# CLOSER Conference

## Health 3: Ageing

Chair: **Rebecca Hardy**

- Education and mortality in three Eastern European populations: findings from the PrivMort retrospective cohort study
  **Katarzyna Doniec**
- Repeatedly measured material and behavioral factors change the explanation of socioeconomic inequalities in all-cause mortality: the GLOBE study
  **Joost Oude Groeniger**
- Examining the relationship between lifetime socioeconomic position and vascular ageing in the 1946 British birth cohort study
  **Anitha George**

closer

Twitter: #CLOSERConf
WIFI: BL-GUEST-CONF
Password: BLgue5T23

# Education and mortality in three Eastern European populations

## Findings from the PrivMort retrospective cohort study

Katarzyna Doniec, Department of Sociology, University of Cambridge
Dr Denes Stefler, Institute of Epidemiology and Health, UCL
Professor Michael Murphy, Department of Social Policy, LSE
Professor Martin McKee, Department of Health Services Research and Policy, LSHTM
Professor Michael Marmot, Institute of Health Equity, UCL
Professor Lawrence King, Department of Sociology, University of Cambridge
Professor Martin Bobak, Institute of Epidemiology and Health, UCL

# Post-communist mortality crisis

# PrivMort research project: overview


- Project timing: 2013-2017
- Project scope: **1980-2013**
- 3 countries: **Russia, Belarus, Hungary**
- Surveys conducted: **63,073** interviews
- Data on **205,607** individuals
- Settlement-level data: annual time series covering the period **1990–2010**

539 towns and 12,082 enterprises in Russia

96 towns and 271 enterprises in Belarus

52 towns and 335 enterprises in Hungary

# Current study: research questions

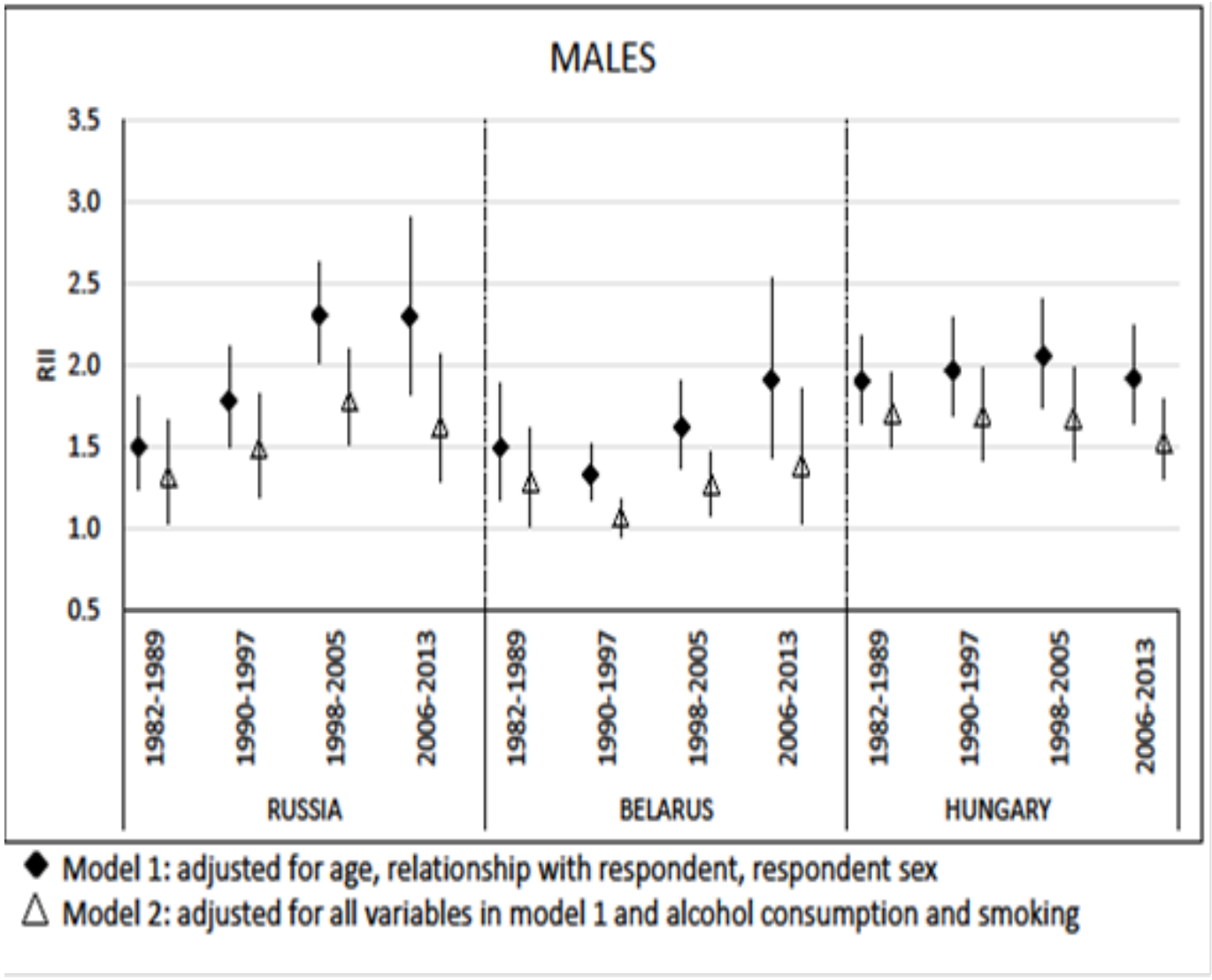
A. What is the potential impact of major political changes on inequalities in all-cause mortality among men and women in Eastern Europe?

B. To what extent do health-related behaviours (smoking and frequency of alcohol consumption) contribute to such changes in inequalities in all-cause mortality?

