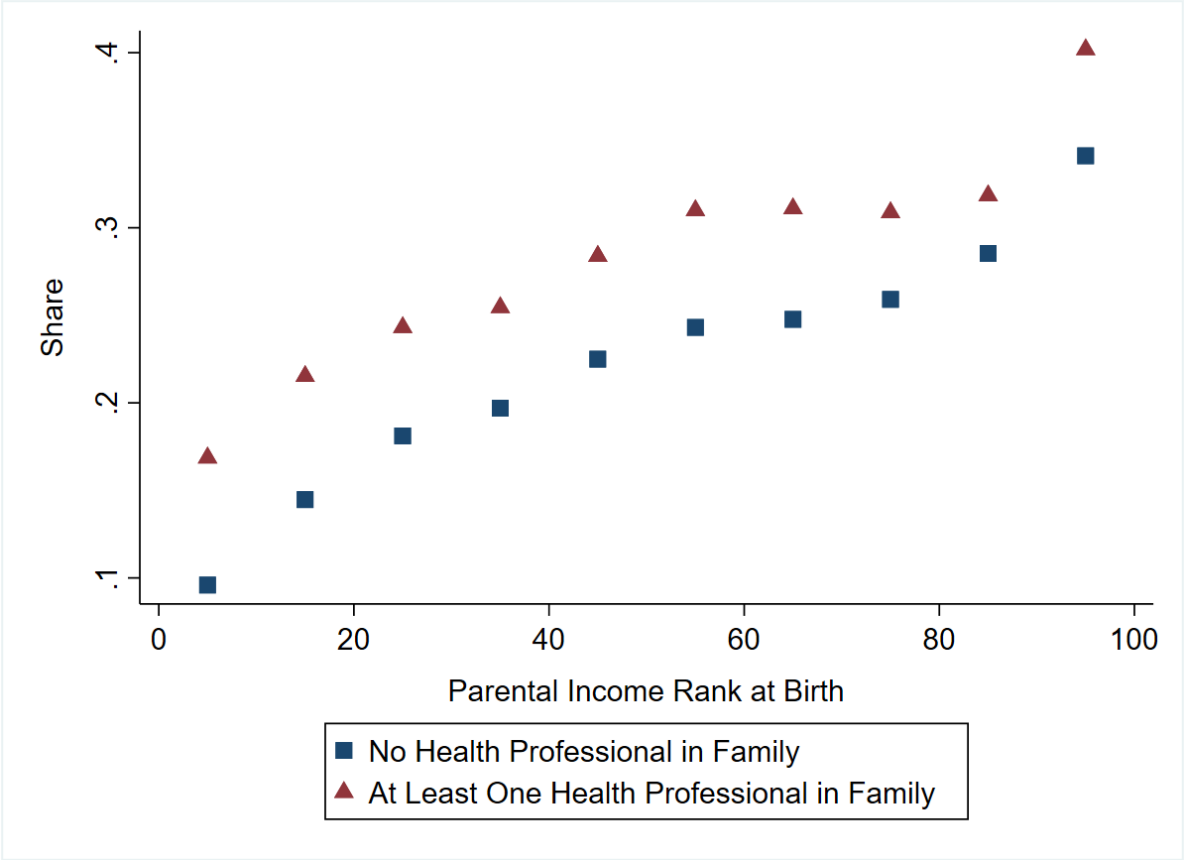
Figure: Lifestyle Index



Z-score index of four chronic conditions that are commonly considered to be linked to lifestyle decisions: type II diabetes, heart attack, heart failure, and lung cancer.

Preventive behaviors at younger ages

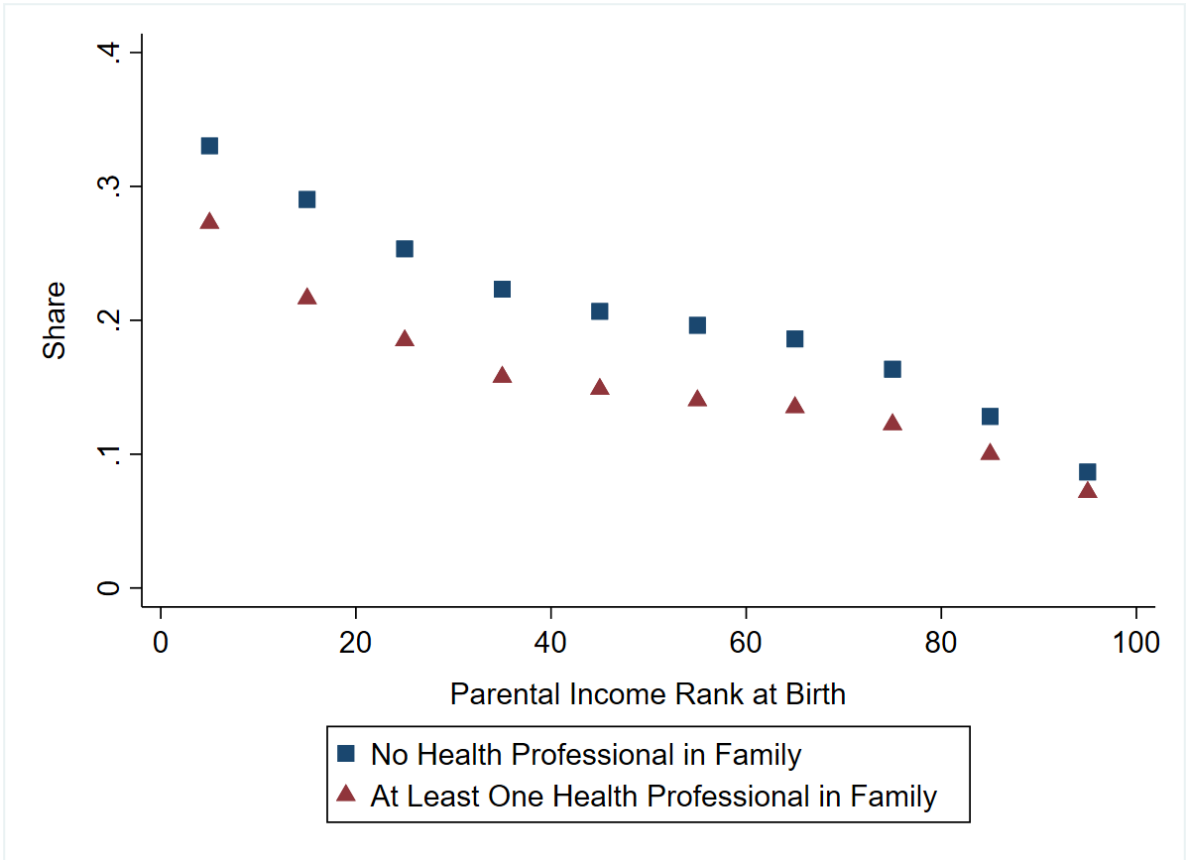
Figure: HPV vaccination



Note: Data covers time period before the HPV vaccine was part of the National Vaccination Programme

Health early in life

Figure: Tobacco exposure *in utero*



▸ More

Summarizing

1. Compared individuals with and without a HP in the family
   - Can control for a wide range of observable characteristics
2. Conclude: having HP in family is associated with **better health and more health capital investments** throughout the life-cycle and across the SES gradient
   - Effects are same or stronger at lower SES
3. Despite rich controls, concerns remain about potential **unobservables** correlated with having an HP in the family
   - Healthcare exposure, health interest, health culture and nudging within family, ..., may drive both

Strategies for addressing selection

1. Learning from Sweden's medical school lotteries
   - Admission randomized among applicants with top GPA
   - Design: compare family members of applicants to medical school with a top GPA who were admitted ("lottery winners") and not admitted ("lottery losers")
   - Sample: Four generations of family members, including in-laws

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2. Event study to examine long-run effects
   - Design: compare parents of medical doctors to parents of lawyers, before and after child acquires degree
   - Sample: parents of doctors and parents of lawyers (excluding those who are doctors or lawyers themselves)

Results from lottery design (1/2)

For **individuals aged** ≥ 50, access to informal health-related expertise through a family member who is a medical doctor:

- Raises preventive health investments
  - Having a relative matriculate into medicine raises the likelihood of **taking prescribed medications** (statins 27%, blood thinners 25%, diabetes drugs 45%)
- Improves physical health
  - Reduces the risk of heart attack and heart failure
- All effects measured over 8-year period

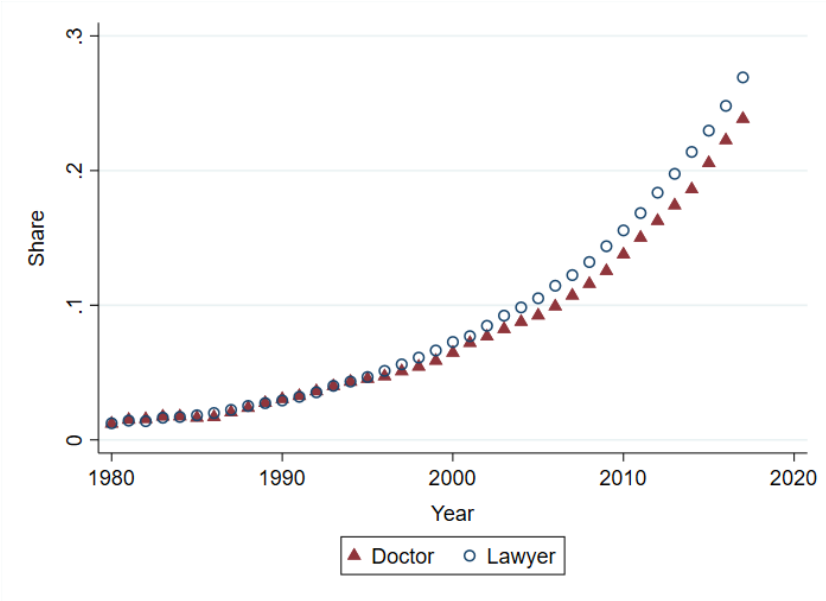
Results from lottery design (2/2)

