



# A Social Global Burden of Disease

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<https://www.ntnu.edu/chain#/view/about>



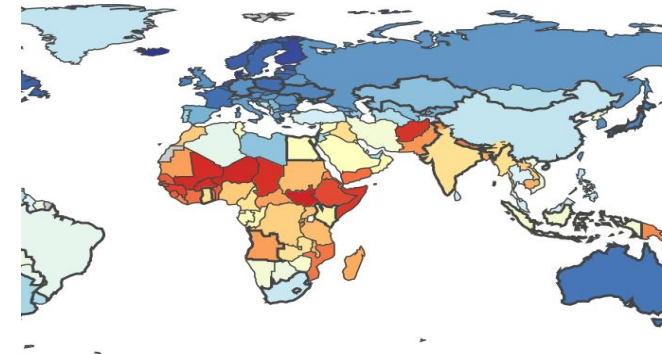
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## CHAIN in the Global Burden of Disease Study

- Inclusion of education as the first socio-economic risk factor in GBD study.



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and Evaluation

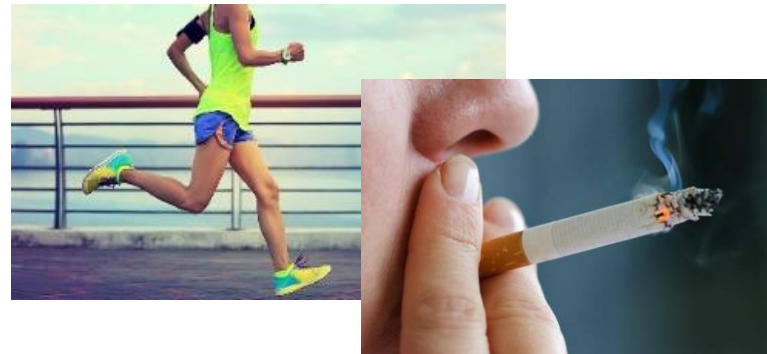


# What is a risk factor?

- Any exposure that leads to a loss of health in the population
- Can be anywhere on the causal chain