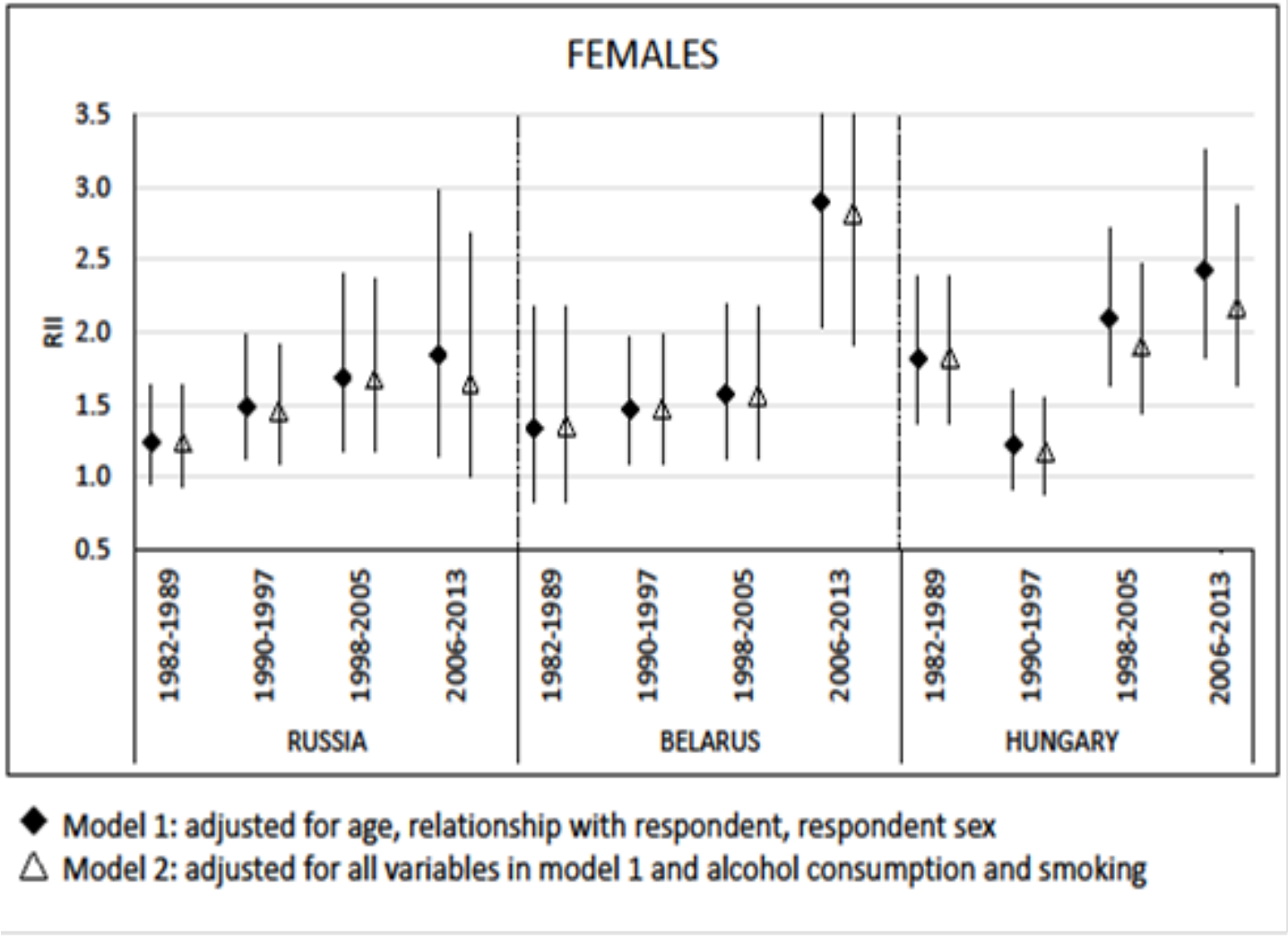
# Methods

- Indirect estimation methodology (so-called **Brass techniques**)
- Selection criteria: individuals born before 1972 with at least one family member living in the same settlement during the 1990s
- Overall response rate **58%**
- Convenience cohort consisting of **parents, siblings , partners**
- **N=179,691** (respondents + relatives)
- Only relatives in working age (**20-65**), at any point of the observational period, included
- Statistical analysis: **discrete-time survival** analysis & **Relative Index of Inequality**

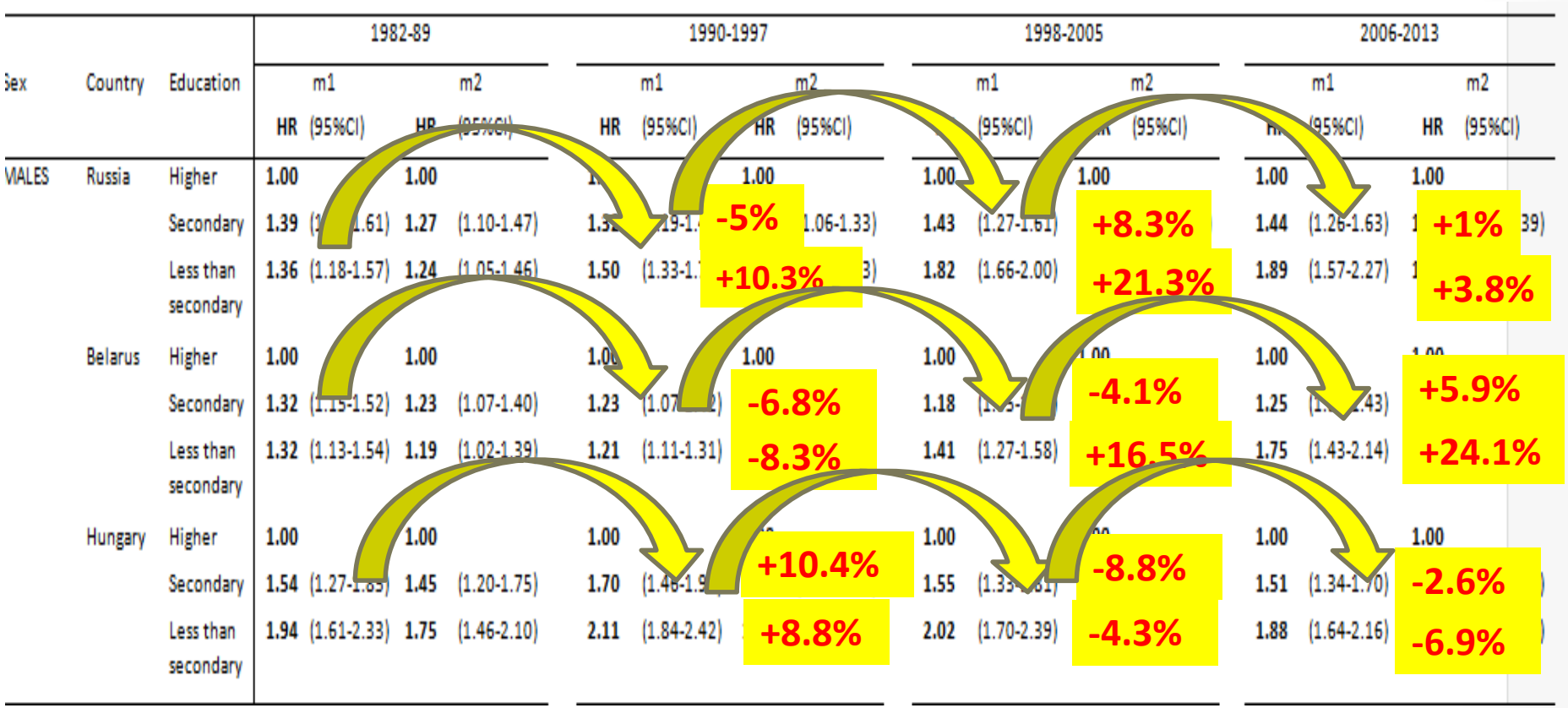
# Results: Relative Inequality Index, males