For **younger individuals**, access to informal health-related expertise through a family member who is a medical doctor:

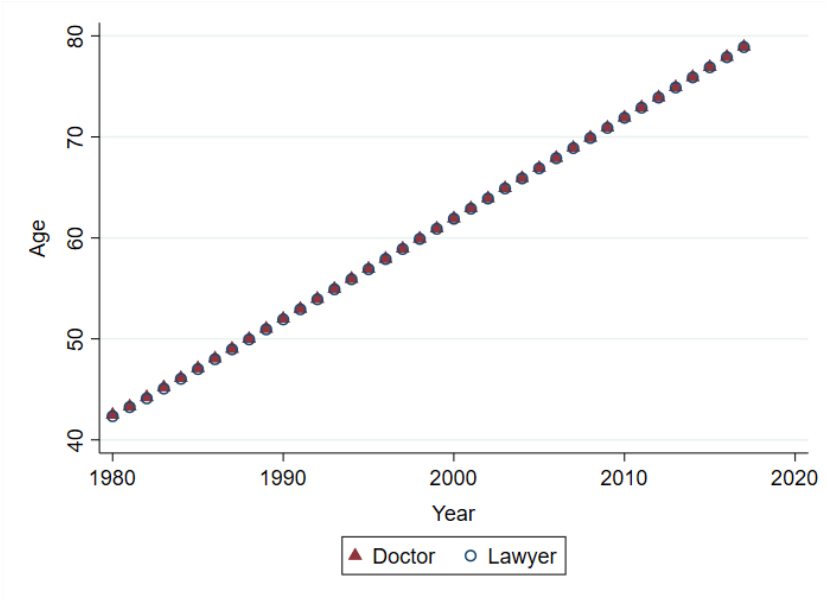
- Raises preventive health investments
  - Having a relative matriculate into medicine raises the likelihood of HPV vaccination
- Improves physical health
  - Fewer hospital admissions

Long-run health bonus: mortality (raw data)

(a) Cumulative mortality



(b) Average age



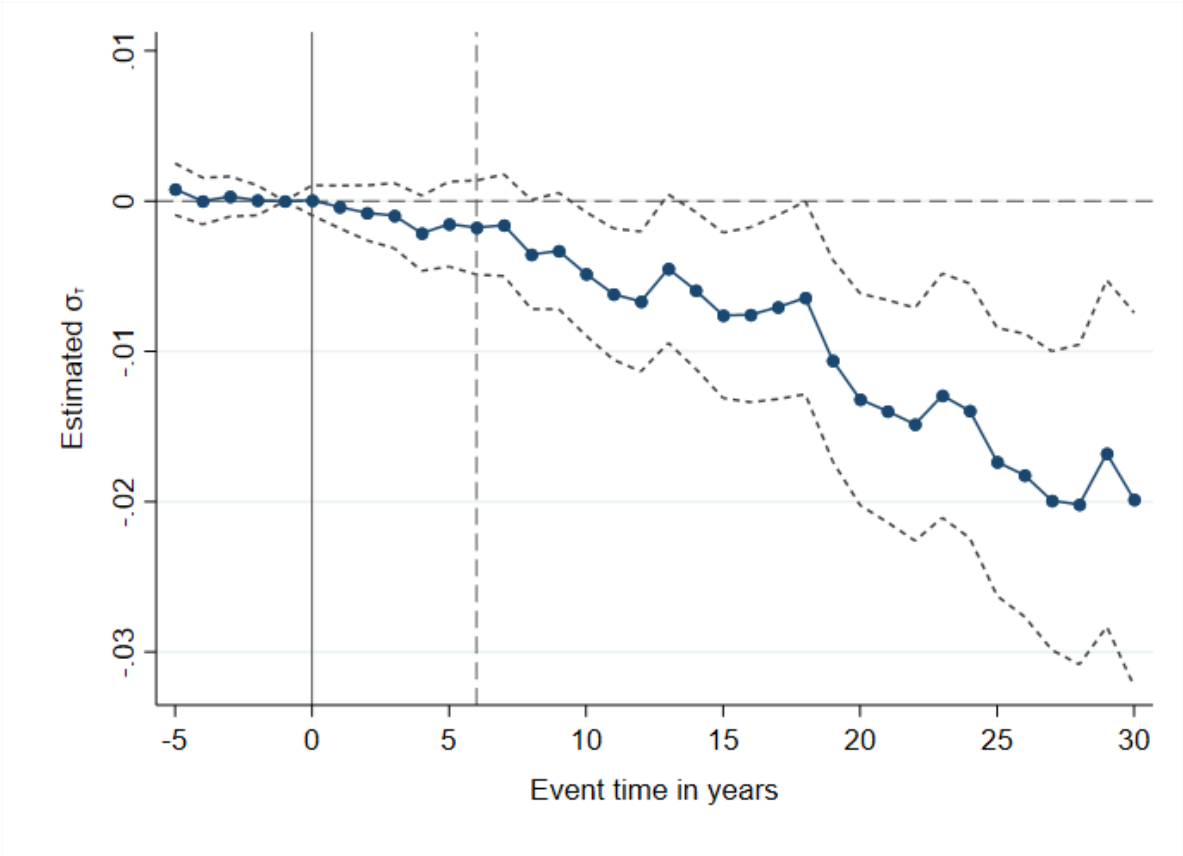
Sample: individuals born in Sweden between 1936 to 1940 who have at least one child with a medical or law degree. We exclude individuals who are health professionals themselves (either a doctor or a nurse) or who have a health professional spouse.

1995 (ages 55-60): difference in mortality trend emerges between lawyer-parents and doctor-parents: parents of doctors are dying at a slower rate than parents of lawyers.

By 2017: 243 per 1,000 lawyer-parents have died; 208 per 1,000 doctor-parents. Diff: 35 per 1,000 lives (14%) statistically significant at less than 1% level.

Event study results: mortality

Figure: Parents of individuals that become MDs vs. lawyers

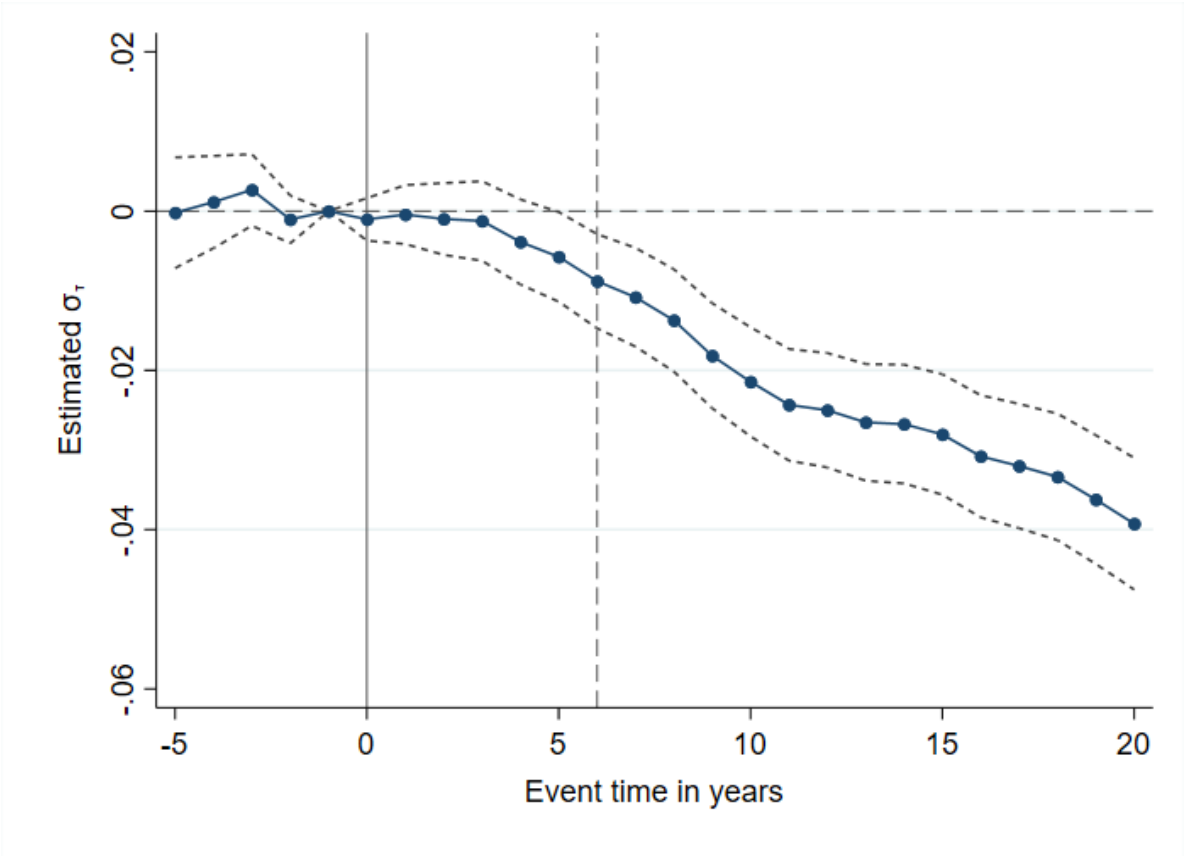


Slow-down in the relative mortality rate of MDs' family members emerge around $\tau = 8$

Mean among lawyers at event year 25: 0.17. Estimate suggests parents of doctors are **10** percent less likely to have died 25 years out.

▸ Income Distribution of Event Study Sample

Long-run health bonus: lifestyle-related conditions



Having a family member matriculated in medical school significantly reduces the long-run incidence of common chronic conditions that are frequently associated with lifestyle causes (type II diabetes, heart attack, heart failure, and lung cancer).

