EUI DEPARTMENT OF POLITICAL AND SOCIAL SCIENCES

Perinatal health and education: individual and population level relevance

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Introduction

- A now large literature has analysed the long-term effects of perinatal health on socioeconomic and health outcomes
  - Relatively recent; In 1999, James P. Smith (JEL) wrote about ”new theories” of the role childhood health, and ”even intrauterine factors”, for socioeconomic outcomes
  - Focus on prenatal period well with the emphasis on the crucial role of early life in human capital formation (Heckman et al)

- This literature typically finds that prenatal health problems have persistent influences
  - By extension, their importance at the population-level is implied
  - Because prenatal health is socially stratified, it can also explain social mobility

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Introduction

- Despite its intuitive appeal, we know little of the population-level relevance of perinatal health

- Two limitations of the previous literature:
  1) Focus on limited indicators of perinatal health (typically, birth weight), or relatively rare natural or man-made disasters or exposure
  2) Lack of explicit assessment of how much of socioeconomic attainment (or inequalities therein) can be attributed to perinatal health

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Contribution

- We estimate the effects of common perinatal health indicators on educational attainment using sibling fixed effects models on Finnish population registers

- We also estimate the population-level relevance of these effects on educational attainment
  - Population attributable fractions (PAF)

- We find that perinatal health has limited population-level relevance on education

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Previous studies

- Studies using direct measures of perinatal health have focused on birth outcomes and in particular, birth weight

- Though used as a ”global” measure, does not capture everything
  - Preterm births and gestational growth partly separate etiologies, other prenatal conditions may have independent effects

- Other studies have used disasters (earthquakes, pandemics, terrorism, Chernobyl) as natural experiments
  - High internal validity, external validity unclear

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Our study

- We analyze the effects of common perinatal health indicators
  - Smoking in pregnancy (SIP)
  - Anemia
  - Gestational hypertension and pre-eclampsia
  - Low birth weight, and its two components
    - Intrauterine growth restriction
    - Prematurity
- Clinical relevance: regularly monitored and registered in prenatal screenings

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Data

- Finnish Medical Birth Register combined with other population registers
- Cohorts born in 1987-89, who were 29-31 at last measurement
- N=180,813, with a sibling sample of 33,793 siblings in 16,816 families

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Variables

- Outcome: Educational attainment
  - Completion of a secondary degree
  - Completion of a tertiary degree
- Birth outcome measures: low birth weight (<2,500g), and small-for-gestational age (<2 SD) and preterm birth (<37th full week)
- Smoking: non-smokers, smokers, heavy smokers (>=10 / day)
- Hypertension: >140/90 mmHg, pre-eclampsia: + proteinurea
- Anemia: hemoglobin <110 mg/l
- Controls: birth month, birth order, mum's age, area of living, parental education, mother's relationship status

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Sibling fixed effects (SFE)

- We use SFE as our preferred model, as it controls for variables shared by the siblings
  - In addition, we estimate random effects (multilevel) models
  - Linear probability models in both cases

- With and without adjustments for other perinatal indicators that may confound the estimate of interest
  - All models include the sociodemographic controls