**patho-physiological** risks such as high blood pressure

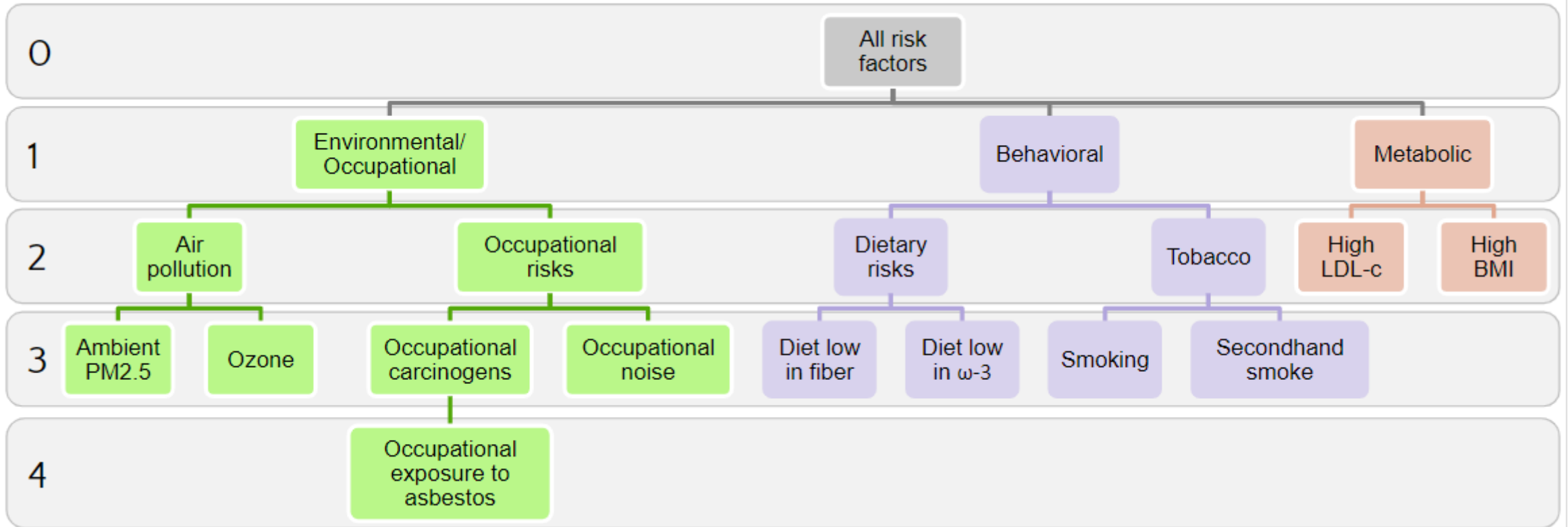


**proximal risks** associated with specific behaviours such as smoking

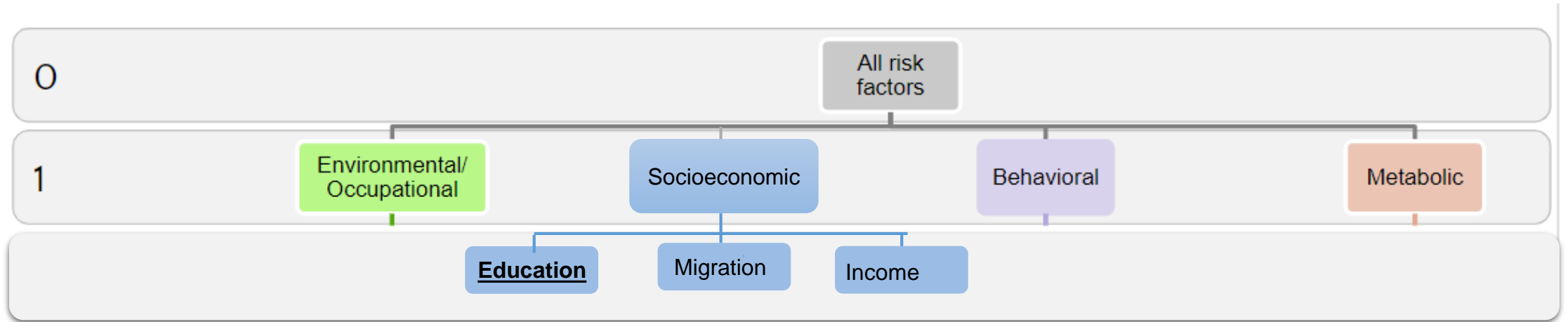


more **structural determinants** of health (distal) such as income, poverty or education