(Type II diabetes: 1 ppt decline at event year 15, relative to lawyer mean of 0.04.)

▸ Heart attack ▸ Heart failure ▸ Type II diabtes ▸ Lung cancer

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Interpreting findings

- Three distinct channels through which HPs can be improving health of family members:
  1. Income effects (Ketel et al., 2016) ▸ No evidence in our setting
  2. "Social capital" - get relatives faster and better care
  3. "Information and reminders"- can transmit info, improve understanding of info, nag about health behaviors, remind to take drugs or get vaccinated, ...
- Policy can only imitate intra-family experitise that leads to **scalable** behaviors
- Hence the policy-relevant question is: Does an "information / reminders / nagging" channel exist? Or is this only capturing "getting ahead in the line"?

Evidence supporting "information / reminders" channel

- Strongest impacts are on (i) heart disease; (ii) adherence to heart medication for adults; (iii) immunizations for adolescents and (iv) smoking during pregnancy
  - Lifestyle-related
  - "Low-tech" and cheap preventives
  - $\Rightarrow$ **Points to knowledge and nagging rather than preferential access!**
- Nb: this does not rule out an access channel – it simply says that there are effects on outcomes that very likely do **not** reflect access – and, hence, that may be scalable!

Scaling the effects? (1/2)

- Suppose that we could "scale up" and give everyone in society access to expertise
- We can use our estimates to calculate **what would happen to health inequality** in this hypothetical scenario
- Calculation suggests: could close as much as 18 percent of existing SES-health gap
  - Intuition: folks at lower end of SES spectrum have less access to expertise to start with
- But: We cannot give everyone access to a health professional in the family!

Scaling the effects? (2/2)

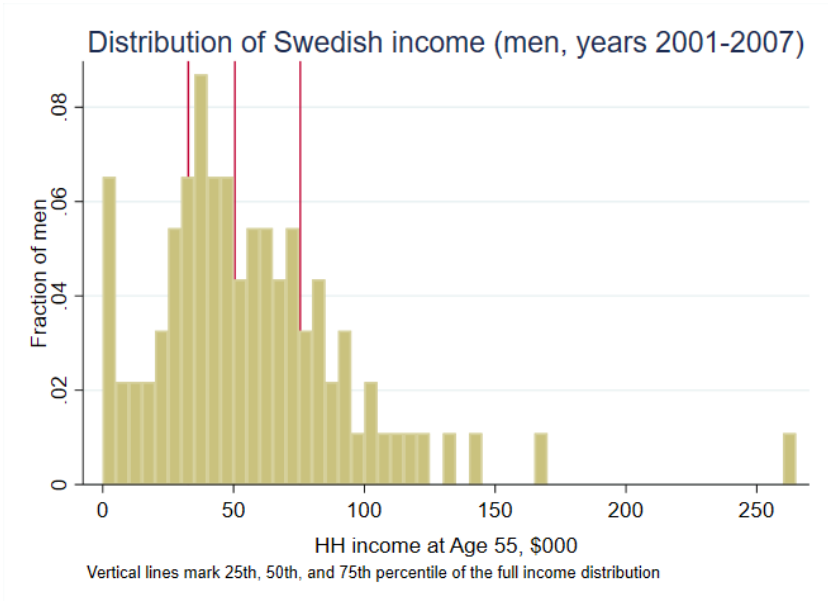
- In reality, our ability to reap these gains depend on the possibility to design policy that actually mimics what goes on inside families with health professionals!
- Features of intra-family transmission of expertise:
  - Same "provider" of expertise over time
  - Detailed knowledge of medical history and of ongoing treatments (knows when to remind, etc.)
  - Trust, social pressure, ...
  - High availability
- Our work suggests that an important question is whether, and how, policy can mimic (some of!) these.

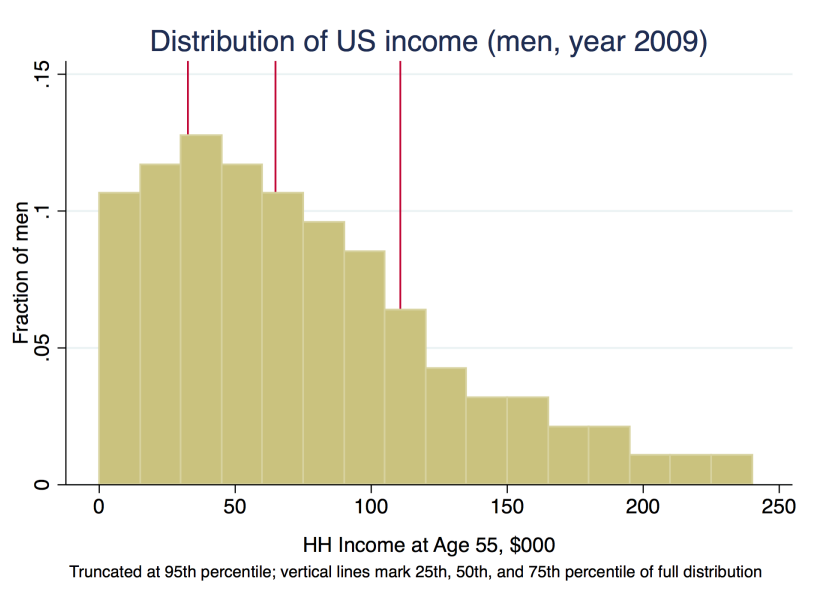
Conclusion

1. Sweden displays strong SES gradients in mortality and health - *despite equalized formal access and a wide safety net*
2. Having a health professional in the family improves physical health and preventive investments throughout the life-cycle
    - Simple, scalable, preventive investments are an important channel: drug adherence, vaccinations, prevention of diabetes, not smoking during pregnancy
3. Public health policies that imitate intra-family expertise could close a meaningful share of the health-SES gap

Appendix

Income distribution in the US vs. Sweden





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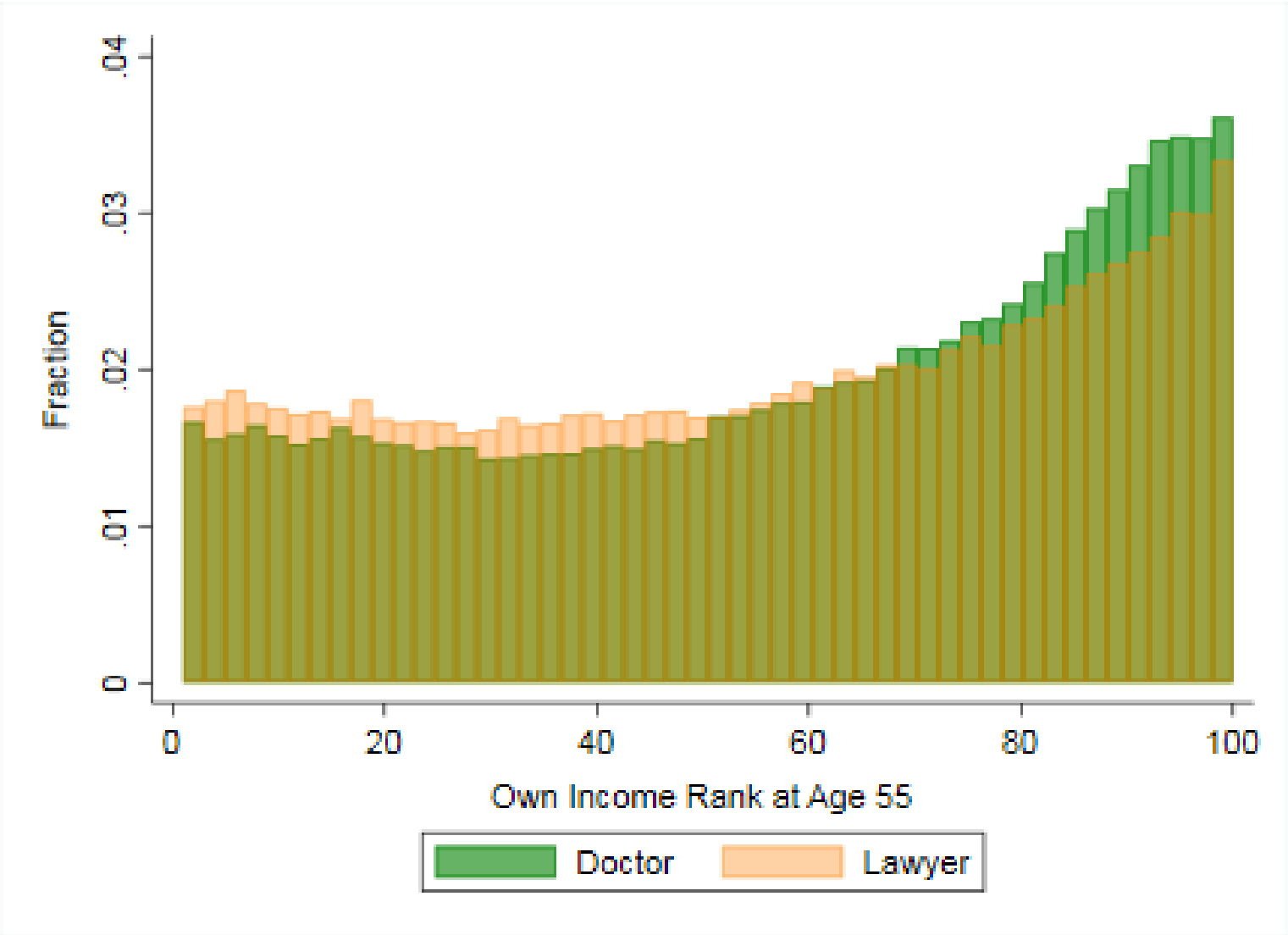
Income Distribution of Event Study Sample