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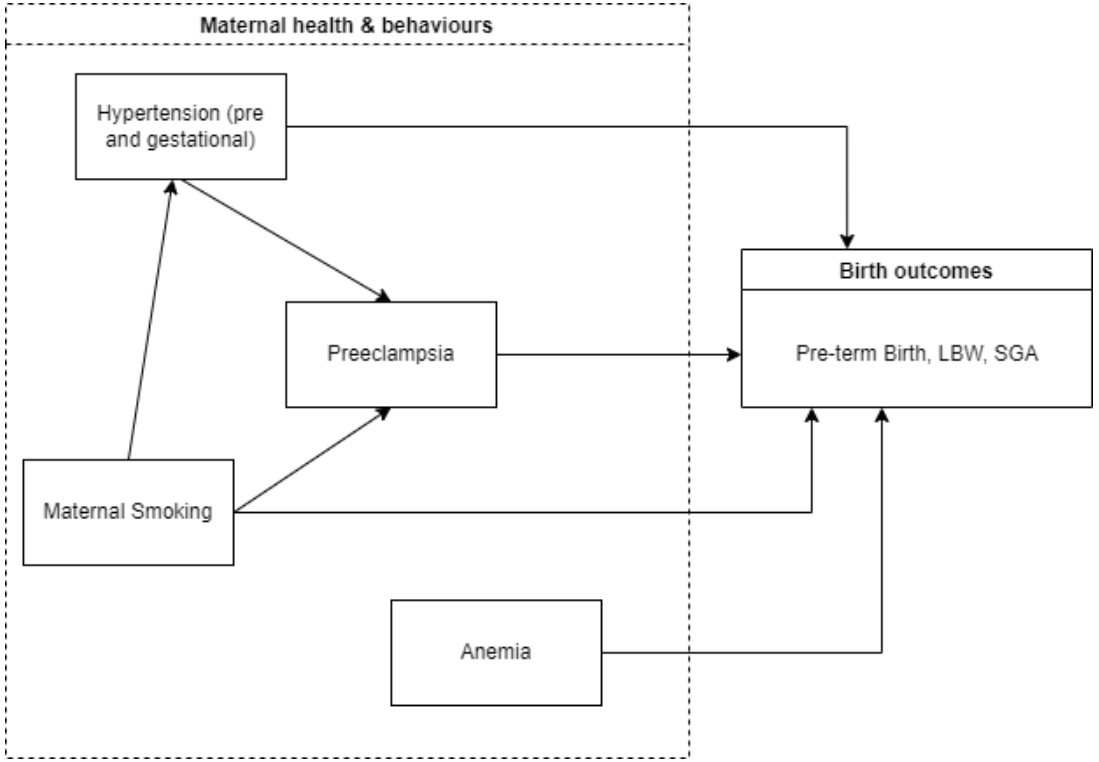
Control strategy



- SIP: demographic controls
- Anemia: demographic
- Hypertension: + SIP
- Pre-eclamspai: + hypertension
- Birth outcomes: + pre-eclampsia + anemia

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Population attributable fractions

- Attributable fractions (AF) used in epidemiology to assess what fraction of the outcomes (”cases”) attributable to exposure
- Population attributable fractions (PAF) tell what fraction of cases at the population level attributable to exposure

$$\bullet \; PAF = \frac{P(Y=1|D=1,X) - P(Y=1|D=0,X)}{P(Y=1|D=1,X)} \times P(D=1) =$$

$$= \frac{Effect}{P(Outcome)_{exposed}} \times P(exposed)$$

- ”How many more would attain a certain education in absence of exposure?”

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Key descriptives (%)

At least secondary degree	87%
Tertiary degree	39%
Anemia	6%
Smoking <10 cigs/day	10%
Smoking >=10 cigs/day	5%
Hypertension: pre-gestational	1%
Hypertension: gestational	2%
Hypertension: pre-eclampsia	3%
Low birth weight	3%
Preterm birth	5%
Small for gestational age	3%

