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Long-run Health and Mortality Effects of Exposure to Universal Health Care at Birth

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Disclaimer

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Motivation

- Health is a central aspect of UN's development agenda
- SDG: promote health and reduction of health inequalities
- Key mechanism: universal healthcare coverage
- Are there lasting benefits from expanding access to healthcare in early years?

The NHS - a natural experiment?

"The astonishing fact is that Bevan's vision has stood both the test of time and the test of change unimaginable in his day. At the centre of his vision was a National Health Service, and sixty years on his NHS – by surviving, growing and adapting to technological and demographic change – remains at the centre of the life of our nation as a uniquely British creation, and still a uniquely powerful engine of social justice."

(Gordon Brown, UK Prime Minister, 2008)

This paper

- Impact of birth exposure to universal healthcare on mortality and health around ages 50-60
  - Intervention: NHS introduction in 1948
  - Outcome: *very long-run, almost life-long* consequences 50 to 60 years after exposure
  - Method: RD design combined with DiD
    exploiting geographical variation in medical services expansion
  - Data: large administrative datasets on health and mortality

The focus of this presentation is the mortality results

Key outcomes

- Health and mortality between ages 50 and 63
  - Mortality: age-specific death rates and mortality due to heart disease
  - Health: onset of cardiovascular disease, a major cause of death
- New, large administrative datasets allow identifying treatment effects on infrequent events
- Data on time and cause of death from administrative death records

This unique combination of

- large administrative individual microdata with high-quality measurements of mortality
- a historic intervention reaching back far enough

allows us to quantify (for the first time) the very long-run, almost life-long dividend of universal health care coverage at birth

Institutional Setting (Pre-NHS)

- Mainly private provision
- National Insurance Act (1911)
  - Compulsory cover provided to employed persons aged 16-70 with annual earnings below a threshold
  - Employee and employer contributions with government top-up
  - Insurance through fragmented network of Approved Societies (ca 6,000), who could refuse to provide insurance coverage
  - Insurance provided entitlement to rudimentary medical care
    - Doctors received a fixed 'capitation' fee per patient
    - Limited access to hospital treatment and medication
    - **Coverage did not extend to dependents**
- Limited access to free healthcare (under severe financing problems by 1940s)
  - Voluntary hospitals - funded through private donations
  - Local authority provision - based on the Poor Law.

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Institutional setting (NHS introduction)

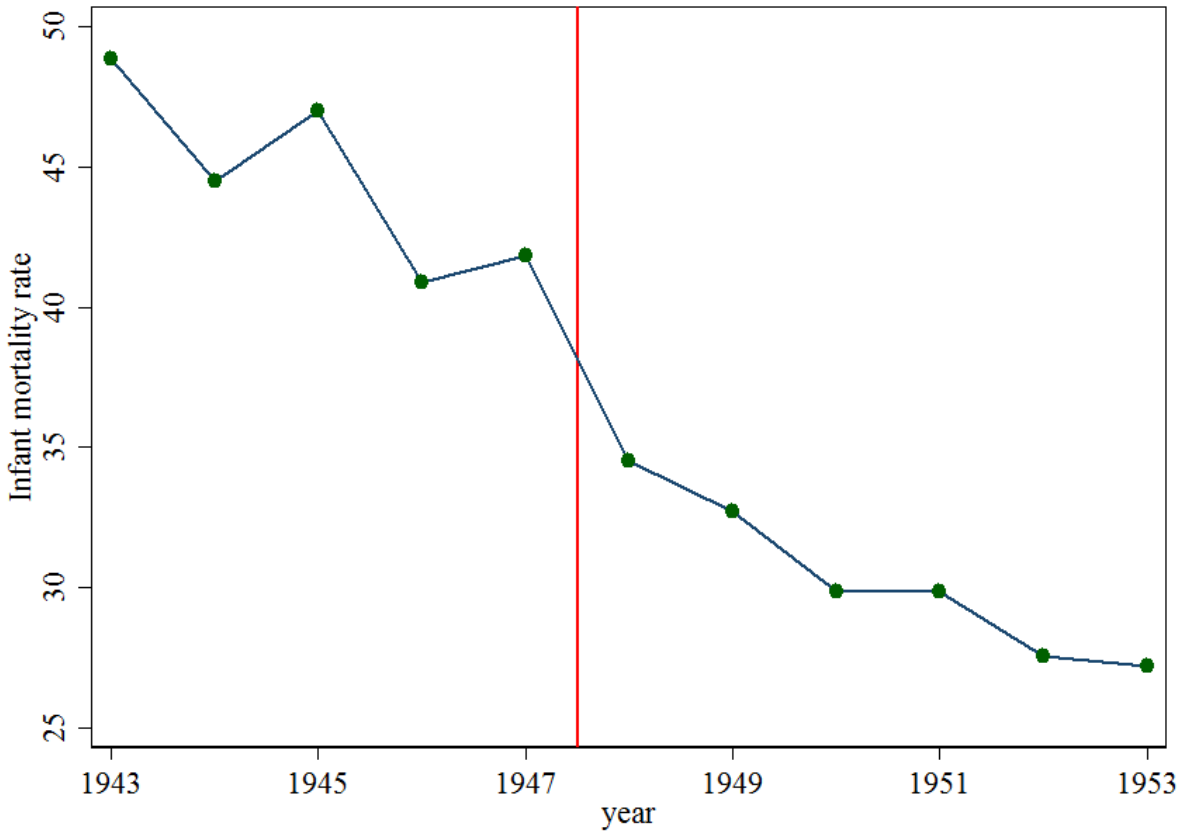
- 1942: Beveridge report highlights social and health disparities in the UK
- July 1948: introduction of universal healthcare via the National Health Service
- Centrally funded through general taxation
- Aims of the NHS:
  - equalisation of access to medical services
  - free at the point of use
  - access is based on clinical need, not ability to pay