# Results: Relative Inequality Index, females



# Results: Odds Ratios, males



| Sex | Country | Education | 1982-89 m1 HR (95%CI) | 1982-89 m2 HR (95%CI) | 1990-1997 m1 HR (95%CI) | 1990-1997 m2 HR (95%CI) | 1998-2005 m1 HR (95%CI) | 1998-2005 m2 HR (95%CI) | 2006-2013 m1 HR (95%CI) | 2006-2013 m2 HR (95%CI) |
|---|---|---|---|---|---|---|---|---|---|---|
| MALES | Russia | Higher | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | Secondary | 1.39 (1.[illegible]1.61) | 1.27 (1.10-1.47) | 1.3[illegible]19-1.[illegible] | 1.06-1.33) | 1.43 (1.27-1.61) | +8.3% | 1.44 (1.26-1.63) | 1[illegible]39) |
| | | Less than secondary | 1.36 (1.18-1.57) | 1.24 (1.05-1.46) | 1.50 (1.33-1.[illegible]3) | +10.3% | 1.82 (1.66-2.00) | +21.3% | 1.89 (1.57-2.27) | +3.8% |
| | Belarus | Higher | 1.00 | 1.00 | 1.0[illegible] | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | Secondary | 1.32 (1.15-1.52) | 1.23 (1.07-1.40) | 1.23 (1.07-1.[illegible]2) | -6.8% | 1.18 (1.[illegible]-1.[illegible]) | -4.1% | 1.25 (1.[illegible]-1.43) | +5.9% |
| | | Less than secondary | 1.32 (1.13-1.54) | 1.19 (1.02-1.39) | 1.21 (1.11-1.31) | -8.3% | 1.41 (1.27-1.58) | +16.5% | 1.75 (1.43-2.14) | +24.1% |
| | Hungary | Higher | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | Secondary | 1.54 (1.27-1.[illegible]) | 1.45 (1.20-1.75) | 1.70 (1.46-1.9[illegible]) | +10.4% | 1.55 (1.33-1.[illegible]) | -8.8% | 1.51 (1.34-1.70) | -2.6% |
| | | Less than secondary | 1.94 (1.61-2.33) | 1.75 (1.46-2.10) | 2.11 (1.84-2.42) | +8.8% | 2.02 (1.70-2.39) | -4.3% | 1.88 (1.64-2.16) | -6.9% |

Column-pairs m1, m2:

Model 1: adjusted for age, relationship with respondent, respondent sex
Model 2: adjusted for all variables in model 1 and alcohol consumption and smoking

# Results: Odds Ratios, females

| Sex | Country | Education | 1982-89 m1 HR (95%CI) | 1982-89 m2 HR (95%CI) | 1990-1997 m1 HR (95%CI) | 1990-1997 m2 HR (95%CI) | 1998-2005 m1 HR (95%CI) | 1998-2005 m2 HR (95%CI) | 2006-2013 m1 HR (95%CI) | 2006-2013 m2 HR (95%CI) |
|---|---|---|---|---|---|---|---|---|---|---|
| FEMALES | Russia | Higher | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | Secondary | 1.33 (0.98-1.81) | 1.33 (0.97-1.81) | 1.34 (1.14-1.57) | | 1.16 (0.93-1.45) | | 1.00 (0.79-1.28) | |
| | | Less than secondary | 1.23 (0.99-1.53) | 1.22 (0.98-1.53) | 1.34 (1.11-1.63) | | 1.44 (1.14-1.82) | | 1.93 (1.39-2.68) | |
| | Belarus | Higher | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | Secondary | 1.14 (0.79-1.74) | 1.12 (0.73-1.70) | 1.47 (1.18-1.82) | | 1.19 (1.03-1.36) | | 1.42 (1.12-1.79) | |
| | | Less than secondary | 1.20 (0.86-1.68) | 1.21 (0.87-1.68) | 1.32 (1.09-1.58) | | 1.33 (1.07-1.65) | | 2.22 (1.73-2.84) | |
| | Hungary | Higher | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | Secondary | 1.03 (0.71-1.50) | 1.02 (0.70-1.49) | 1.08 (0.80-1.45) | | 1.18 (0.84-1.67) | | 1.19 (0.84-1.69) | |
| | | Less than secondary | 1.38 (0.97-1.96) | 1.37 (0.96-1.95) | 1.17 (0.87-1.59) | | 1.67 (1.25-2.23) | | 1.81 (1.30-2.52) | |

+1% -13.4% -13.8%
+8.9% +7.5% +34%
+28.9% -19% +19.3%
+10% +0.8% +66.9%
+4.9% +9.3% +0.8%
-15.2% +42.7% +8.4%

Model 1: adjusted for age, relationship with respondent, respondent sex
Model 2: adjusted for all variables in model 1 and alcohol consumption and smoking

# Results: contribution of health-related behaviors, males

| Sex | Country | Education | 1982-89 m1 HR | 1982-89 m1 (95%CI) | 1982-89 m2 HR | 1982-89 m2 (95%CI) | 1990-1997 m1 HR | 1990-1997 m1 (95%CI) | 1990-1997 m2 HR | 1990-1997 m2 (95%CI) | 1998-2005 m1 HR | 1998-2005 m1 (95%CI) | 1998-2005 m2 HR | 1998-2005 m2 (95%CI) | 2006-2013 m1 HR | 2006-2013 m1 (95%CI) | 2006-2013 m2 HR | 2006-2013 m2 (95%CI) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MALES | Russia | Higher | 1.00 | | | | 1.00 | | | | 1.00 | | | | 1.00 | | | |
| | | Secondary | 1.39 | (1.20- | | 10-1.47) | 1.32 | (1.19- | | 6-1.33) | 1.43 | (1 | | .12-1.40) | 1.44 | (1. | | (1.06-1.39) |
| | | Less than secondary | 1.36 | (1.18- | | 05-1.46) | 1.50 | (1.33 | | 3-1.53) | 1.82 | (1 | | .35-1.72) | 1.89 | (1. | | .24-1.77) |
| | Belarus | Higher | 1.00 | | | | 1.00 | | | | 1.00 | | | | 1.00 | | | |
| | | Secondary | 1.32 | (1.15 | | -1.40) | 1.23 | (1.0 | | -1.24) | 1.18 | (1.03-1.32 | | 0.94-1.17) | 1.25 | (1.0 | | .91-1.27) |
| | | Less than secondary | 1.32 | (1.13- | | -1.39) | 1.21 | (1.1 | | 1.11) | 1.41 | (1. | | 08-1.33) | 1.75 | (1 | | .16-1.69) |
| | Hungary | Higher | 1.00 | | | | 1.00 | | | | 1.00 | | | | 1.00 | | | |
| | | Secondary | 1.54 | (1.27 | | -1.75) | 1.70 | (1.4 | | 1.76) | 1.55 | (1 | | 7-1.59) | 1.51 | (1 | | .17-1.51) |
| | | Less than secondary | 1.94 | (1.61- | | -2.10) | 2.11 | (1.8 | | -2.07) | 2.02 | (1 | | .38-1.97) | 1.88 | (1 | | .31-1.76) |

-8.6% -8.8% -6.8% -9.8% -5.8% -9.8%

-9.8% -12% -11.4% -14.9% -10.6% -15.2%

-12.6% -16.5% -11.1% -14.9% -12.3% -18.3%

-16% -21.7% -14.4% -20% -11.9% -19.1%

Column-pairs m1, m2:

Model 1: adjusted for age, relationship with respondent, respondent sex
Model 2: adjusted for all variables in model 1 and alcohol consumption and smoking