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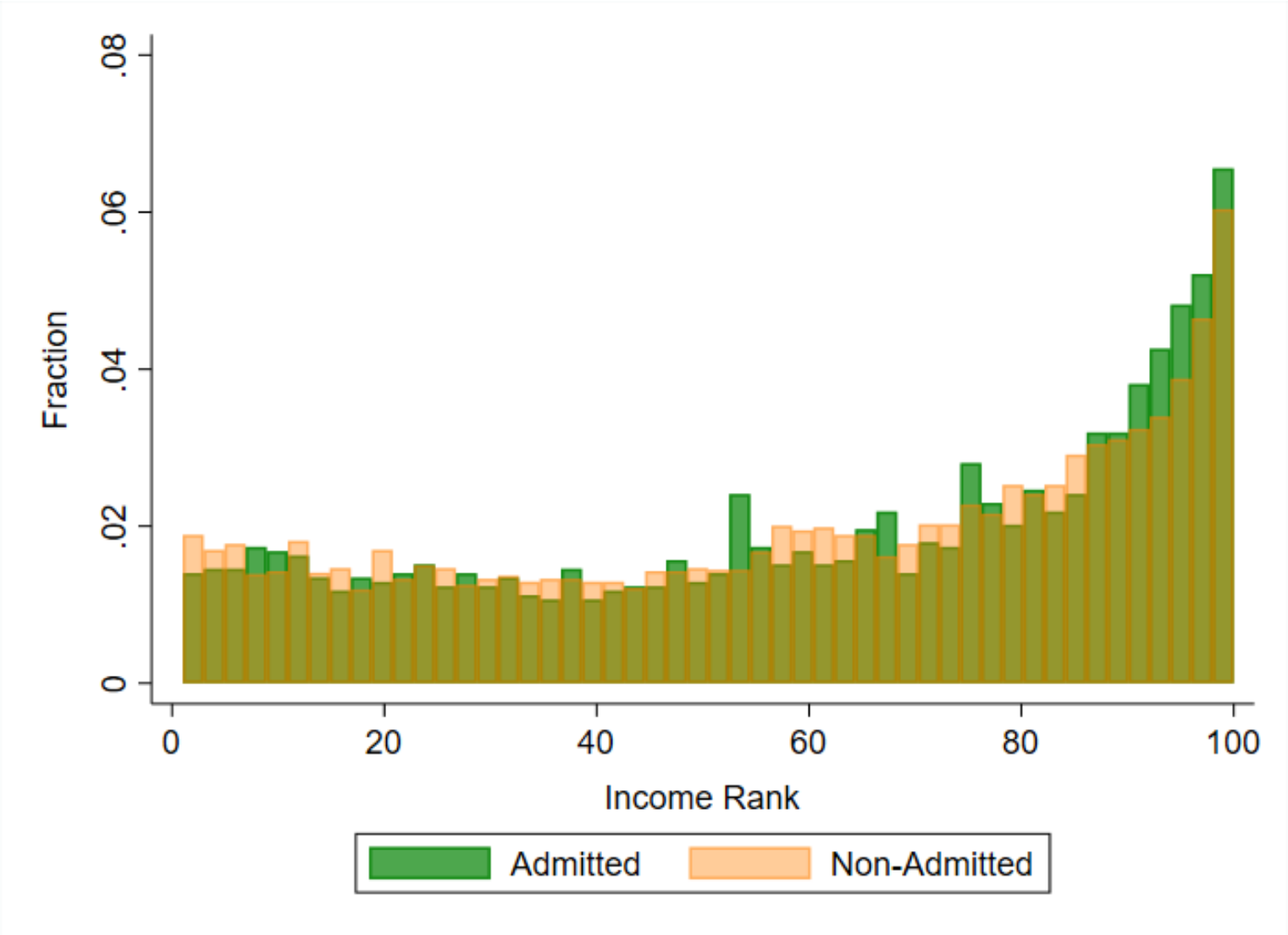
Income Distribution of 2SLS Sample



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Treatment conditional on heart attack

	More vs. Less Invasive		Procedure vs. none	
	(1) No Control	(2) Full Control	(3) No Control	(4) Full Control
Health professional kid	0.002	0.000	0.023***	-0.007
	[0.004]	[0.004]	[0.007]	[0.006]
Mean, Dep. Var	0.01	0.01	0.22	0.22
S.D. Dep. Var	0.12	0.12	0.42	0.42
R-Squared	0.000	0.062	0.000	0.331
Obs	17,186	17,186	77,256	77,256

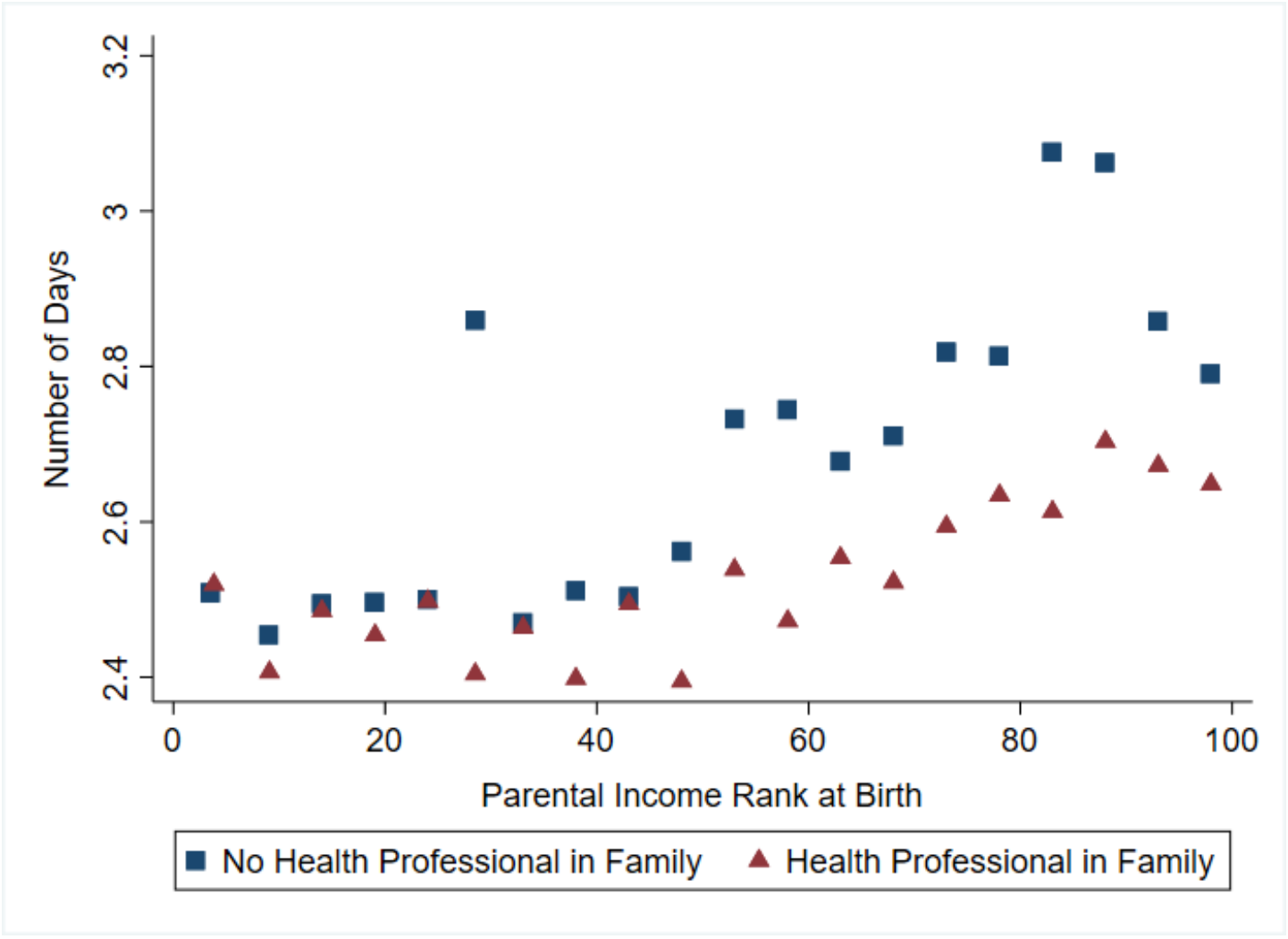
Sample restricted to individuals with first occurrence of heart attack and born between 1936-1961. Standard errors clustered by family. The set of full controls include: income percentile at age 55 FE, gender FE, birth year FE, municipality of residence in the year of the first heart attack FE, maximum education FE, and FE for age at the first heart attack. ▸ Back

Length between first breast cancer diagnosis and surgery

	Kid Health Prof.		Daughter Health Prof.	
	(1) No Control	(2) Full Control	(3) No Control	(4) Full Control
Health professional	-13.150**	-7.223	-17.940***	-11.729*
	[6.553]	[6.577]	[6.527]	[6.614]
Mean, Dep. Var	62.08	62.08	61.97	61.97
S.D. Dep. Var	367.01	367.01	366.32	366.32
R-Squared	0.000	0.038	0.000	0.038
Obs	36,765	36,765	36,309	36,309

Breast cancer surgery refers to mastectomy or lumpectomy. Sample restricted to female breast cancer patients born between 1936-1961. Standard errors clustered by family. The set of full controls include: income percentile at age 55 FE, gender FE, birth year FE, municipality of residence in the year of the surgery, maximum education FE, and type of surgery underwent (mastectomy vs. lumpectomy). Back

Number of postpartum hospital days



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Income effects of medical school matriculation

	(1) No Control	(2) Control
Matriculated	451.607 [325.375]	472.530 [385.826]
Mean dep. var	3952.16	3952.16
S.D. dep. var	1657.28	1657.28
Obs	487	487