Initially not accompanied by a large investment programme to boost resources (no new hospitals, no discontinuous expansion in doctors or nurses)

- hospitals were centralised
- doctors became independent contractors
- local authorities continued to administer family health services

Immediate effects: Infant mortality data

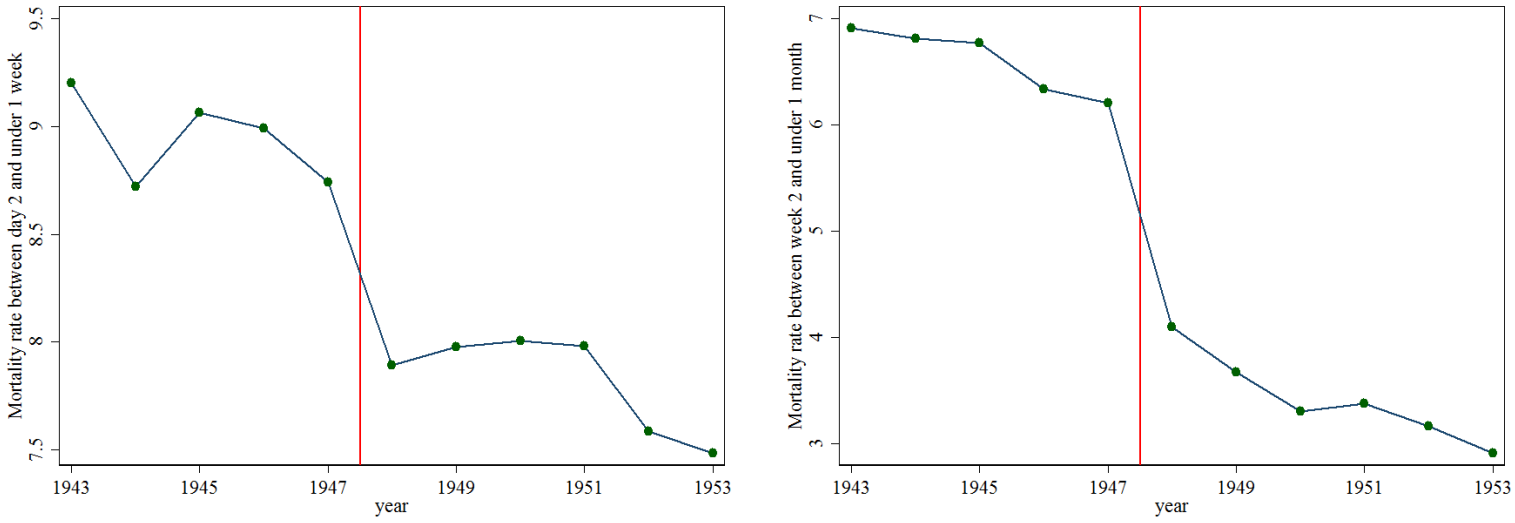
We use data digitised from Registrar General's Statistical Review of England and Wales, and from Ministry of Health Annual Reports to show that the introduction of the NHS induced a large reduction in infant mortality (17%)



Source: Registrar General's Annual report 1940-1955, The Wellcome Library.