# Results: contribution of health-related behaviors, females

| | | | 1982-89 | | | | 1990-1997 | | | | 1998-2005 | | | | 2006-2013 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex | Country | Education | m1 | | m2 | | m1 | | m2 | | m1 | | m2 | | m1 | | m2 | |
| | | | HR | (95%CI) | HR | (95%CI) | HR | (95%CI) | HR | (95%CI) | HR | (95%CI) | HR | (95%CI) | HR | (95%CI) | HR | (95%CI) |
| FEMALES | Russia | Higher | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| | | Secondary | 1.33 | (0.9 | -0% | (0.97-1.81) | 1.34 | (1.14 | -1.5% | 2-1.54) | 1.16 | (0.9 | -0.9% | -1.44) | 1.00 | (0.7 | -6% | 0.74-1.20) |
| | | Less than secondary | 1.23 | (0. | -0.8% | (0.98-1.53) | 1.34 | (1.1 | -1.5% | 09-1.60) | 1.44 | (1.1 | -0.7% | -1.80) | 1.93 | (1.3 | -6.7% | 1.27-2.54) |
| | Belarus | Higher | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| | | Secondary | 1.14 | (0 | -1.8% | 3-1.70) | 1.47 | (1.1 | -0.7% | 1.81) | 1.19 | (1.0 | -0% | -1.36) | 1.42 | (1.1 | -1.4% | 0-1.79) |
| | | Less than secondary | 1.20 | (0 | -0.8% | 7-1.68) | 1.32 | (1.0 | -0% | 1.58) | 1.33 | (1.0 | -0% | -1.65) | 2.22 | (1.1 | -2.3% | 6-2.82) |
| | Hungary | Higher | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| | | Secondary | 1.03 | (0 | -1% | (0.70-1.49) | 1.08 | (0.8 | -1.9% | -1.44) | 1.18 | (0.8 | -2.5% | -1.63) | 1.19 | (0.8 | -3.4% | 2-1.63) |
| | | Less than secondary | 1.38 | (0 | -0.7% | (0.96-1.95) | 1.17 | (0.8 | -2.6% | -1.55) | 1.67 | (1.2 | -7.2% | -2.08) | 1.81 | (1.3 | -7.7% | 1-2.30) |

Model 1: adjusted for age, relationship with respondent, respondent sex
Model 2: adjusted for all variables in model 1 and alcohol consumption and smoking

# Potential limitations of the study

- Not nationally representative samples
- Proxy reports not always accurate
- Never-married population under-represented in sample
- Mortality among relatives can be highly correlated

# Further Information

- Publications:

Irdam D, King L, Gugushvili A, et al. **Mortality in Transition: Study Protocol of the PrivMort Project, a multilevel convenience cohort study.** *BMC Public Health*. 2016;16:672. doi:10.1186/s12889-016-3249-9.

Azarova A, Irdam D, Gugushvili A, et al. **The effect of rapid privatisation on mortality in mono-industrial towns in post-Soviet Russia: a retrospective cohort study**. *The Lancet Public Health*. 2017;2(5):e231-e238. doi:10.1016/S2468-2667(17)30072-5.

- Contact:

kd353@cam.ac.uk
denes.stefler@ucl.ac.uk

www.privmort.sociology.cam.ac.uk

Erasmus MC
University Medical Center Rotterdam

# Repeatedly measured material and behavioural factors change the explanation of socioeconomic inequalities in all-cause mortality

**Joost Oude Groeniger**

Department of Public Health, Erasmus MC

Carlijn B.M. Kamphuis, Johan P. Mackenbach, Frank J. van Lenthe

# Persistent socioeconomic inequalities in health

- One of the hardest public health issues to tackle
- Publication of “Black Report” in 1980 revitalised research
- Differential distribution of material and behavioural factors
- Explanatory factors usually measured once at baseline

# Recent emphasis on time-varying behaviours

- Stringhini et al. (2010): health behaviours explained 72% of socioeconomic inequalities in all-cause mortality when assessed multiple times against 42% when only assessed once
- Nandi et al. (2014): health behaviours explained 68% of the association between SES and all-cause mortality when measured multiple times
- Mehta et al. (2015): behavioural factors explained 41% as fixed and 50% as time-varying factors

# Aim of this study

- Changes in risk factors may be socially patterned

- Both behavioural and material factors may contribute to inequalities

- Research question:
  - Do repeatedly measured material and behavioural factors contribute differently to socioeconomic inequalities in all-cause mortality compared to one baseline measurement?

# Data

- Study sample
  - GLOBE study: prospective cohort started in 1991
  - City of Eindhoven and surrounding municipalities
  - Age 25-75 years at baseline
  - 2445 women (746 deaths) and 2406 men (934 deaths)
  - Measurements from 1991, 1997 and 2004 were used

- All-cause mortality data from Statistics Netherlands (CBS)
  - Those alive on 31 December 2013 were censored

# Socioeconomic position

- Highest attained educational level
  - High: higher professional education and university (ISCED 5-7)
  - Middle: intermediate professional and higher general education (ISCED 3-4)
  - Low: lower professional and intermediate general education (ISCED 2)
  - Lowest: primary education (ISCED 0-1)

- Occupation
  - Professional
  - White-collar
  - Blue-collar

# Behavioural factors

- Smoking status
  - 1 – never; 2 – former; 3 – current
- Leisure time physical activity
  - 1 – active (>2 hr/w); 2 – moderately active (1-2 hr/w); 3 – little active (<1 hr/w); 4 – inactive (no activity)
- Sports participation
  - 1 – active; 2 – moderately active; 3 – little active; 4 – inactive
- BMI
  - 1 – normal weight; 2 – underweight; 3 – overweight; 4 – obese

# Material factors

- Financial difficulties
  - 1 – no financial difficulties; 2 – some financial difficulties; 3 – major financial difficulties
- Housing tenure
  - 1 – house owner or 2 – rented house
- Health insurance
  - 1 – private insurance or 2 – other (civil servant, public or no insurance)

# Statistical analysis

- Cox proportional hazards regression models
- Four-step mediation approach
- Mediation effect: reduction in excess risk after inclusion of mediators
- Two strategies:
  - Mediators measured once at baseline
  - Mediators as measured three times included as time-varying covariates

# Associations between educational level and mortality

| Men | HR | 95% CI | Women | HR | 95% CI |
|---|---|---|---|---|---|
| High | 1 | - | High | 1 | - |
| Middle | 1.41 | 1.04 - 1.90 | Middle | 1.53 | .87 - 2.70 |
| Low | 1.22 | .92 - 1.62 | Low | 1.55 | .96 - 2.50 |
| Lowest | 1.84 | 1.40 - 2.41 | Lowest | 1.69 | 1.03 - 2.76 |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (men)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.87, 1.69) | 1.37 | (1.01, 1.87) | 75% | (44%, 129%) | 56% | (28%, 101%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.68 | (1.26, 2.24) | 1.44 | (1.09, 1.91) | 19% | (-4%, 46%) | 48% | (39%, 92%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.84 | (1.40, 2.41) | 1.21 | (0.86, 1.69) | 1.21 | (0.88, 1.66) | 75% | (42%, 134%) | 75% | (55%, 134%) |

# Relative inequalities in mortality between the lowest and highest educational group (women)

| | No risk included | | Baseline factors | | Time-varying factors | | Baseline factors | | Time-varying factors | |
|---|---|---|---|---|---|---|---|---|---|---|
| | HR | (95% CI) | HR | (95% CI) | HR | (95% CI) | % Explained | (95% CI) | % Explained | (95% CI) |
| **Material factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.69 | (1.03, 2.76) | 1.35 | (0.82, 2.22) | 1.44 | (0.85, 2.43) | 49% | (9%, 186%) | 36% | (-4%, 139%) |
| **Behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.69 | (1.03, 2.76) | 1.43 | (0.85, 2.40) | 1.34 | (0.80, 2.22) | 38% | (-1%, 167%) | 51% | (34%, 211%) |
| **Material and behavioral factors** | | | | | | | | | | |
| **Lowest vs highest** | 1.69 | (1.03, 2.76) | 1.19 | (0.71, 2.01) | 1.17 | (0.69, 1.95) | 72% | (21%, 267%) | 75% | (37%, 307%) |