Table reports 2SLS estimation results for applicants whose last medical school application attempt is in 2009 or before. Income is measured as income in year 2016. Robust standard errors. Controls in column 2 include: birth year fixed effects, gender, and a dummy that equals one if the applicant is born in Sweden. Back

Income effects

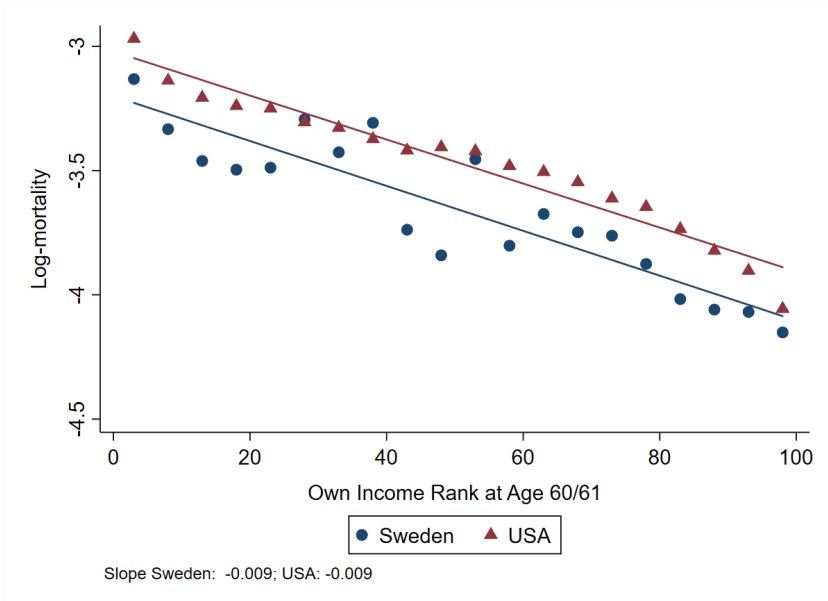
- Concern: do families that "win" a physician merely become richer relative to families that loose the MD lottery?
- Several pieces of evidence suggest results not driven by income effects
  - No income gains to "winning" the medical school lottery
    ▸ Income Impacts of Medical School Matriculation
  - Many relatives we look at do not live in the same household as the HP and so are not directly exposed to physician's HH income
  - Similarly, given Swedish institutional environment, elderly individuals not directly exposed to physician's HH income, as likely to live separately

▸ Back1 ▸ Back2

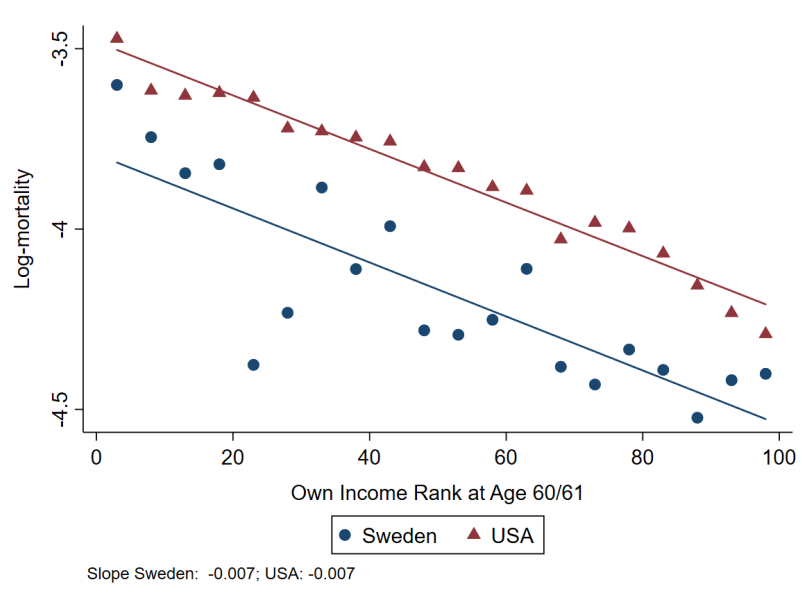
Gradient in mortality: comparison to the US

- Figures plot 1-year log mortality against own income rank in each country.
- Use combination of age at death and age of income measurement for which we can construct estimates that can be directly compared to those reported for the U.S. in Chetty et al. (2016).
- Income measure: positive Adjusted Gross Income (AGI). Also includes capital-based income and non-disability government transfers.
- Sweden has a lower mortality *level*, but we **cannot reject identical gradients**.

(a) Mortality at Age 75, Men



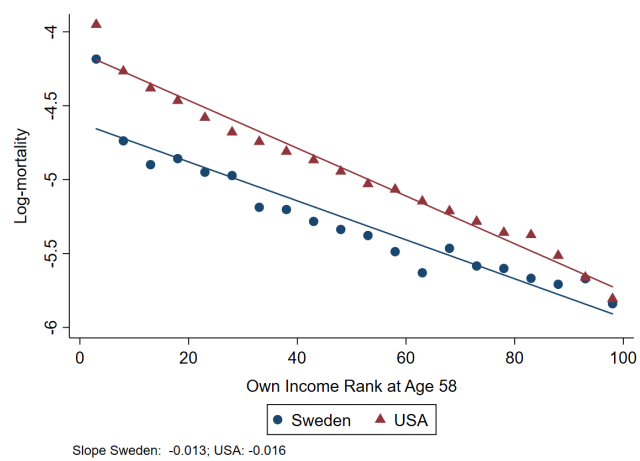
(b) Mortality at age 75, Women



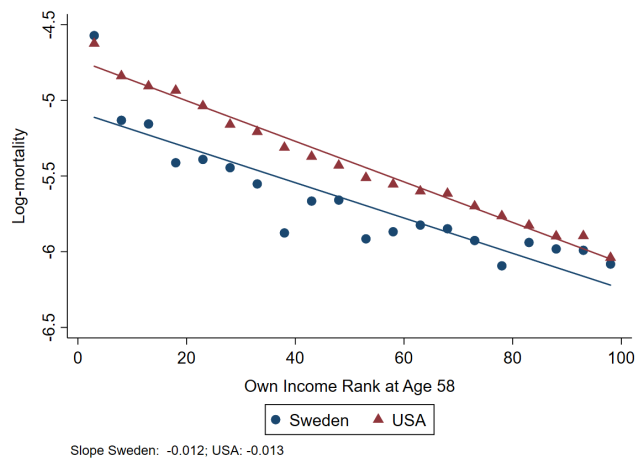
▸ Gradient at earlier ages ▸ Income distribution ▸ Back