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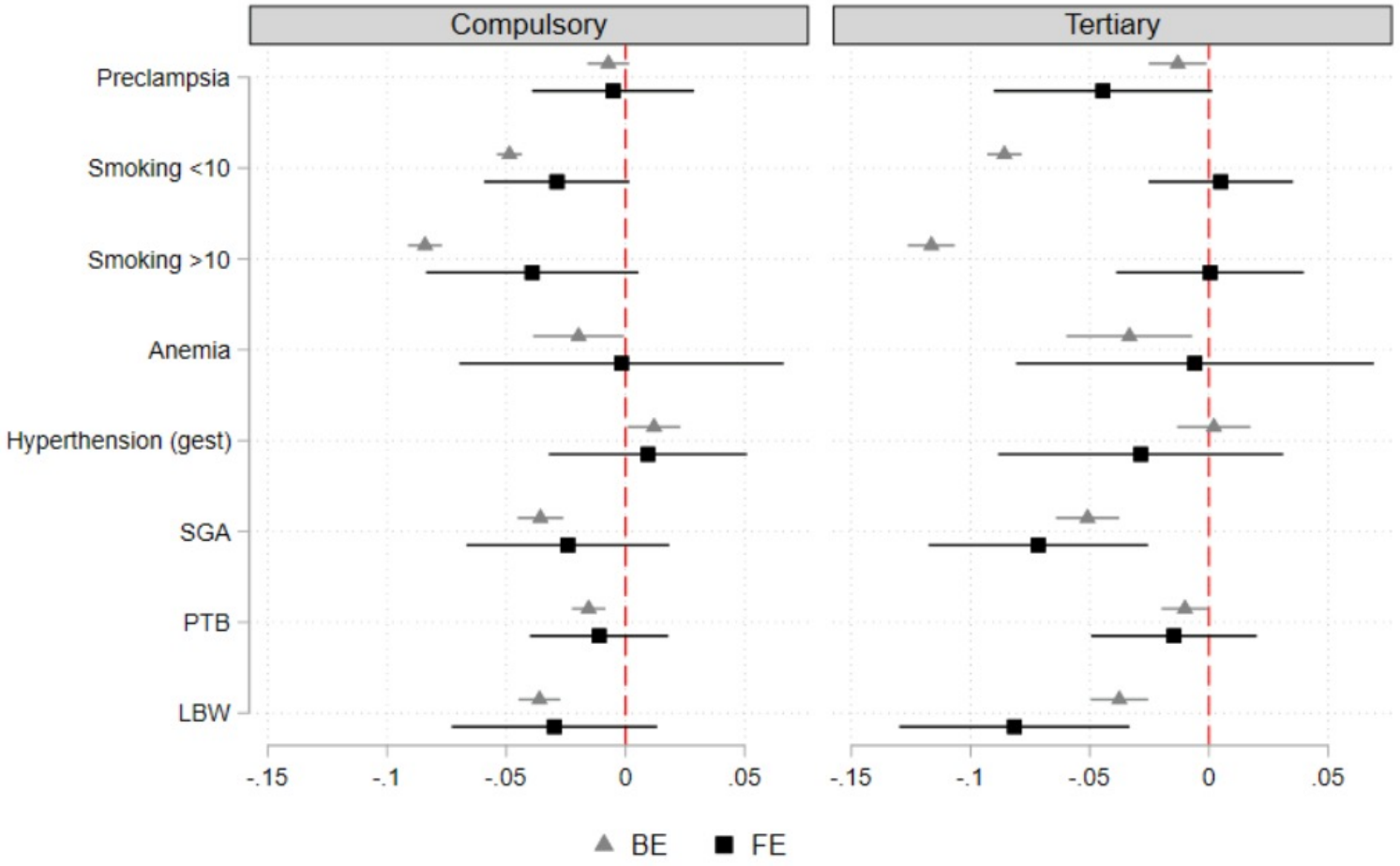
Results



Estimates obtained from adjusted models

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Results: Population attributable fractions

- Based on the SFE models for tertiary degree completion
  - PAF for both SGA and LBW is 0.5
  - This indicates that in the absence of SGA and LBW, the population with tertiary degrees would be 0.5% higher

- Based on the RE models (upper bound)
  - Tertiary degree: PAFs for the two smoking variables are both 3.3
  - All other PAFs are <1

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Conclusions

- We analyzed the effects of a range of common and clinically relevant perinatal health conditions on educational attainment in Finland

- Prenatal health has a limited effect on educational attainment: the effects are mostly confined to prenatal growth restrictions (and gestational age)

- The population-level relevance of these prenatal health conditions is limited
  - At the individual level, perinatal health problems can hamper educational attainment, but these may not translate into major effects at the population level
  - Also suggests that perinatal health is not a major contributor to social mobility