# Conclusion

- Both behavioural and material factors impact upon the explanation of socioeconomic inequalities in mortality

- The contribution of behavioural factors was greater when three measurements were used than when measured once at baseline

- The contribution of material factors was smaller when three measurements were used than when measured once at baseline

# Baseline-only versus time-varying models

- Inequalities in both behavioural and material factors increased over time

- Stronger association between behavioural factors and mortality in time-varying models; weaker association between material factors and mortality
  - Period effect (e.g. better medical treatment)
  - Age effect (e.g. material deprivation has worse effects at a younger age)

- Methodological considerations
  - Potential time-varying confounding
  - Time lapse that is needed for changes in mediators to affect mortality risk

# Thank you

For more information, suggestions or questions:

j.oudegroeniger@erasmusmc.nl

# Examining the relationship between lifetime socioeconomic position and vascular ageing in the 1946 British birth cohort study

**A. George**, R. Hardy and W. Wulaningsih

MRC Unit for Lifelong Health and Ageing at
University College London

# Background

- CVD leading cause of death globally and the UK
  (BHF, 2015; WHO, 2017)
- Long-standing evidence of inequalities in CVD mortality
  (Kaplan & Keil, 1993)
- Decrease in mortality rates in industrialised countries
  (BHF, 2011; GBD, 2017)
- Inequality in CVD mortality rates in the UK
  (Marmot & McDowall, 1986; Bajekal, 2013)
- High prevalence of people living with CVD
  (Bhatnager et al, 2015)
- CVD mortality vs vascular ageing

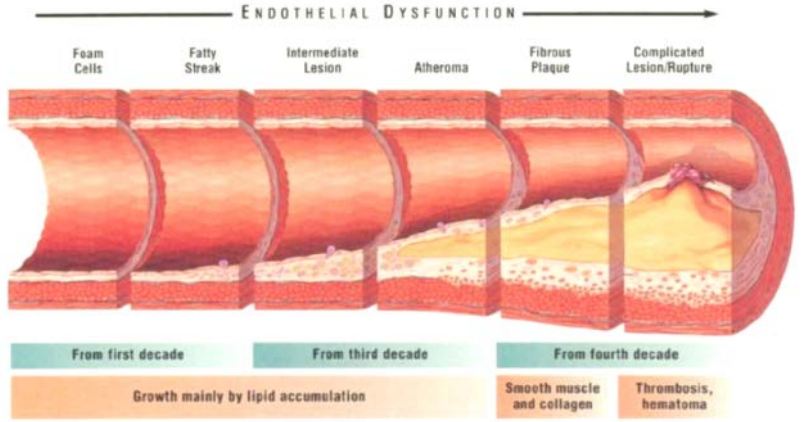
# Aetiology of cardiovascular disease

Vascular ageing results in changes in vascular structure and function

Atherosclerosis - an example of unhealthy vascular ageing

Evidence that atherosclerosis starts early in life (Virmani, 2000; Insull, 2009)

Lifetime factors important in the development of CVD




Source: http://www.pcrm.org

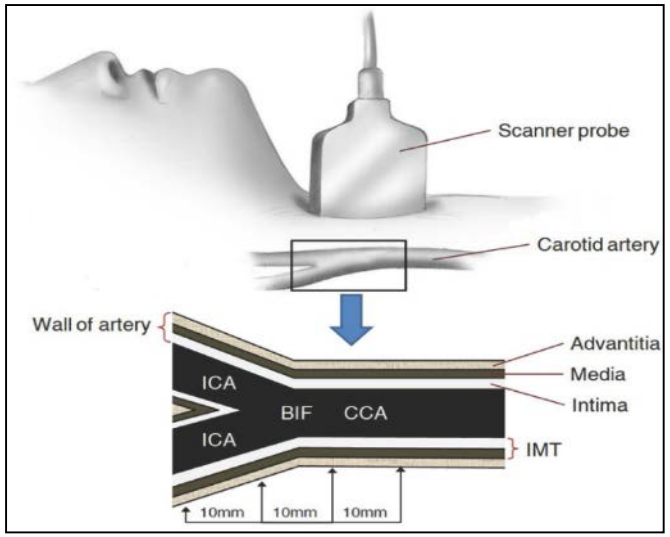
# Identifying vascular ageing: carotid intima-media thickness (cIMT)

Combined measure of the intimal and medial levels of the carotid artery

Identifies subclinical levels of atherosclerosis (Cobble & Bale, 2010)

0.2mm increase associated with 33% increase in relative risk for MI and 28% increase for stroke (de Groot et al, 2008)

Reduction 0.012mm per year associated with OR of 0.48 in decline in CV events (de Groot et al, 2008)




Source: Kim et al, 2016

# Socioeconomic position

"The social and economic factors that influence what positions individuals or groups hold within the structure of a society" (Golabardes et al, 2006)

Includes social class, status and material resources (Bartley, 2008)

Consists of resource and prestige-based indicators (Krieger, 1997)

Proxy indicators e.g., household crowding

Life course approach (Kuh & Ben-Shlomo, 2001)

# CVD, cIMT and inequality

Stable evidence of an inverse relationship between adult SEP and CVD (Kaplan & Keil, 1993)

Strong evidence of an inverse relationship between childhood SEP and CVD (Galobardes et al, 2005)

Support for an inverse relationship between cumulative SEP and CVD (Pollitt et al, 2005)

Less evidence on the relationship between SEP and cIMT

- Most evidence based on non-UK data
- Uses different measures of SEP
- Shows differences by sex

# Study aims and objectives

Main aim: to explore the relationship between SEP at different stages of life and cIMT

Objective 1: To ascertain if there are separate associations between:

- Father's social class at age 4 (childhood SEP)
- Education up to age 26, and
- Own social class at age 53, with cIMT

Objective 2: To ascertain if there is a cumulative effect of SEP on cIMT

# Methods: Data

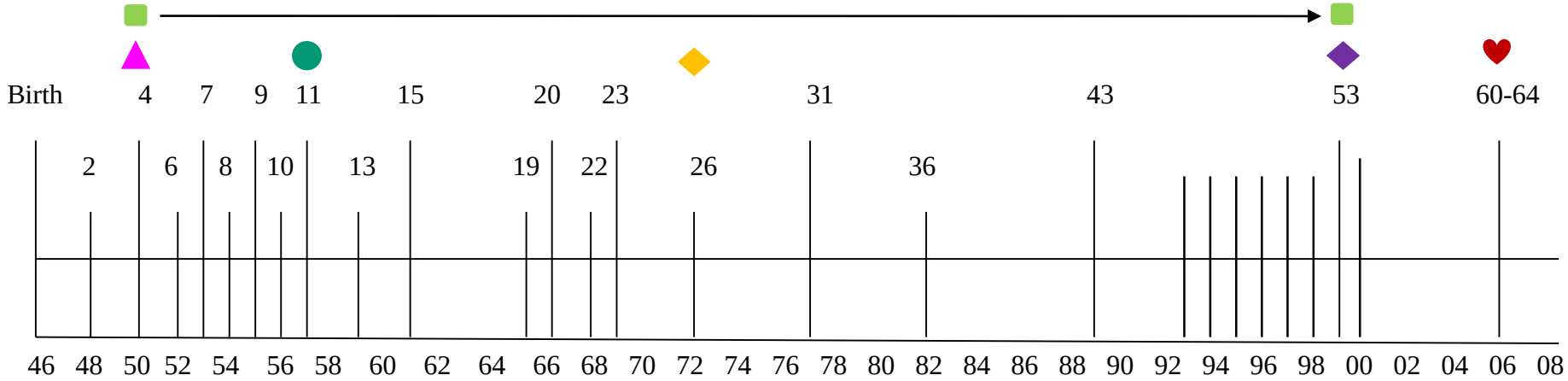
The MRC National Study of Health and Development (NSHD) (1946 British birth cohort)

