

# Educational inequalities in longevity: the mediating role of epigenetic aging in two cohort studies

**Dr. Cristian Carmeli, PhD**

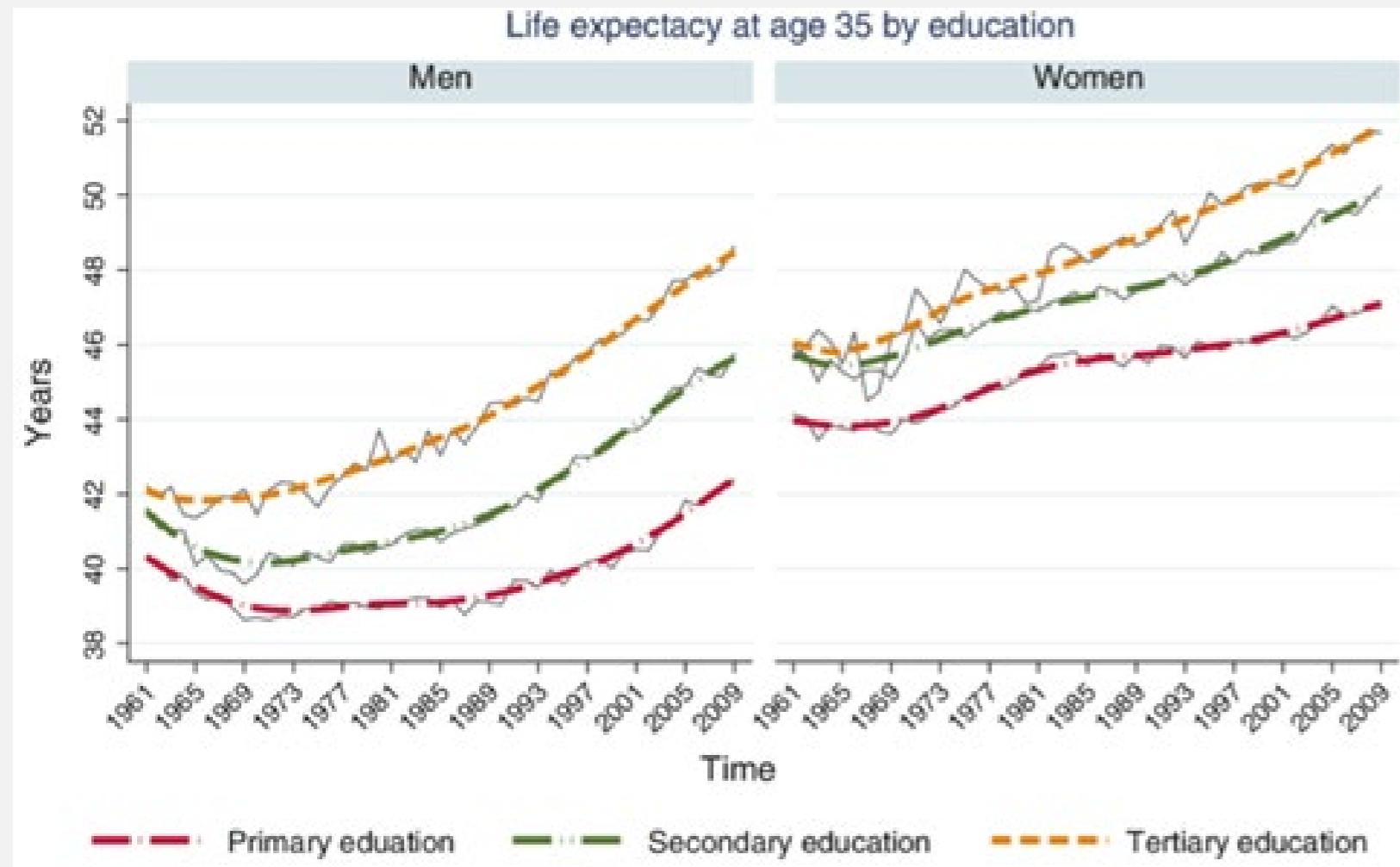
Population Health Laboratory (#PopHealthLab)