# GBD risk factor hierarchy

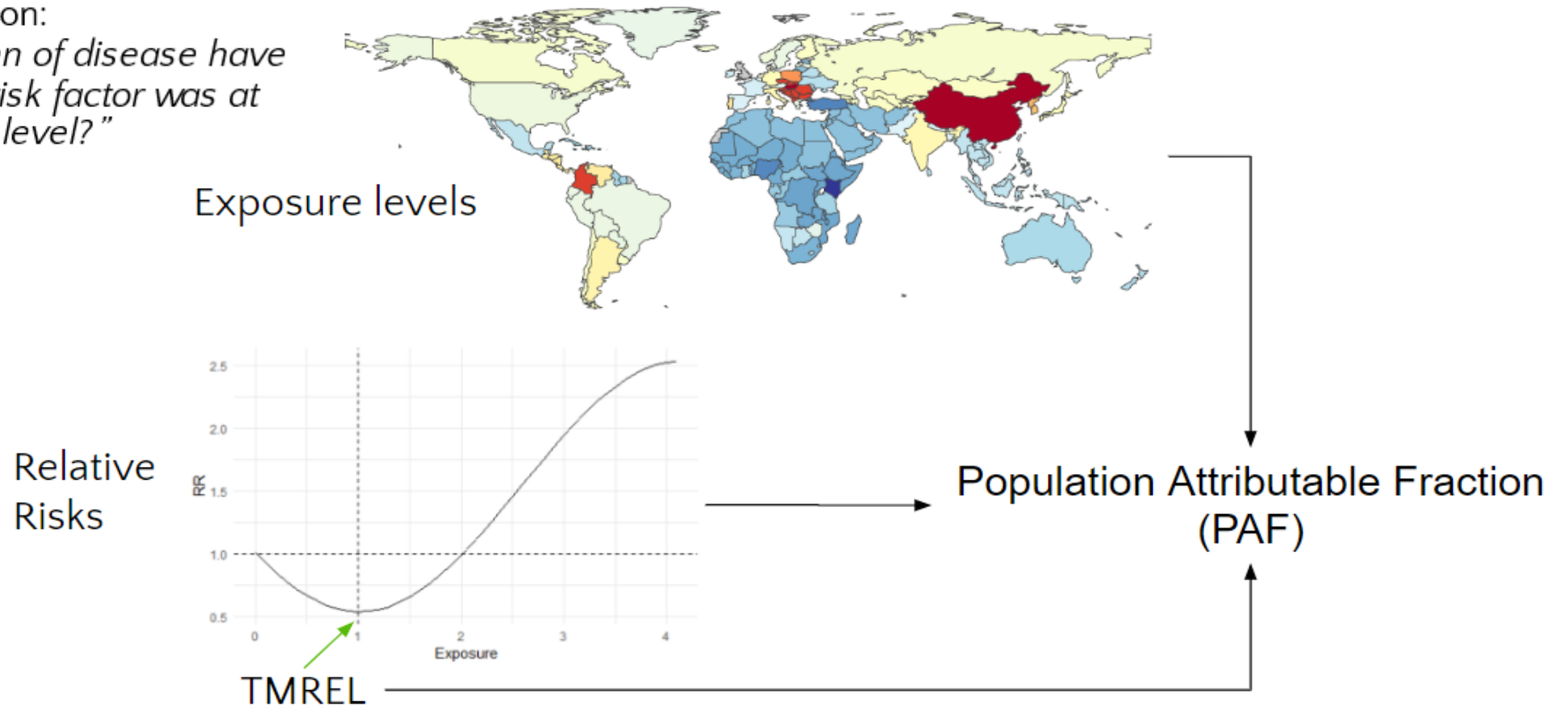


# Socioeconomic risk factor

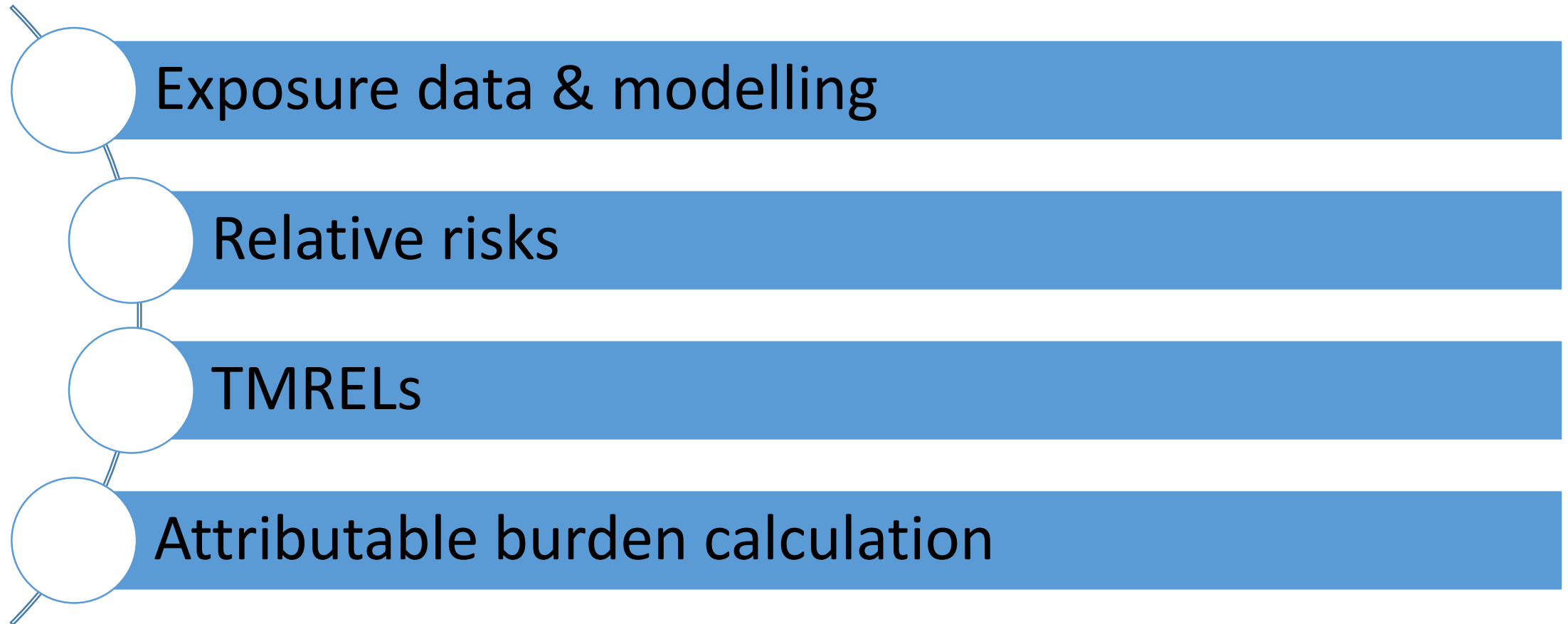


# Comparative Risk Assessment (CRA) Framework

- Counterfactual attribution:  
*“What would the burden of disease have been if exposure to a risk factor was at a theoretical minimum level?”*



## GBD risk analysis: steps



- **Global meta-analysis:**

- **Educational inequalities in child mortality**
  - **Educational inequalities in adult mortality**
  - **Educational inequalities in cause-specific mortality**
-



# Meta-analytic approach: steps

- Search for and extract data from published studies
- Estimate relative risks for association between exposure and outcome
- Evaluate evidence for publication bias

# Systematic review

- Search literature for studies that present relevant measures of association
- Apply inclusion/exclusion criteria to select appropriate sources