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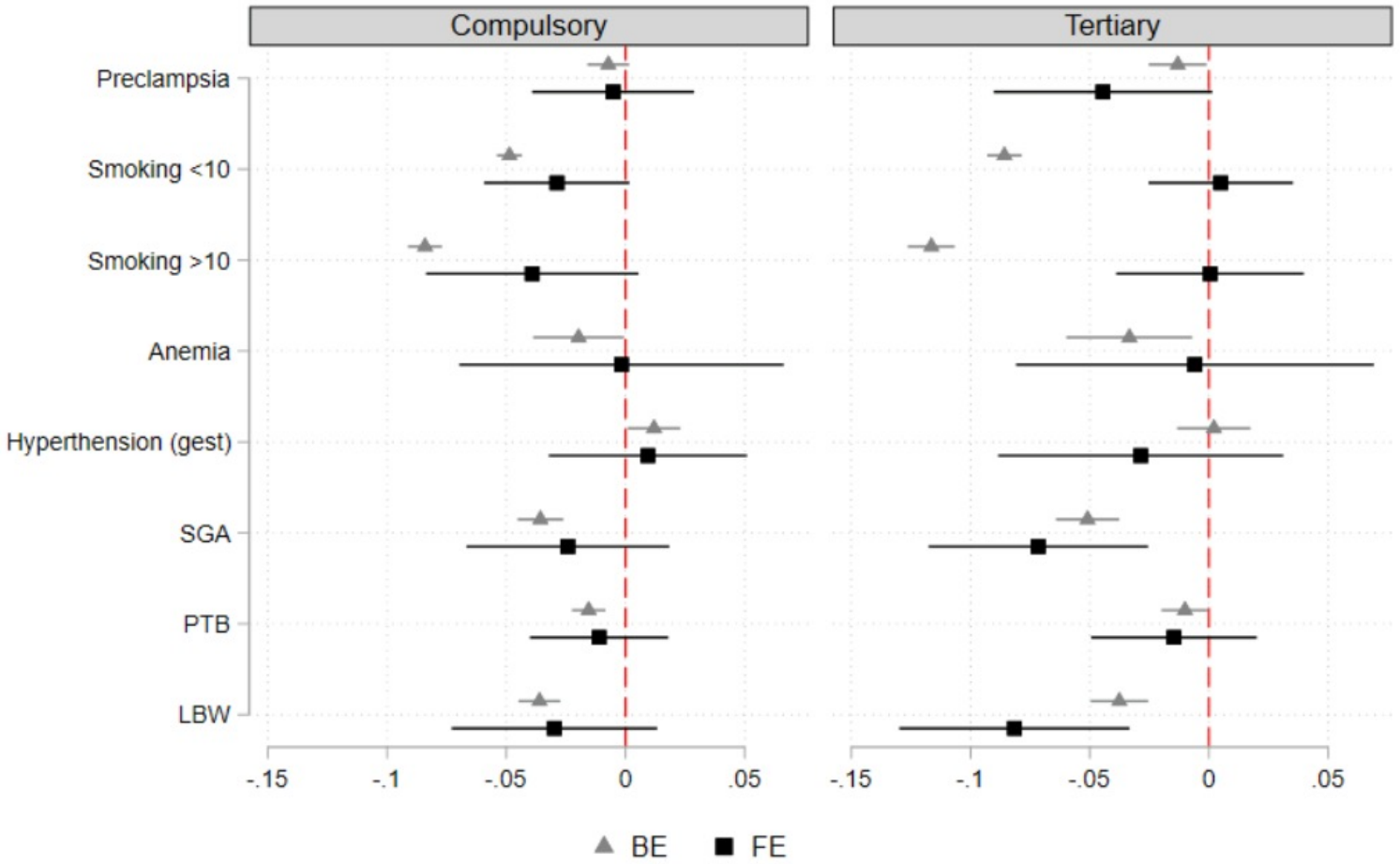

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Implications

- Two decades of research has found that perinatal health limitations can have important effects on the socioeconomic attainment of those experiencing them
  - Limited attention paid to population-level relevance either in the prevalence of the conditions analysed or aggregate level outcomes

- Too much emphasis on prenatal and early health?
  - Many (mental) health problems appear in late childhood and adolescence, which have gained less attention (Currie 2019: ”the missing middle”)
  - Mikkonen et al. (2018; 2020) estimated that (mental) health problems in adolescence have large individual-level as well as population-level (PAF up to 20-30% of school non-completion) effects

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Limitations

- We do not have data on all common and relevant prenatal conditions (e.g., alcohol use, maternal depression/anxiety)
- Sibling fixed effects models may control not only for shared confounders, but also shared mediators (Sjölander 2018), thus leading to overcontrol bias
- Sibling models do not account for non-shared confounders
- Siblings samples (esp. with three cohorts) can be selected, although sensitivity analyses suggested that this is not a major problem

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Sensitivity analyses

1) Add two more cohorts (1990 & 1991): birth outcome estimates statistically significant for secondary degrees

   (PTB: -0.028; SGA: -0.024; LBW: -0.041)

2) Larger thresholds for SGA (5% & 10%): effect sizes consistent

3) Replicate results for tertiary education, included those still enrolled: Results are robust

4) Is the within-sample a select sample? We re-ran the RE models with the sibling sample only, with robust findings

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Sensitivity analysis: What if Finland were another country?

- Finland has one of the lowest infant mortality and low birth weight rates in the world, and free and universal healthcare and schooling

- To calculate PAFs in other countries from previous studies, we would need information on effect size, LBW prevalence, and P(outcome | LBW). The latter mostly not provided by authors

- If Finland had LBW prevalence of the US (8%), PAF for LBW on tertiary education would be 1.3
  - If effect size doubled, it would be 2.6

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