University of Fribourg, Fribourg, Switzerland

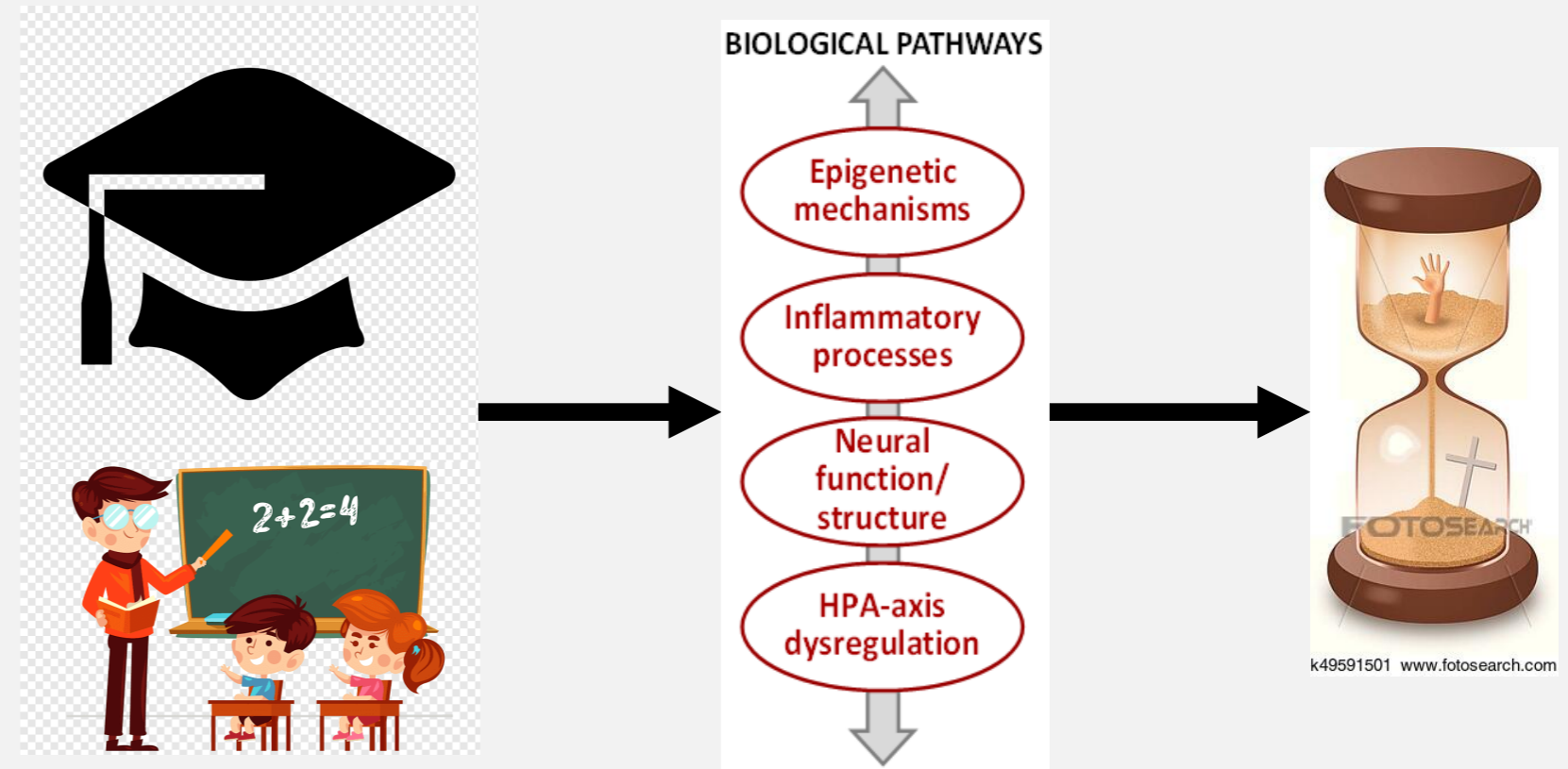
E-mail: [cristian.carmeli@unifr.ch](mailto:cristian.carmeli@unifr.ch)