- Extract data:
  - Demographics: location, age, sex, race,
  - Sample size: number of participants and events in each exposure group
  - Follow-up: duration of follow-up
  - Study design and analytic details (e.g. adjustment variables)
  - Exposure definition, units, assessment method and range for each reported category
  - Outcome definition and ascertainment method
  - Relative risk estimate and its corresponding uncertainty

- Ability to model non-linear associations with splines with automatic knot selection and shape constraints
- Ability to use study-level covariates to account for elements of study design that could introduce bias
- Ability to estimate uncertainty with and without consideration of between-study heterogeneity
- Ability to assess publication bias.





# THE LANCET

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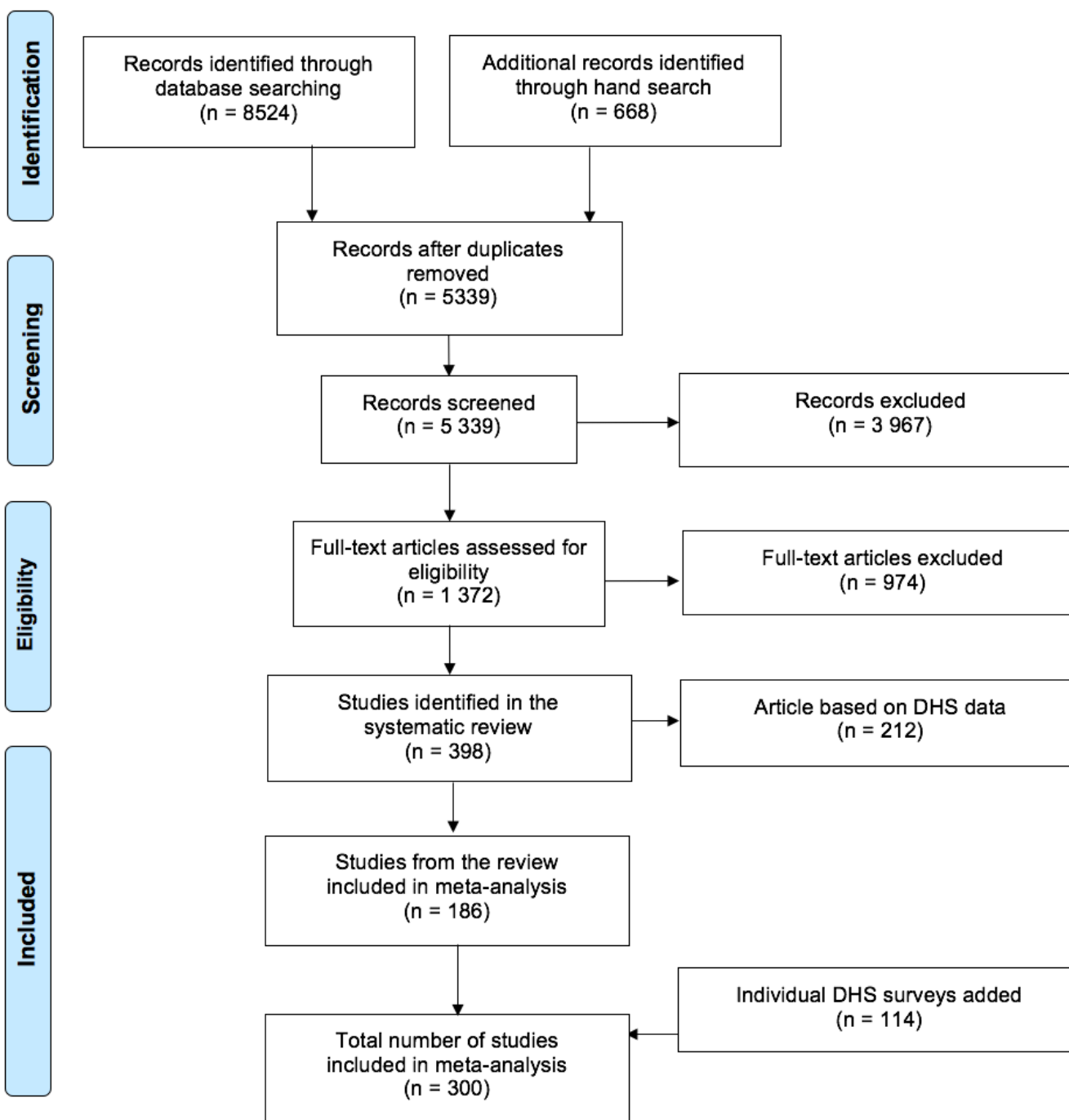
Articles