Gradient in mortality: comparison to the US

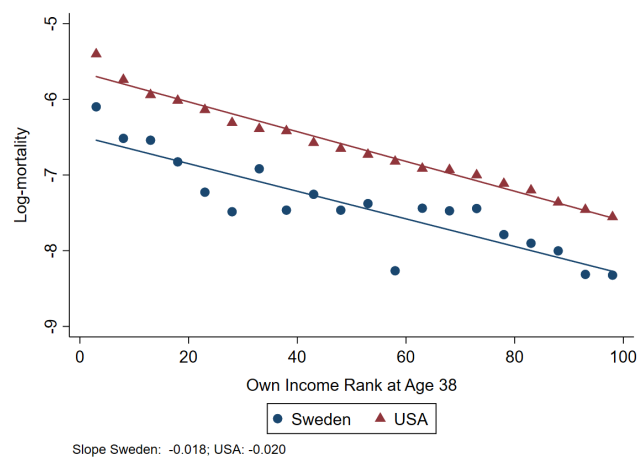
(a) Mortality at Age 60, Men



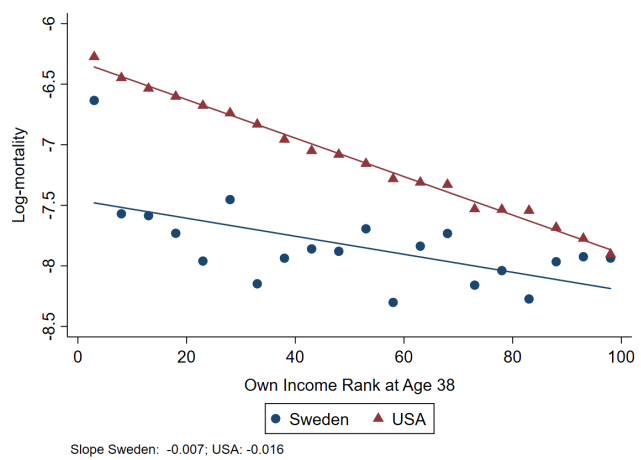
(b) Mortality at Age 60, Women



(c) Mortality at Age 40, Men



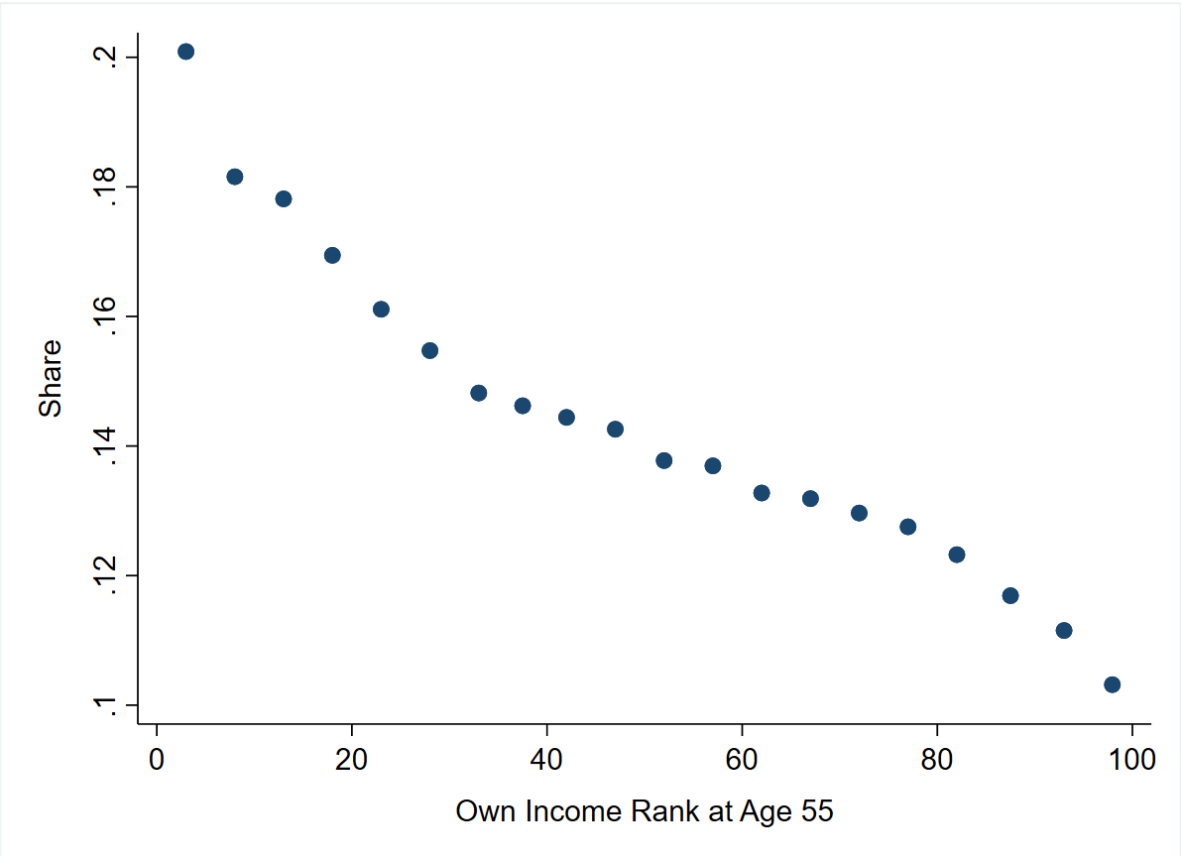
(d) Mortality at Age 40, Women



Back

Gradient in morbidity at older ages

Figure: Lifestyle-related diseases

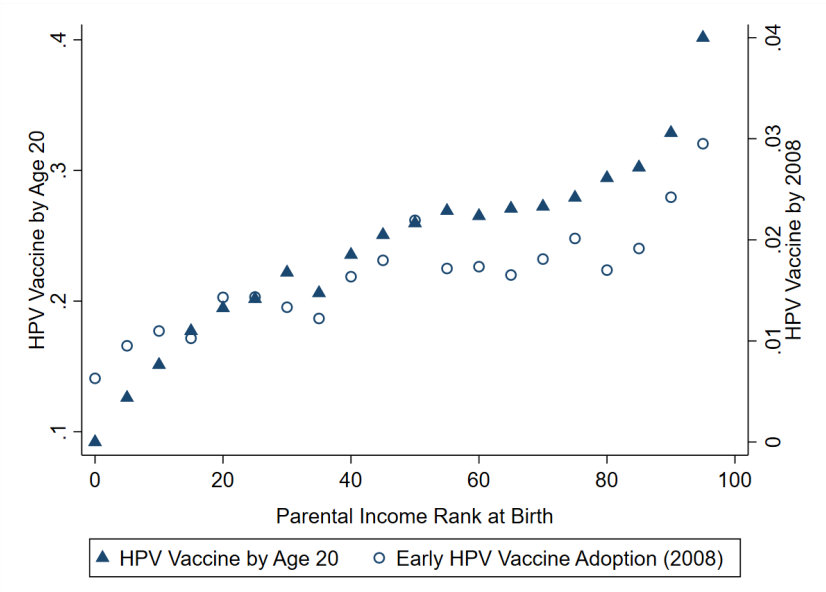


Diseases include type II diabetes, heart attack, heart failure, and lung cancer.

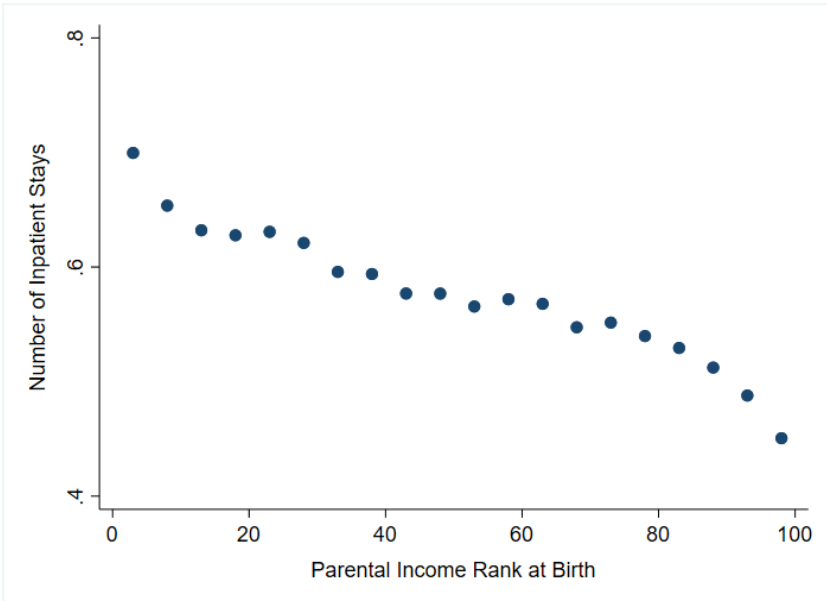
Back

Gradient in health at younger ages

(a) HPV Vaccine, by Age 20



(b) Number of Inpatient Stays, Age 0-5



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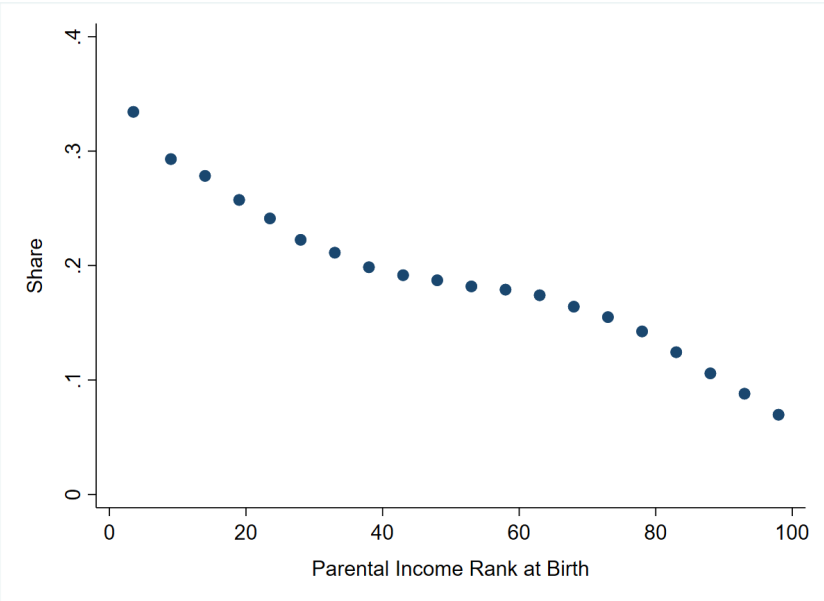
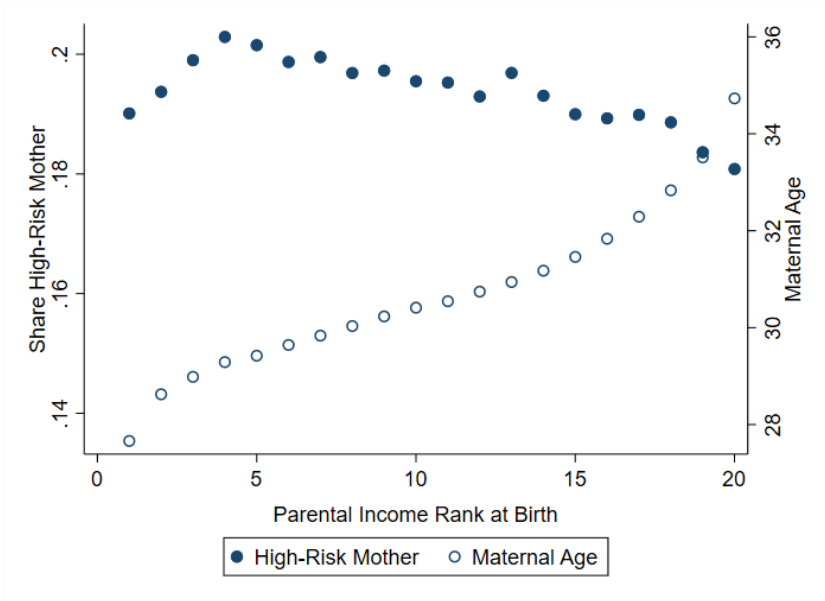
Gradient in health at birth

(a) Tobacco exposure, in-utero



(b) Maternal Age/High-Risk Mother



A high-risk mother is defined as whether the mother has any of the following conditions during pregnancy: chronic kidney diseases, diabetes, epilepsy, lung diseases, systemic lupus erythematosus (SLE), ulcerative colitis, hypertension, or urinary tract infections.