5,362 individuals born in Britain in March 1946

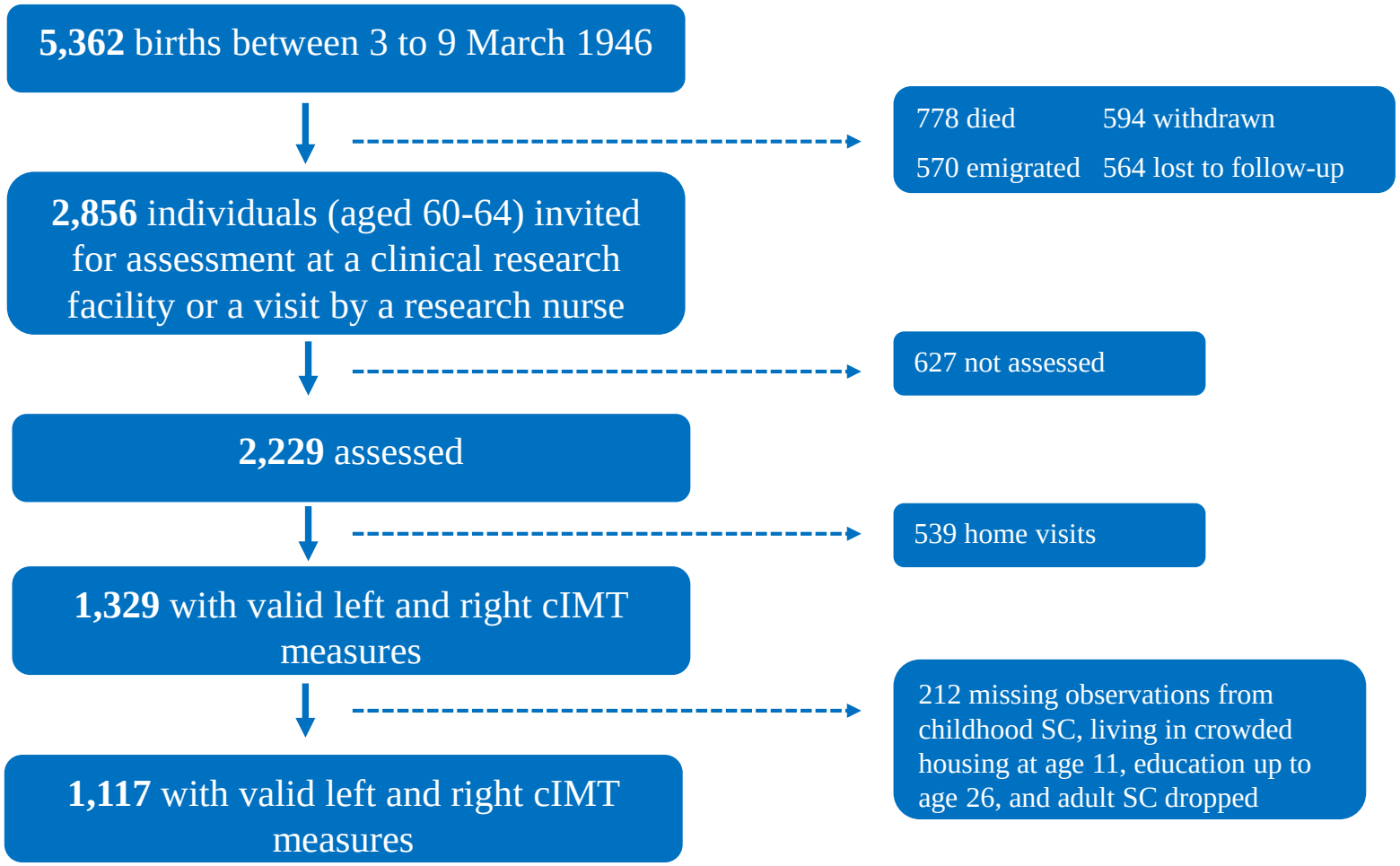
Linear regression analysis

## Variables measured

- Father's social class
- Educational attainment
- Own social class
- Household overcrowding
- Change in SC from age 4 to age 53
- cIMT