Immediate effects: Infant mortality data

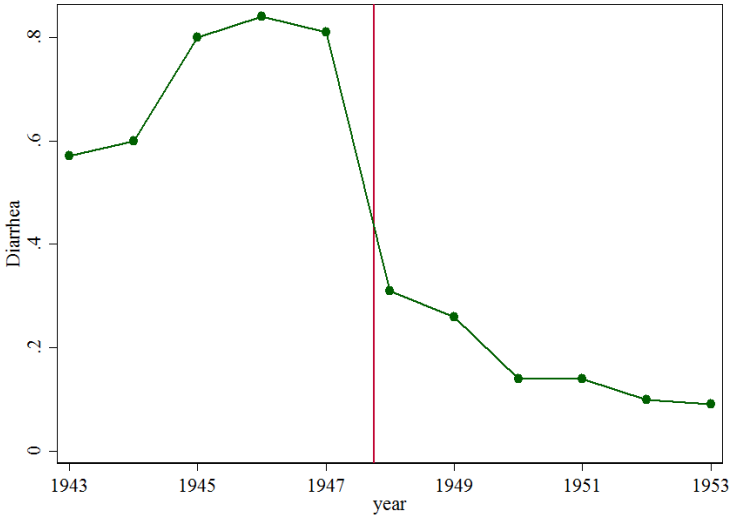
This reduction is predominantly driven by large declines in the neo-natal period...



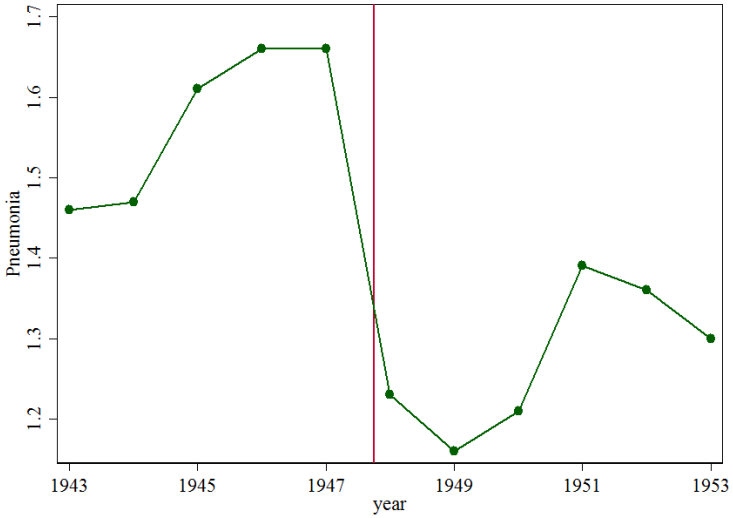
Source: Registrar General's Annual report 1940-1955, The Wellcome Library.

Immediate effects: Infant mortality data

.. due to prevention of deaths from acute conditions (pneumonia and diarrhea)...