## Parental education and inequalities in child mortality: a global systematic review and meta-analysis

Mirza Balaj PhD <sup>a\*</sup>, Hunter Wade York MPH <sup>b, d\*</sup>, Kam Sripada PhD <sup>a\*</sup>, Elodie Besnier MA <sup>a</sup>, Hanne Dahl Vonen <sup>a</sup>, Aleksandr Aravkin PhD <sup>b, c, e</sup>, Joseph Friedman MPH <sup>b, f</sup>, Max Griswold MA <sup>g</sup>, Magnus Rom Jensen MA <sup>h</sup>, Talal Mohammad MSc <sup>a</sup>, Erin C Mullany BA <sup>b</sup>, Solvor Solhaug MA <sup>h</sup>, Reed Sorensen MPH <sup>b, e</sup>, Donata Stonkute MSc <sup>a</sup>, Andreas Tallaksen cand.psych <sup>i</sup>, Joanna Whisnant MPH <sup>b</sup>, Peng Zheng PhD <sup>b, e</sup>, Prof Emmanuela Gakidou PhD <sup>b, e, †</sup>    

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# PRISMA



- **Literature search of 7 databases:** CINAHL, Embase, MEDLINE, PsycINFO, PubMed, Scopus, and Web of Science
- Primary analyses of **Demographic and Health Survey (DHS)** data.
- **Mortality at six age intervals:** 0-1 month, 0-12 months, 0-60 months, 1-12 months, 12-60 months, and 1-60 months.
- **Key study-level covariates:** age (43%), sex (30%), parity (18%), urban/rural (17%), marital status (13%), ethnicity (12%), wealth index (11%).
- Registered with PROSPERO (CRD42020141731)