# Methods: Sample

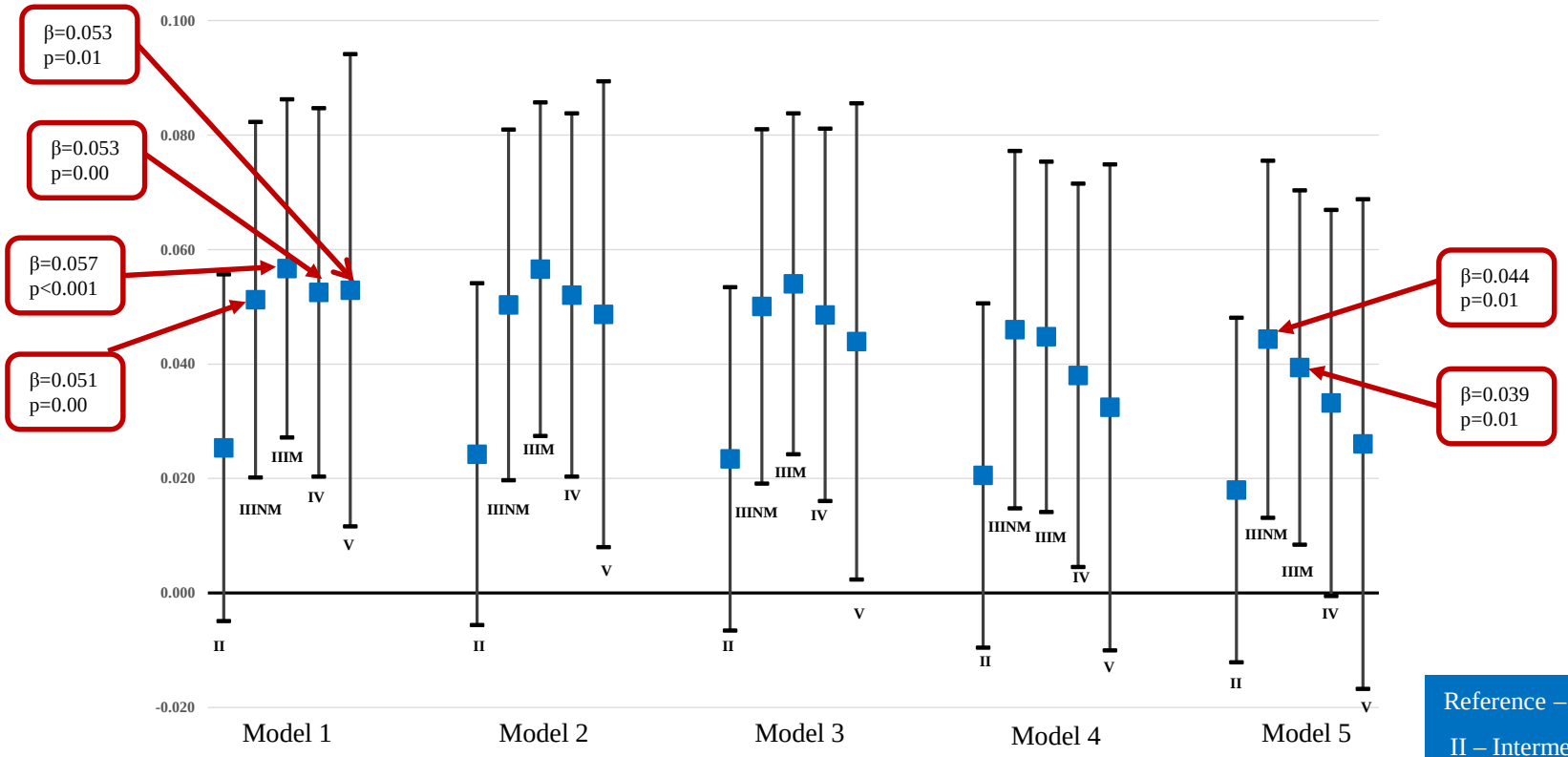


# Results: Study population characteristics

At age 60-64 (N=1,117)

- 53% women
- 46% manual social class at age 4 (father's occupational class)
- 24% lived in overcrowded housing at age 11
- 23% manual social class at age 53
- Mean cIMT 0.69mm
- Mean cIMT women 0.67mm
- Mean cIMT men 0.71mm

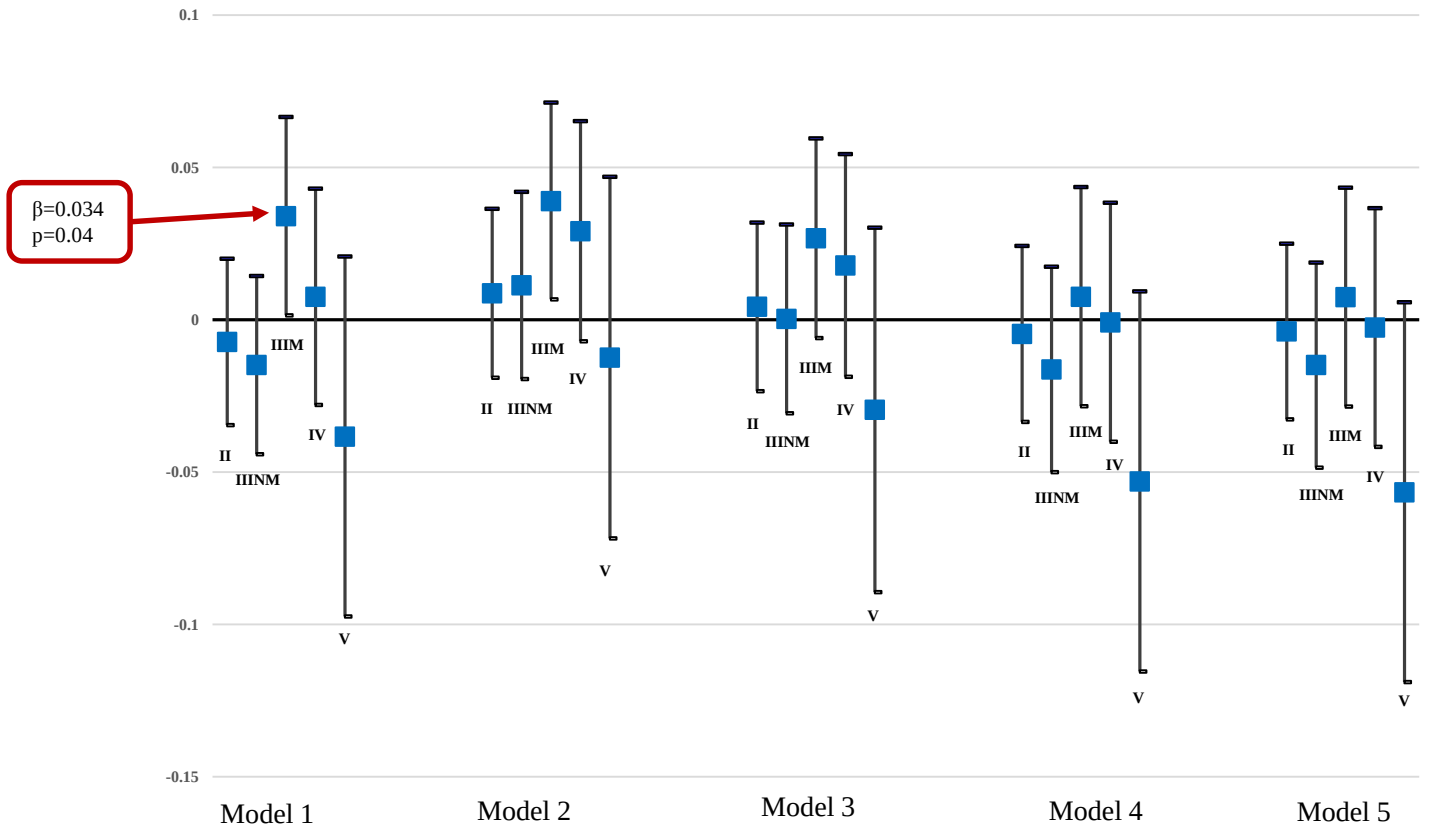
# Association between childhood social class and cIMT




M1 – unadjusted
M2 – adjusted for sex
M3 – adjusted for sex & adult social class
M4 – adjusted for sex, adult social class & education
M5 – adjusted for sex, adult social class, education & household crowding

Reference – Professional
II – Intermediate
IIINM – Skilled Non-Manual
IIIM – Skilled Manual
IV – Semi-skilled
V – Unskilled