(a) Diarrhea

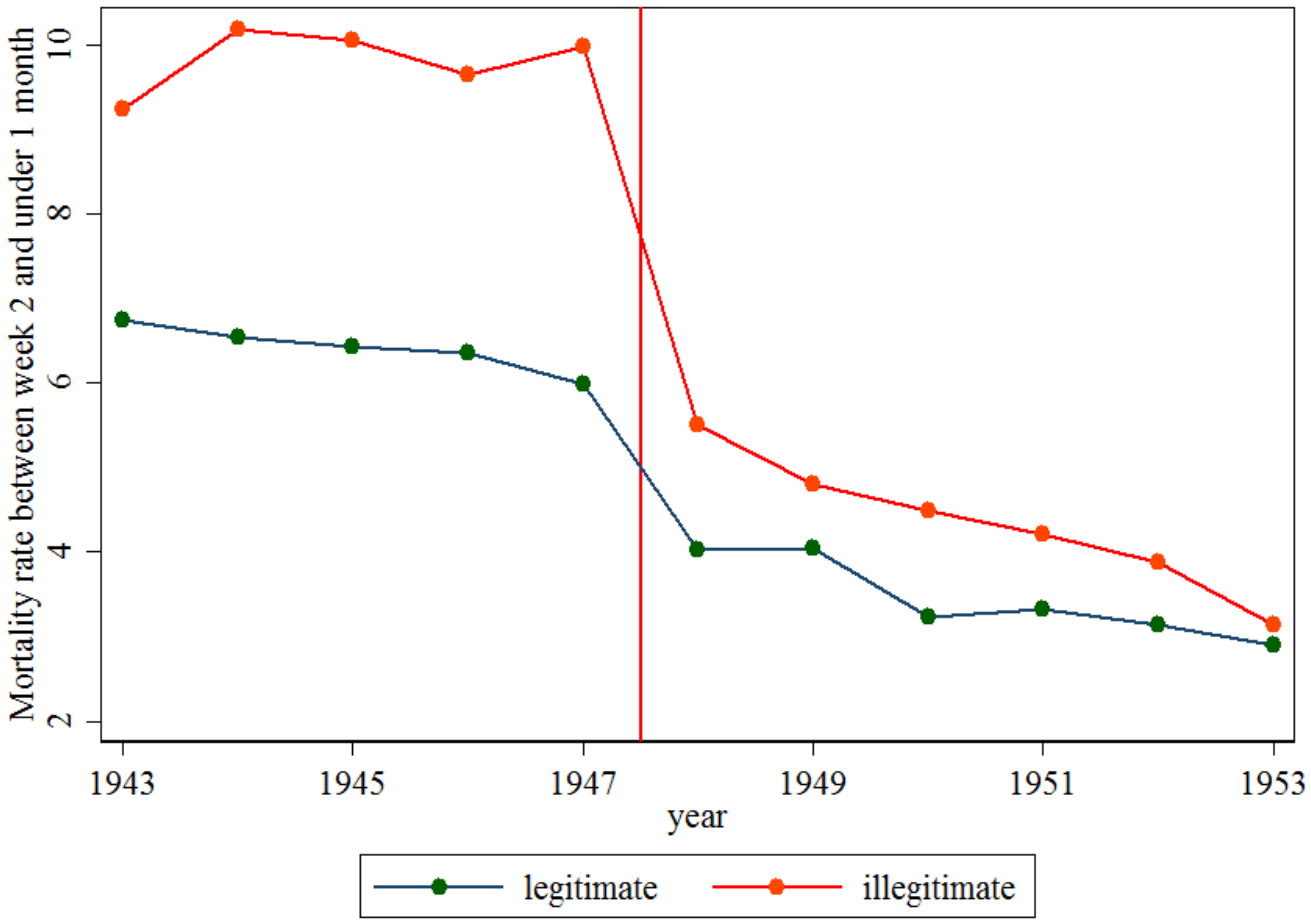


(b) Pneumonia

Source: Ministry of Health Annual Reports, The Wellcome Library.

Immediate effects: Infant mortality data

.. and concentrated among individuals of lower socio-economic status who prior to the NHS had low or no access to healthcare



Source: Registrar General's Annual report 1940-1955, The Wellcome Library.

Adult mortality data

ONS Longitudinal Study

- administrative data from five successive linked censuses (1971-2011)
- census panel is linked to death records up to 2015 with information on time and cause of death
- approximate 1% sample of the population of England and Wales
- data contains rich set of socio-economic characteristics
- ...and location at birth

combined with GBHD data on social class composition

Measurements

	ONS LS
Outcome	Age-specific mortality rate (between age 31 and 63) cohort
LC_{ic}	Social class V-VII 1971
$HIGHarea_g$	1951 GBHD county-level social class composition $= 1$ if county in upper tertile of proportion in high class (Professional and Intermediate Occupations) matched to individuals via county of birth information
Birth place	County of birth (historic definition)

Identification strategy I

- fuzzy RD design
- threshold: birth in 1948 (NHS introduction) (T_c)
- window: cohorts born between 1945 and 1951 (C_c)
- fuzzy: probability of an increase in pre- or postnatal care is a function of socio-economic status (LC_{ic})
- county of birth FE capturing local economic conditions, local healthcare infrastructure (μ_g)

$$y_{icg} = \alpha + \beta C_c + \gamma_1 T_c + \gamma_2 T_c LC_{ic} + \delta LC_{ic} + X'_{ic}\eta + \mu_g + \epsilon_{ic} \quad (1)$$