▸ Back

Exposure to a health professional in family

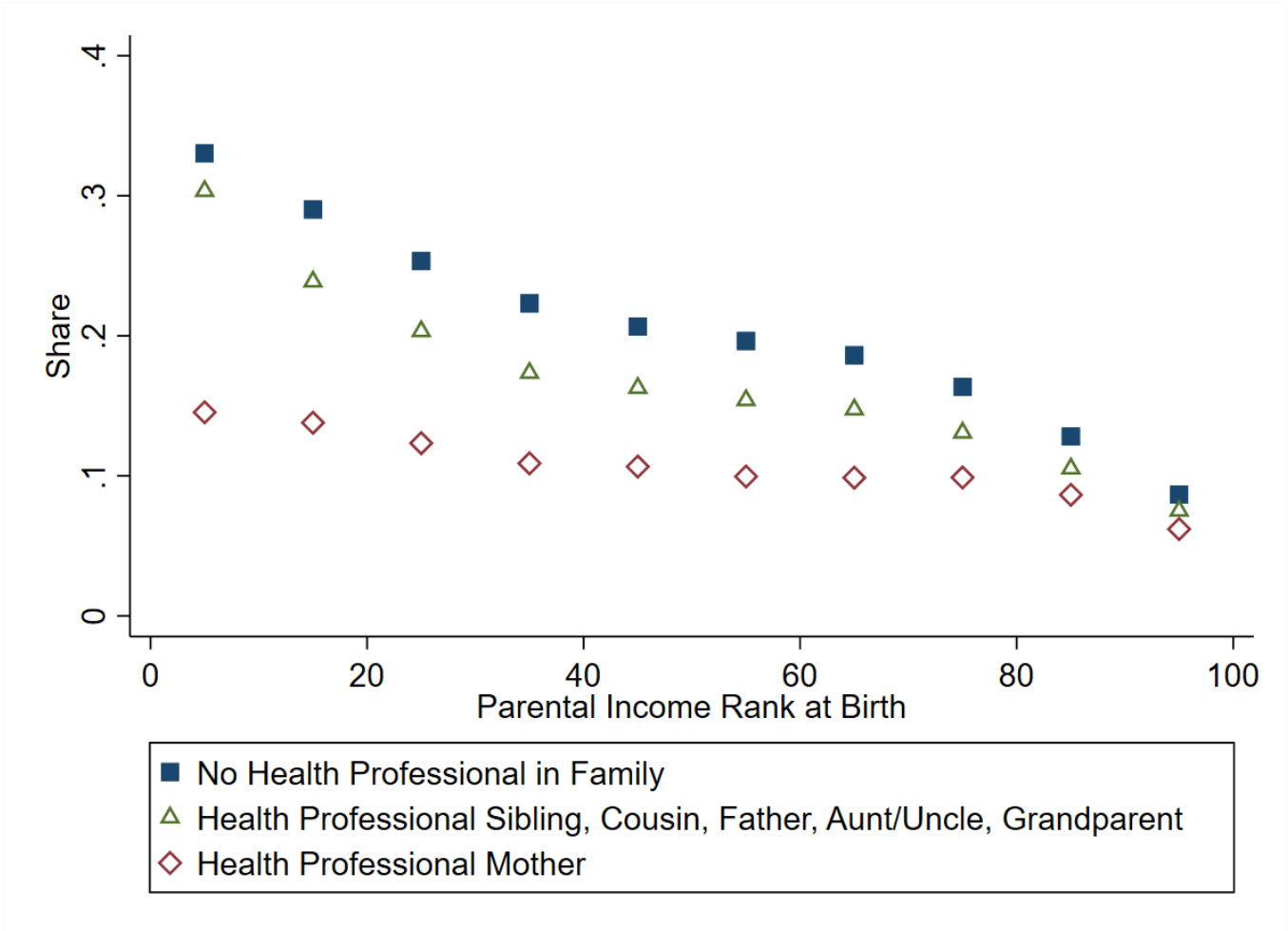
Figure: Share of population with a doctor or nurse family member

Notes: Sample: 1936-1937 cohorts. Family members include spouse, sibling, cousin, child, child-in-law, niece/nephew, and grandchild.

▸ Back

Tobacco exposure *in utero*: finer relative division

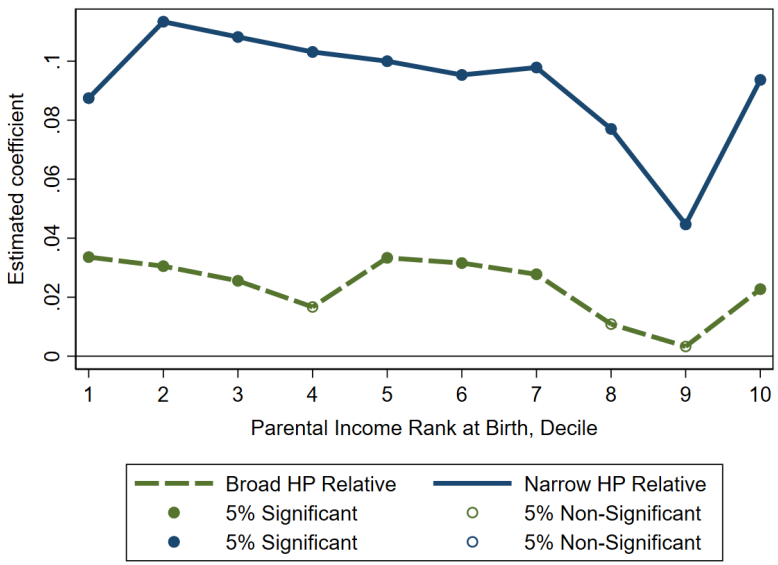
Figure: Tobacco exposure *in utero*



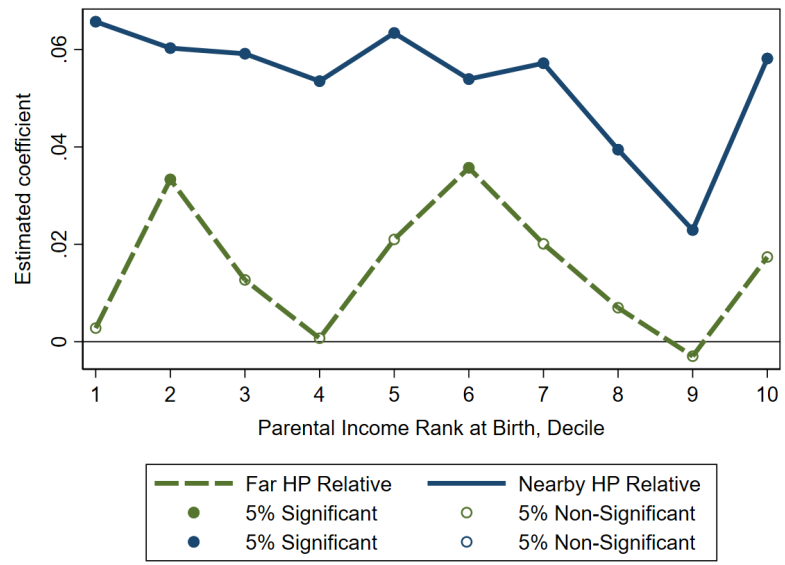
▸ Back

HPV Vaccination

(a) HPV Vaccination, by Age 20



(b) HPV Vaccination, by Age 20



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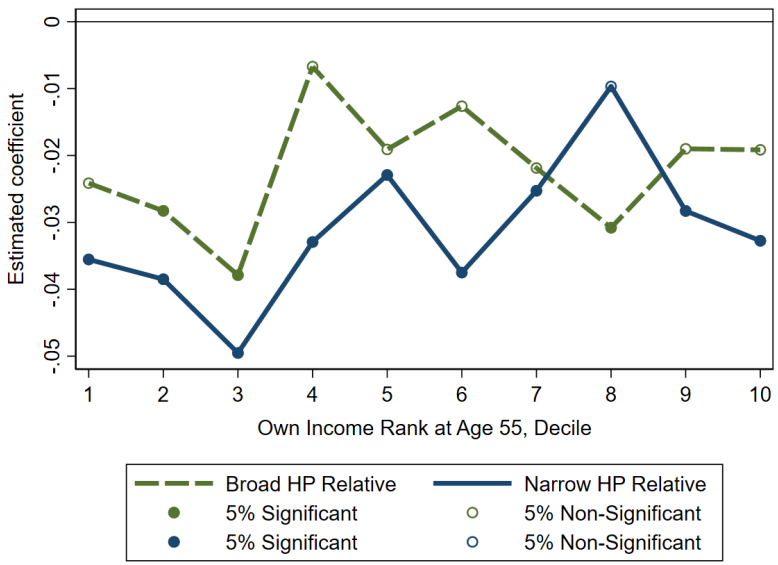
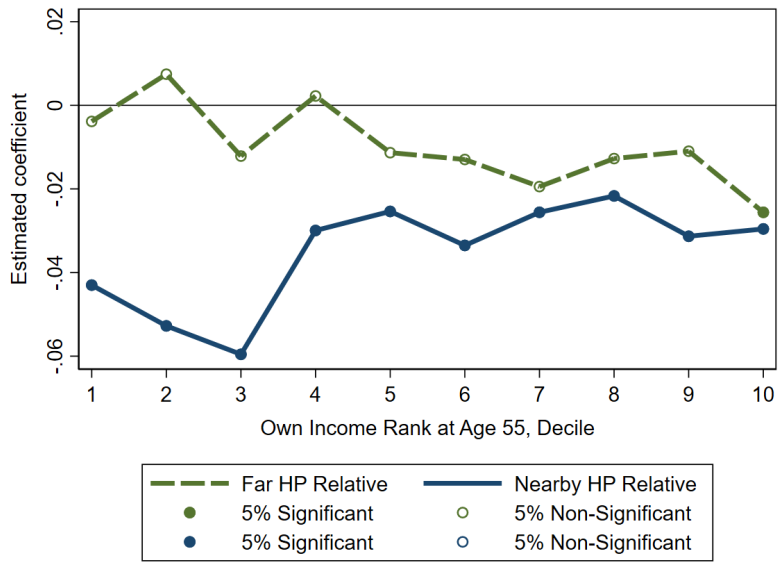
Mortality