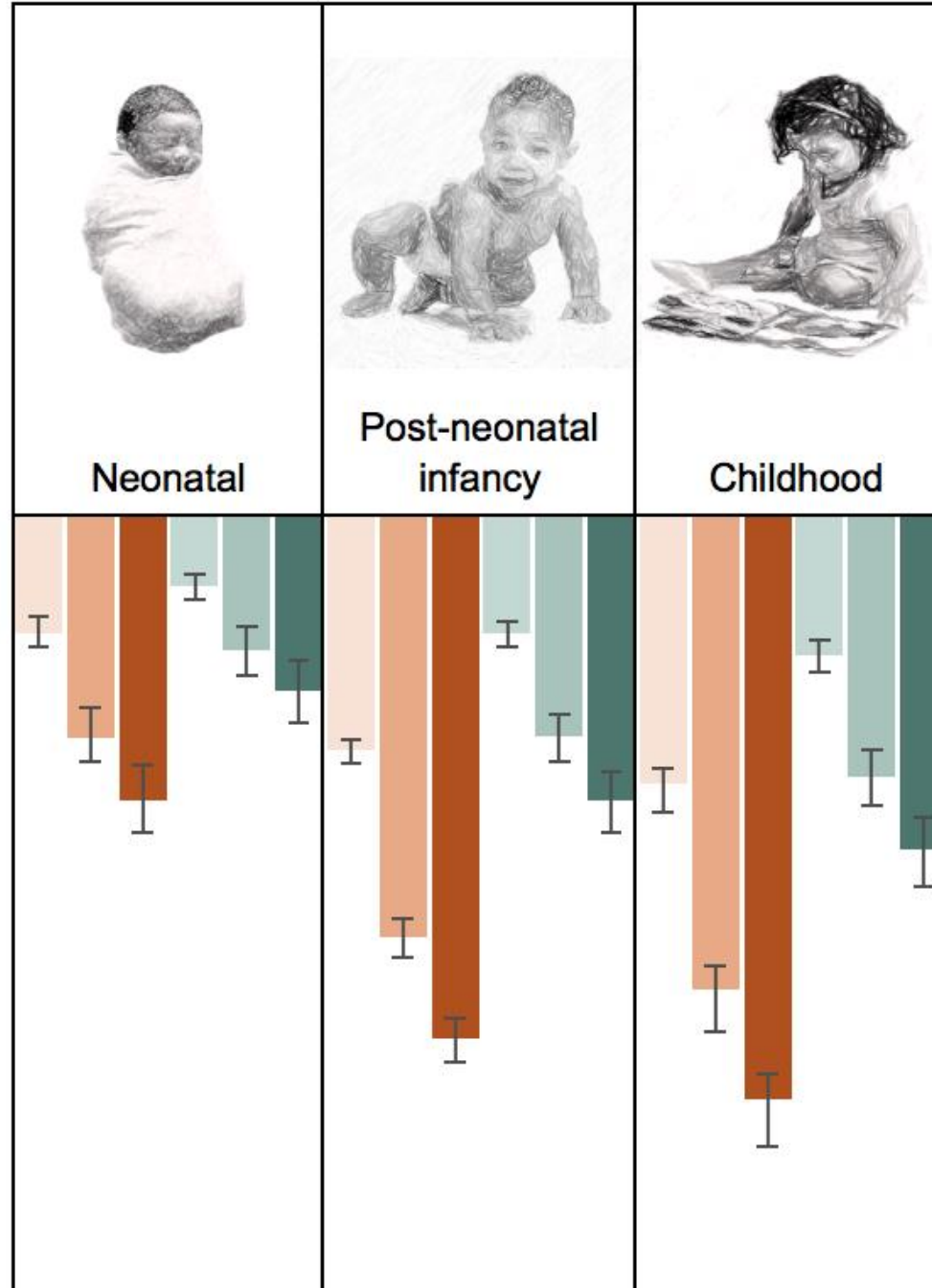
## Profile of included studies

- All included studies were published in the last 40 years
- Covered cohorts starting as early as 1967 and cross-sectional studies covering the lifetimes of the mothers interviewed
- Literature biased heavily towards studies examining child survival and maternal education (83.3% of observations)
- GBD high-income super-region accounted for 45.0% of observations used in meta-analysis

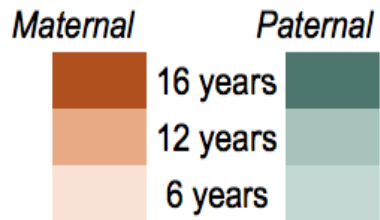


- **Both increased maternal and paternal education exhibit a dose-response relationship linked to reduced under-5 mortality**
- A single additional year of schooling is, on average, associated with a reduction in under-5 mortality of 3.04% (2.82% to 3.23%) for maternal education and 1.57% (1.35% to 1.72%) for paternal education.
- The association between higher parental education and lower child mortality was significant for both parents at all ages studied and largest after the first month of life.