# Education affects longevity through various putative biological pathways



Steingrimsdottir et al., EJE 2012



- Lack of studies interrogating the mechanistic role of biological pathways with data encompassing: education (exposure), biological pathways (mediator), and all-cause mortality (outcome)
- In this study, we explore the biological pathway by epigenetic clock as it predicts healthspan and lifespan (Bell et al., Genome Biology 2019)

# Data and methods

| Characteristics / Cohort                                    | EPIC              | MCCS              |
|---|-------------------|-------------------|
| Country   | Italy             | Australia         |
| N participants (w/m)  | 917 / 607         | 1,093 / 1,719     |
| Mean age at baseline (year)                                 | 53                | 69                |
| Highest educational attainment (primary/secondary/tertiary) | 1,038 / 334 / 152 | 1,879 / 292 / 641 |
| Mean follow-up (year)                                       | 15                | 14                |
| N all-cause deaths (w/m)                                    | 147 / 135         | 333 / 760         |

EPIC

European Prospective Investigation into Cancer and Nutrition

MCCS

Melbourne Collaborative Cohort Study

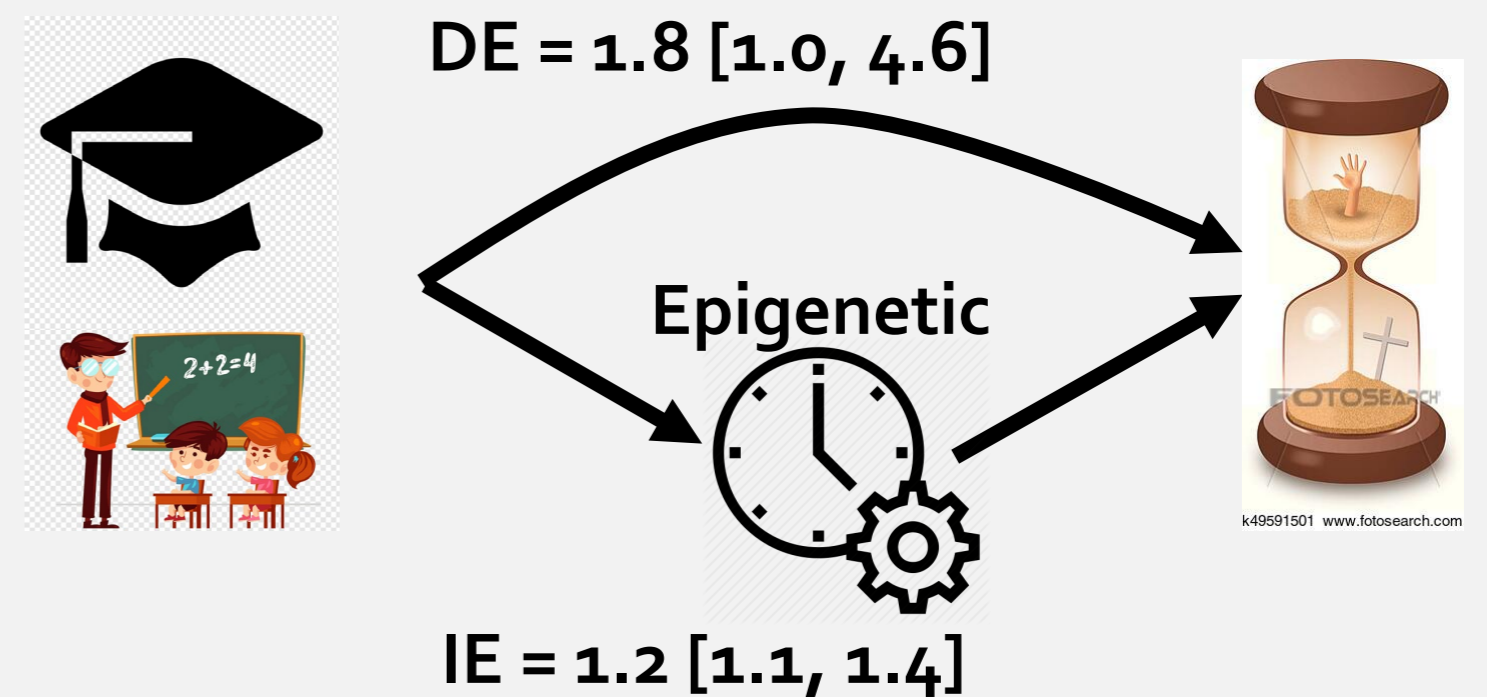
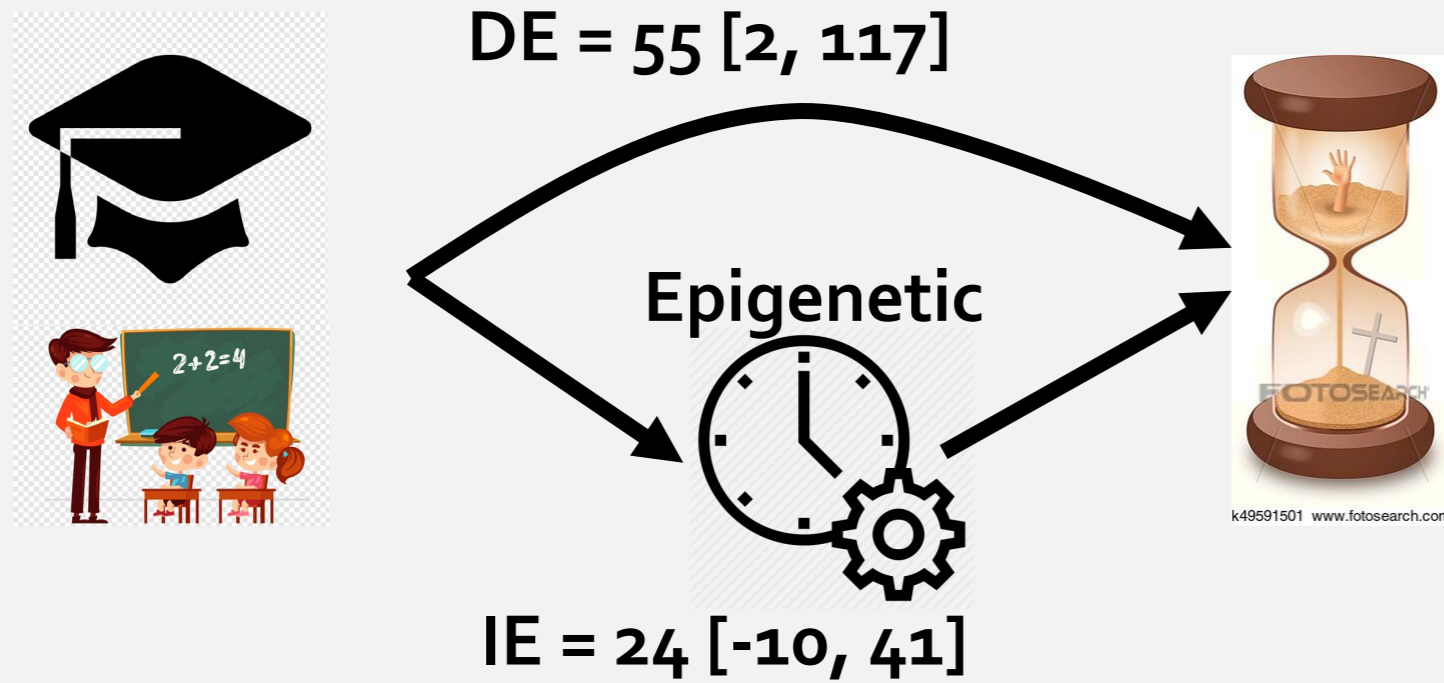
- Mediation method based on counterfactuals (IORW – Tchetgen Tchetgen, Stat Med 2013)
- Mediator – epigenetic clock – was derived via GrimAge estimator (Lu et al., Aging 2019)
  - Decomposed educational inequalities in all-cause mortality into:
    1. Portion through epigenetic clock – indirect effect IE
    2. Portion through other (unmeasured) pathways – direct effect DE
  - Used Aalen and Cox survival models to estimate:
    1. Absolute inequalities – excess deaths
    2. Relative inequalities – hazard ratios