(a) Died by Age 80



(b) Died by Age 80



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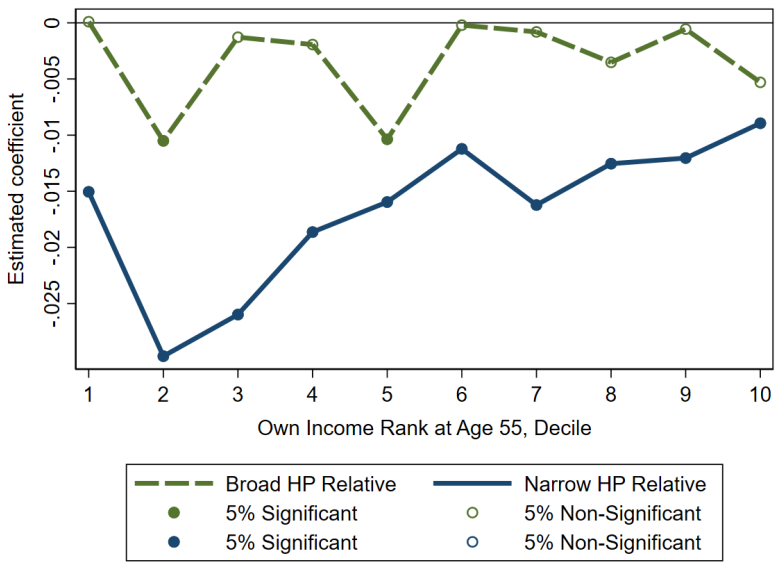
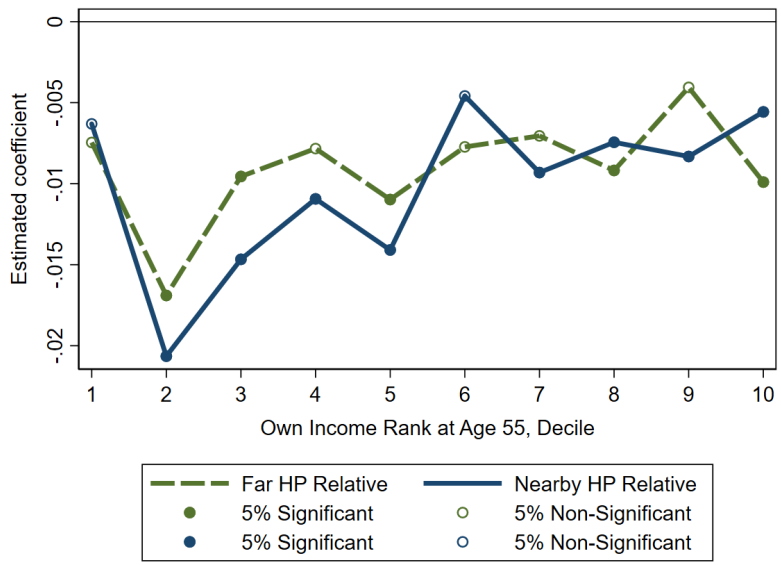
Life-style related diseases

(a) Lifestyle-Related Conditions, Age 55+



(b) Lifestyle-Related Conditions, Age 55+



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Distribution of expertise at baseline

(a) Distribution of health expertise

	Prefer Seeing Same Doctor (1)	Believe Doctor Always Tells Truth (2)	Regular Vegetables (3)	Regular Fruit (4)	Regular Sport (5)	Not Smoking (6)	Good Health (7)
No College Degree	0.06	-0.07	-0.19	-0.16	-0.06	-0.14	-0.06
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
No. of Obs.	927	927	738	738	738	738	927
Mean of Dep. Var.	0.70	0.28	0.77	0.55	0.56	0.84	0.76
Std. Dev. of Dep. Var.	0.46	0.45	0.42	0.50	0.50	0.36	0.43
Age Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Weights Used	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year	2004	2004	2014	2014	2014	2014	2004

(b) Share older adults with $\geq$ college

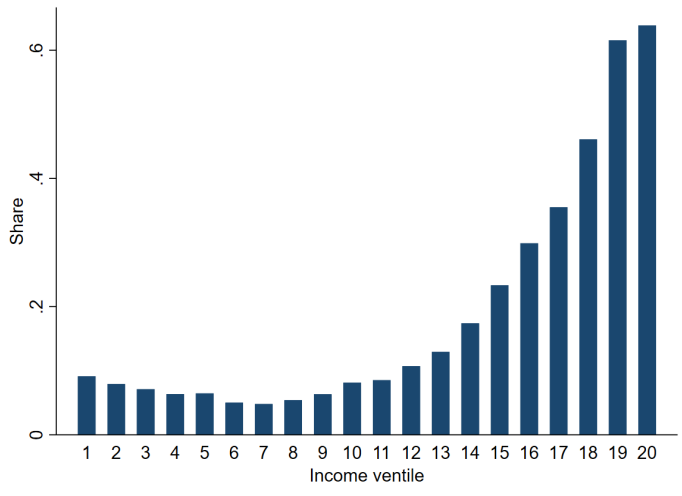

Table (a) reports OLS relationship between the level of education and health-related behaviors. The analysis is based on the 2004 and 2014 waves of the European Social Survey for Sweden.

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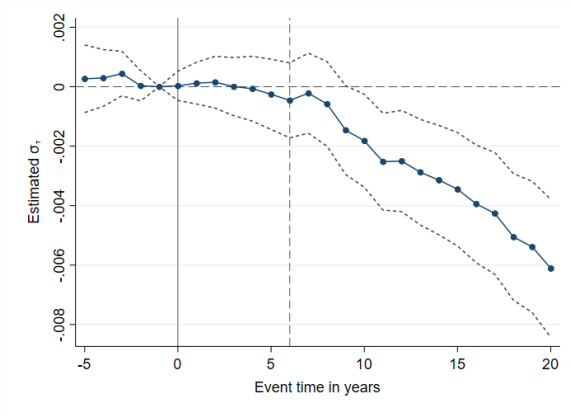
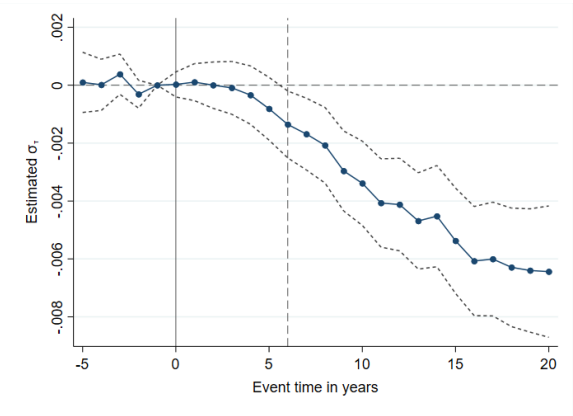
Long-run health bonus: lifestyle-related conditions

Figure: Doctor in the Family and Long-Run Health Bonus: Event Studies

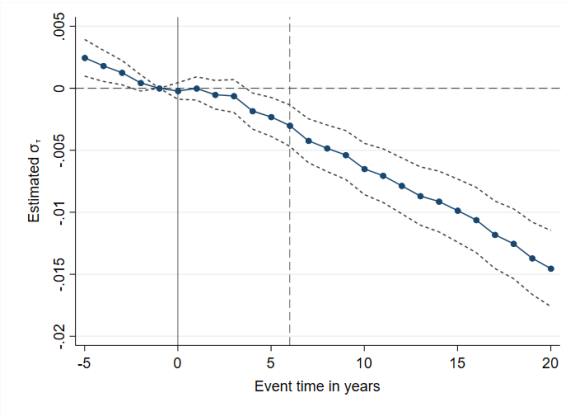
(a) Heart Attack



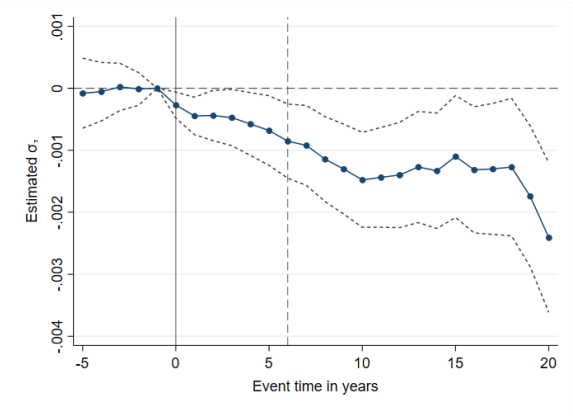
(b) Heart Failure



(c) Type II Diabetes



(d) Lung Cancer



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Definition

For tobacco exposure in utero:

- A **broad** family tie is defined as having a health professional who is a sibling, cousin, aunt/uncle, or grandparent. A **narrow** family tie is defined as having a health professional who is a parent.
- A child is defined to have a **nearby** health professional relative if in the year of birth, a health professional relative lived in the same county as the mother, and defined to have a **far** health professional if the health professional relative lived in a county different from the mother's in the year the child was born.

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Controls

When outcome is drug purchase, we control for having any condition that may warrant the need for this medication. In addition to the controls that we include to improve precision, the subset of regressions where the outcome captures individuals drug purchases also includes controls for the presence of asthma, type II diabetes, heart failure, ischemic heart diseases, stroke, hyperlipidemia, and hypertension

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Controls in 2SLS

- $x_{j(i)}$: Family member's birth year fixed effects, gender, educational attainment, family tie fixed effects (e.g., sibling, parent), and whether the family member was born in Sweden.
- In regressions using statins, blood thinners, diabetes drugs, beta blockers, and asthma drugs as the outcome, $x_{j(i)}$ also includes controls for relevant chronic conditions that may warrant the need for this medication: dummies for whether the family member has asthma, type II diabetes, heart failure, ischemic heart diseases, stroke, hyperlipidemia, or hypertension.
- X_i: The applicant's birth year fixed effects and gender, whether the applicant was born in Sweden, and the number of medical schools that the applicant applied to in the first application cycle.

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