Parent's years of completed education

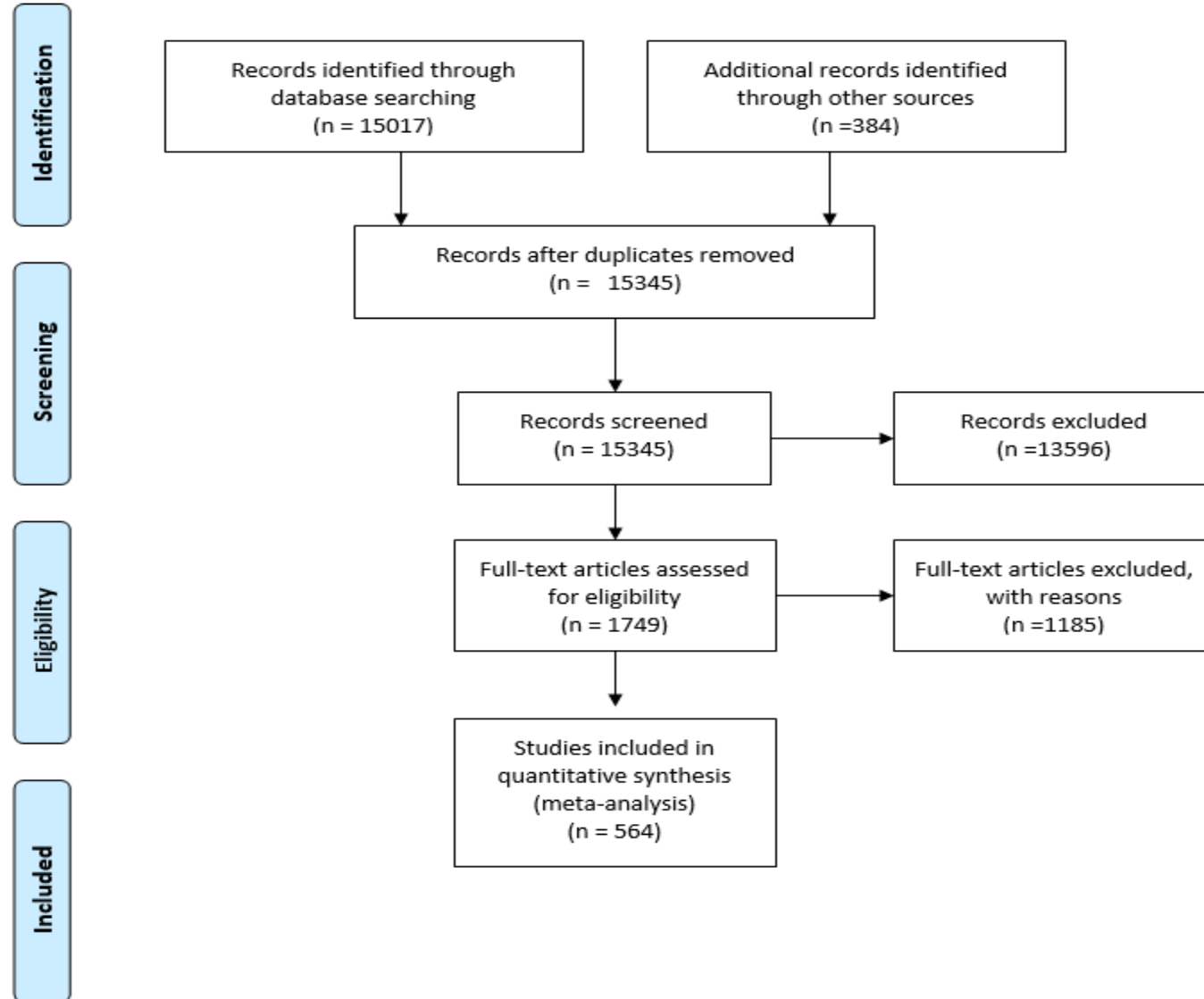


- Reduction in under-5 mortality of 31% (95% CI: 29% to 32.6%) for children born to mothers with 12 years of education
- Reduction in under-5 mortality of 17.3% (15% to 18.8%) for children born to fathers with 12 years of education