# Association between adult social class and cIMT




Reference – Professional

II – Intermediate

IIINM – Skilled Non-Manual

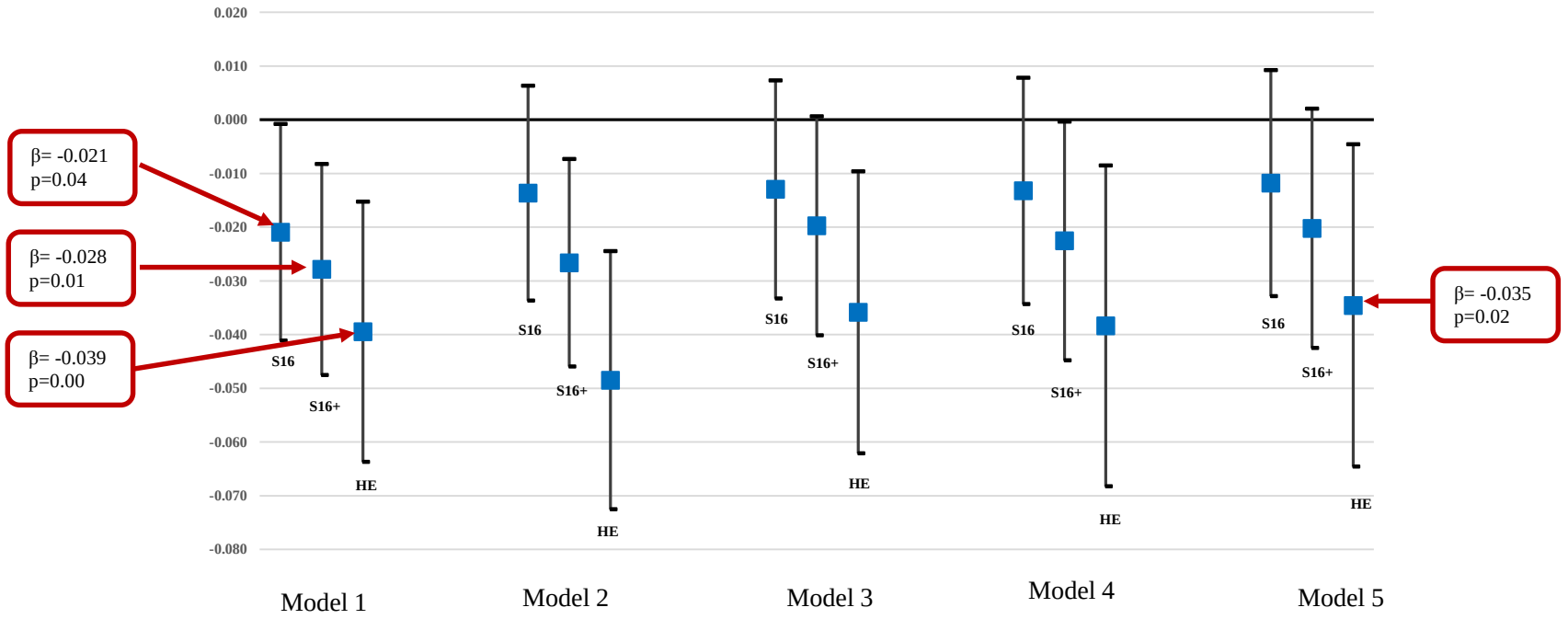
IIIM – Skilled Manual

IV – Semi-skilled

V – Unskilled

M1 – unadjusted
M2 – adjusted for sex
M3 – adjusted for sex & father's social class
M4 – adjusted for sex, father's social class & education
M5 – adjusted for sex, father's social class, education & household crowding

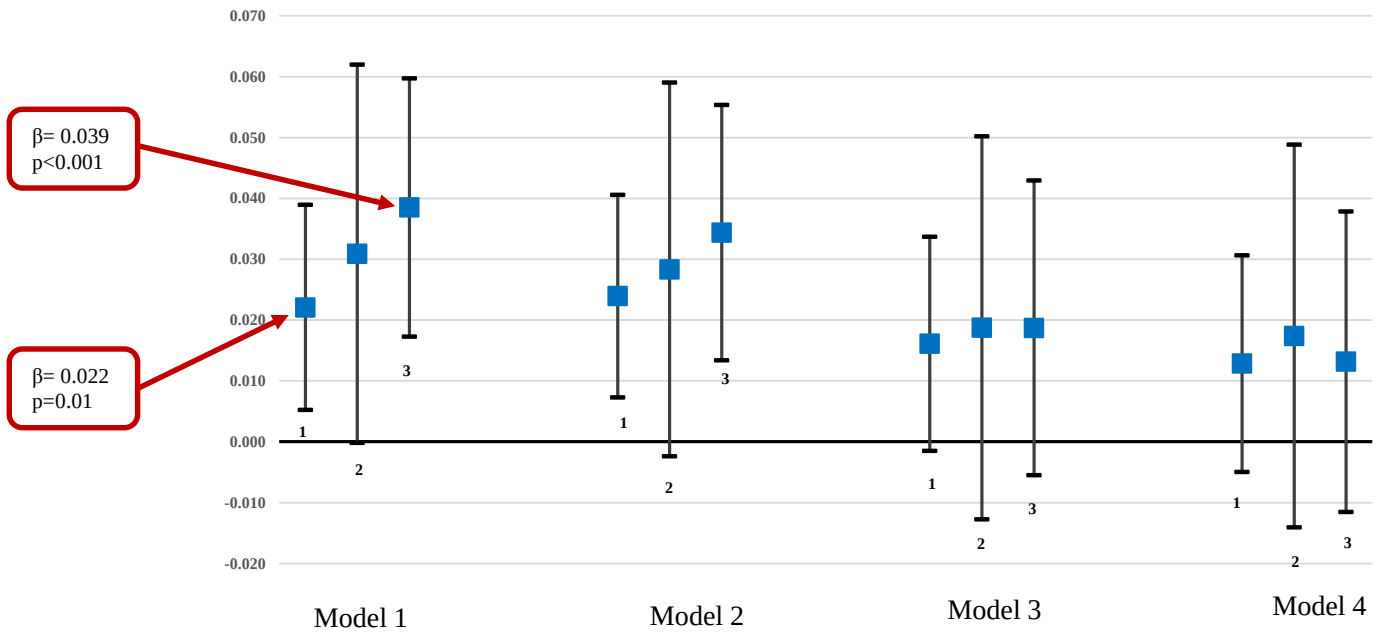
# Association between education and cIMT




M1 – unadjusted
M2 – adjusted for sex
M3 – adjusted for sex & father's social class
M4 – adjusted for sex, father's social class & adult social class
M5 – adjusted for sex, father's social class, adult social class & household crowding

Reference – No qualifications
S16 – school up to age 16
S16+ – school post-16
HE – higher education

# Association between cumulative SEP and cIMT




M1 – unadjusted

M2 – adjusted for sex

M3 – adjusted for sex & education

M4 – adjusted for sex, education & household crowding

Reference – Stable non-manual

1 – Manual to non-manual

2 – Non-manual to manual

3 – Stable manual

# Summary of results

Relationships with cIMT:

✓ Childhood SEP (father's social class)

✓ Inverse with education

✓ Direct with household crowding

But

✗ Adult SEP (study member's social class)

✗ Cumulative SEP

✗ Effect modification by sex

# Discussion

Increased risk for accelerated vascular ageing for those who experienced greater disadvantaged in childhood and attained lower educational qualifications

Sensitive period in childhood for socioeconomic disadvantage and vascular ageing

- Similar results found:
  - Childhood SEP- Newcastle 1000 families (Lamont et al, 2000)
  - Childhood SEP (but also adult SEP and sex differences) in US Multi-Ethnic Study of Atherosclerosis (Lemelin et al, 2009)
- Support for early life sensitive period:
  - Childhood BMI and height with midlife cIMT (Johnson et al, 2014)

# Discussion

Possible pathways: BMI, health behaviours, embodiment

Conclusion: important to mitigate influence of childhood disadvantage on adult vascular ageing and CVD

Future research: extend to other cohorts, mediation analysis which includes SEP and other factors, e.g. health behaviours

# THANK YOU

**Medical Research Council**

**MRC Lifelong Health and Ageing Team**

**Study members of the MRC NSHD**