# Results – primary vs tertiary education in men

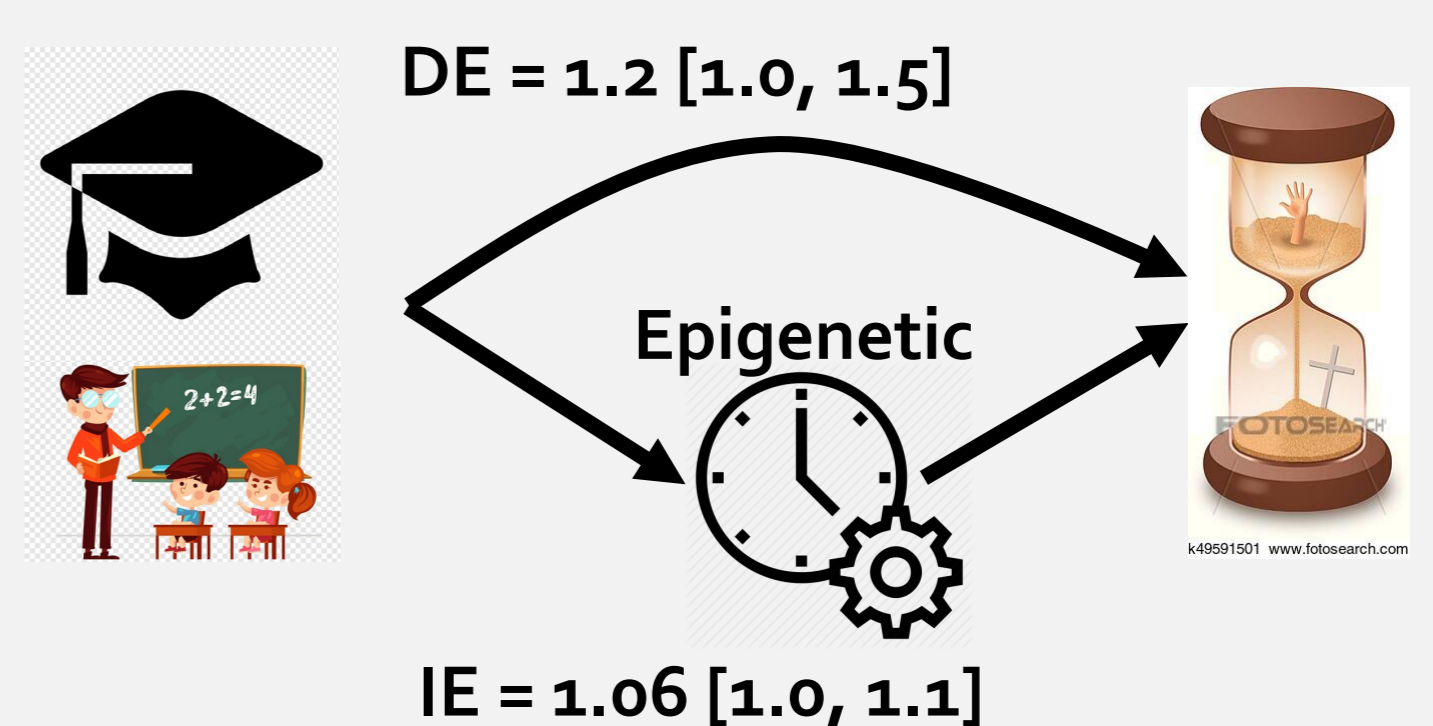
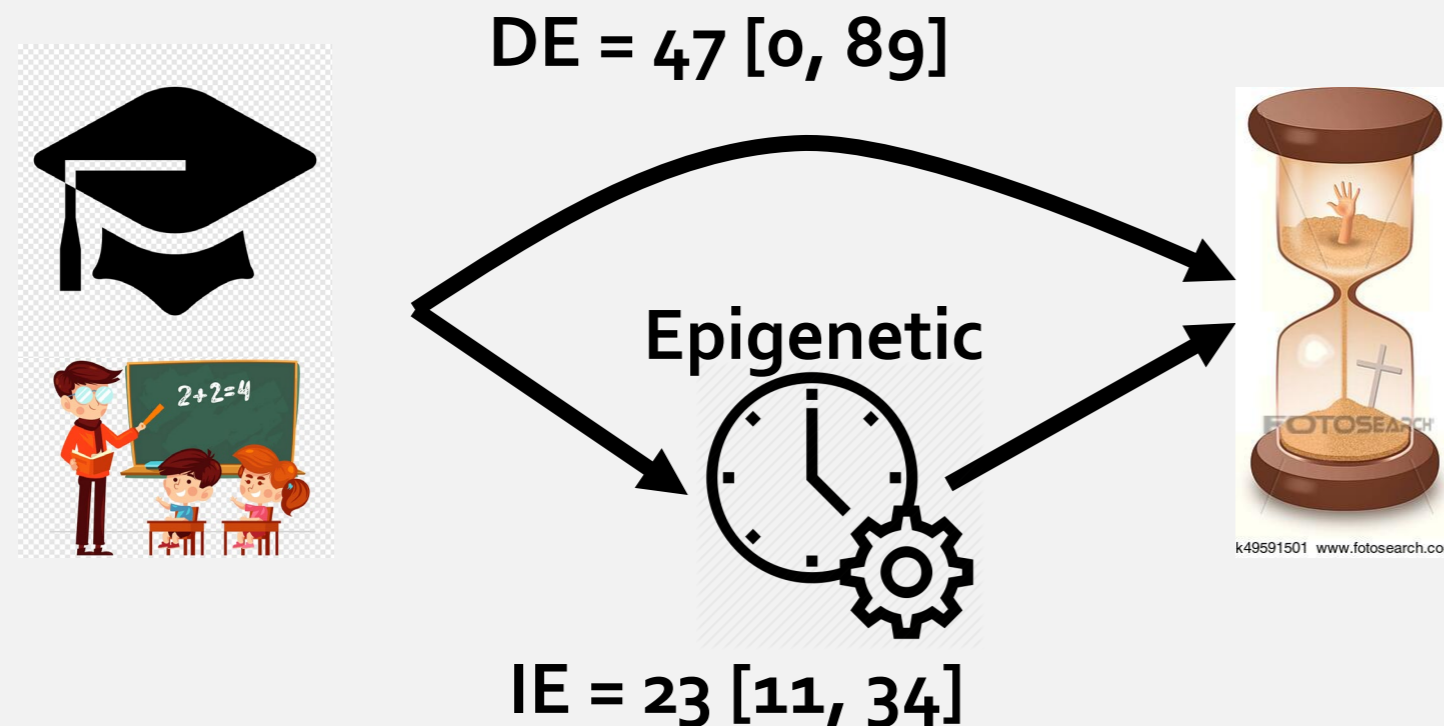
Excess deaths per 10,000 person-years [95% CI]

Hazard ratios [95% CI]

EPIC



MCCS



# Results summary

- Epigenetic clock is a biological pathway underpinning educational inequalities in all-cause mortality in men
- Found small educational inequalities in women but imprecise estimates – more data needed

## Ongoing work

- Collecting data from additional cohorts to strengthen confidence in our findings
- Performing sensitivity analyses for potential
  - i) unmeasured confounding
  - ii) errors in epigenetic clock measurement

### Thanks to our collaborators

Giovanni Fiorito and Paolo Vineis – Imperial College London, UK

Vittorio Krogh, Simonetta Guerrera, Giuseppe Matullo, Salvatore Panico, Carlotta Sacerdote, Rosario Tumino – EPIC

Allison Hodge, Graham Giles, Pierre-Antoine Dugué – MCCS