Identification strategy II

- additionally exploit geographical variation in medical services (from differential inflows of new patients)
- proxy inflow of new patients through county-level social class composition (proportion of insured)
- Data: combine data on county-level class composition from 1951 census with individual information on county of birth

$$\begin{aligned} y_{icg} = \alpha + \beta C_c + \gamma_1 T_c + \gamma_2 T_c LC_{ic} \\ + \gamma_3 T_c HIGHarea_g + \gamma_4 T_c LC_{ic} HIGHarea_g \\ + \gamma_5 LC_{ic} HIGHarea_g + \delta LC_{ic} + \zeta HIGHarea_g \\ + X'_{ic}\eta + \epsilon_{ic} \end{aligned} \tag{2}$$

$HIGHarea_g$: area with a high (upper tertile) proportion of previously insured ($\rightarrow$ low inflow of new patients)
allow for health externalities in areas with a high proportion of previously insured individuals that benefit individuals without such access (γ_5)

Estimates of mortality rate

$$y_{icg} = \alpha + \beta C_c + \gamma_1 T_c + \gamma_2 T_c LC_{ic} + \delta LC_{ic} + X'_{ic}\eta + \mu_g + \epsilon_{ic}$$

$\gamma_2 < 0$ - higher mortality reductions amongst low SES

	Died between age 31 and age...					
	52	**54**	**56**	**58**	**60**	**62**
$T_c * LC_{ic}$	-0.0044	-0.0079	-0.0046	-0.0113*	-0.0135**	-0.0138**
	(0.0041)	(0.0053)	(0.0049)	(0.0063)	(0.0066)	(0.00658)
Observations	44,108	44,108	44,108	44,108	44,108	44,108
Lower-class mean mortality rate						
	0.0435	0.0534	0.0655	0.0785	0.0915	0.1086
Lower-class mortality reduction in percent (relative to mean)						
	-10.11	-14.79	-7.02	-14.39	-14.75	-12.71

*Robust standard errors reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Source: ONS Longitudinal Study*

Estimates of mortality rate, Part II

$$y_{icg} = \alpha + \beta C_c + \gamma_1 T_c + \gamma_2 T_c LC_{ic} + \gamma_3 T_c HIGHarea_g + \gamma_4 T_c LC_{ic} HIGHarea_g + \gamma_5 LC_{ic} HIGHarea_g + \delta LC_{ic} + \zeta HIGHarea_g + X'_{ic}\eta + \epsilon_{ic}$$

$\gamma_4 < 0$ - higher mortality reductions for low SES born in High SES areas
$\gamma_3 < 0$ - higher mortality reductions in High SES areas
$\gamma_2 < 0$ - higher mortality reductions amongst low SES

	Died between age 31 and age...					
	52	54	56	58	60	62
$T_c * LC_{ic} *$ HIGHarea	-0.0150	-0.0056	-0.0070	-0.0230*	-0.0245*	-0.0276*
	(0.0128)	(0.0129)	(0.0114)	(0.0121)	(0.0129)	(0.0144)
$T_c *$ HIGHarea	-0.0073**	-0.0081**	-0.0108**	-0.0093**	-0.0072*	-0.0054
	(0.0031)	(0.0036)	(0.0051)	(0.0045)	(0.0042)	(0.0046)
$T_c * LC_{ic}$	-0.0024	-0.0074	-0.0039	-0.0082	-0.0101	-0.0099
	(0.0044)	(0.0059)	(0.0056)	(0.0072)	(0.0075)	(0.0074)
Observations	44,108	44,108	44,108	44,108	44,108	44,108
Lower-class mean mortality rate in HIGHarea	0.0496	0.0555	0.0685	0.0822	0.0940	0.1142
HIGH area lower-class mortality reduction in percent (relative to mean mortality rate)						
	-30.24	-10.13	-10.28	-27.98	-26.06	-24.17

*Robust standard errors reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Source: ONS Longitudinal Study*

Summary of mortality results

- no evidence of a mean reduction in mortality rates after universal healthcare rollout
- but a large mortality reduction around 10-15% among
  - lower social class individuals
  - larger in areas in which access to medical services increased more strongly
  - largest for those with limited pre-NHS access to healthcare in areas with lower changes in the number of patients
- robust reductions in both identification strategies, monotonically across age

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Conclusion

- birth exposure to universal healthcare strongly reduces infant mortality (-17%)
- Is there evidence of long-run impacts on health and mortality 50-60 years after the intervention?
- Yes, mortality by ages 52 to 62 reduces by roughly 14%
  - ...among individuals with lower SES at birth, and hence lower access to medical services prior to the NHS.
  - ...and by more among lower SES individuals in areas with more medical services per person.
- In further work we find that the onset of cardiovascular disease reduces by ca. 5-10% among those with less access to healthcare prior to NHS.

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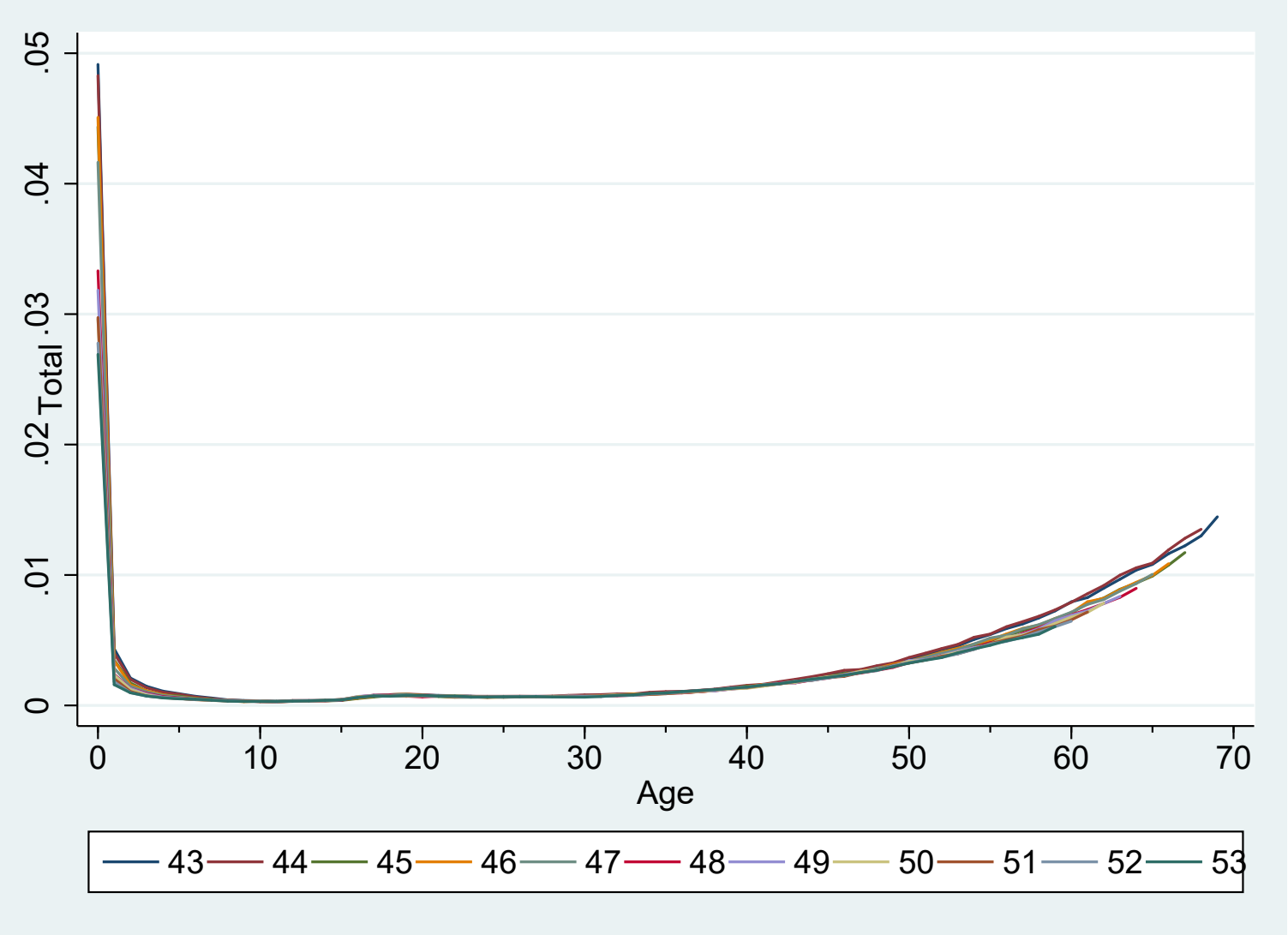
Implications for public policy

- Access to universal healthcare at birth yields benefits across almost the entire lifetime into older ages $\rightarrow$ benefits of early childhood interventions may be underestimated
- equalising access to healthcare (at birth) reduces existing health and mortality gaps between SES groups

Thank you!

Cohort difference in mortality over life-cycle



Back

Source: Human Mortality Database.