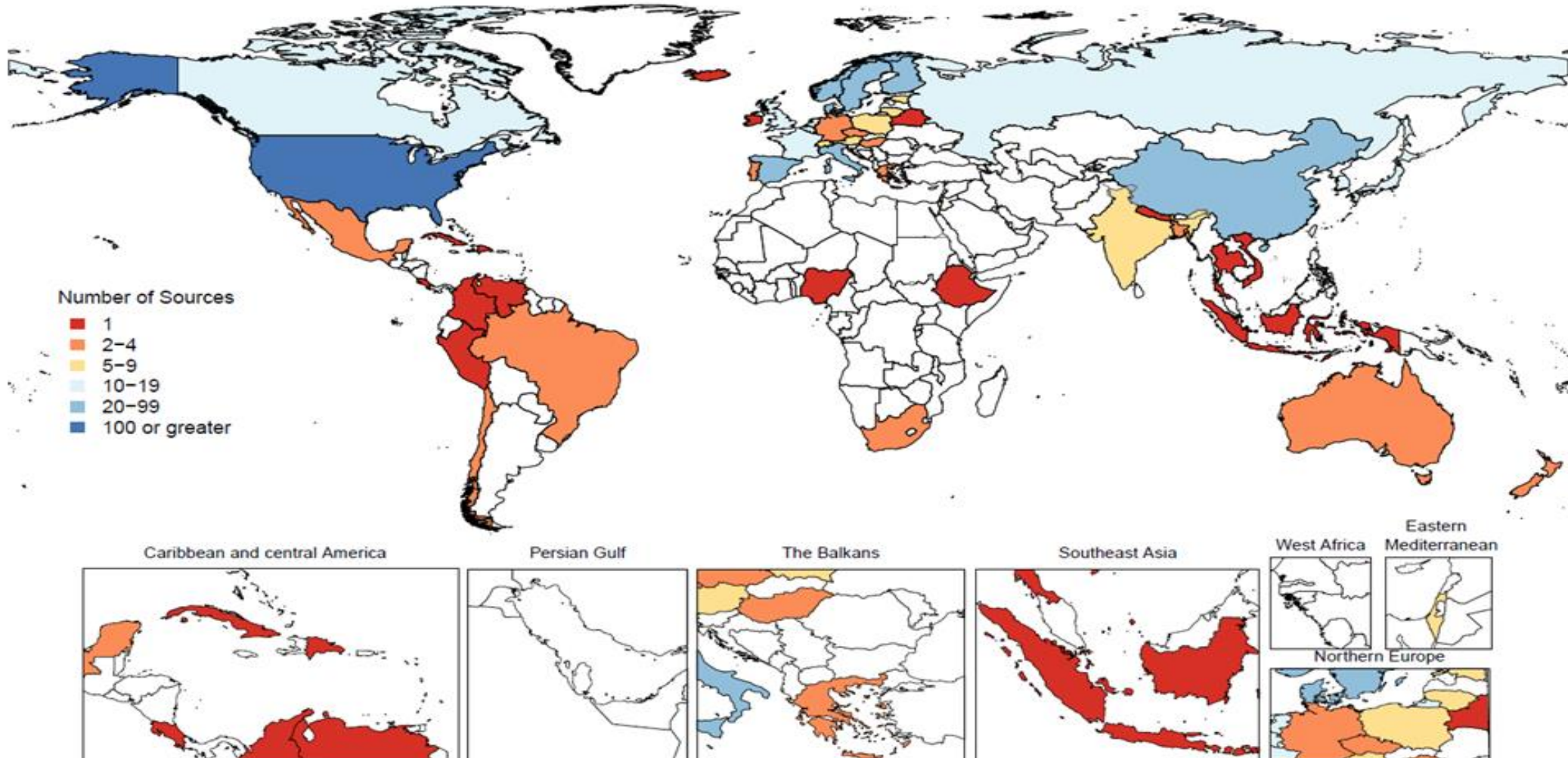
## **Social inequalities in adult mortality: a global systematic review and meta-analysis**

Mirza Balaj, Claire Henson, Lorena Donadello, Joseph Friedman, Talal Mohammad, Hunter York, Hanne Dahl Vonen, Kristoffer Eikemo, Anna Gkiouleka, Anders Hult, Claire Degail, Celine Westby, Indrit Gradeci, Donata Stonkute, Kathryn Beck, Amanda Aronsson, Kam Sripada, Solvor Solhaug, Magnus Rom Jensen, Emmanuela Gakidou, Terje Andreas Eikemo

## PRISMA



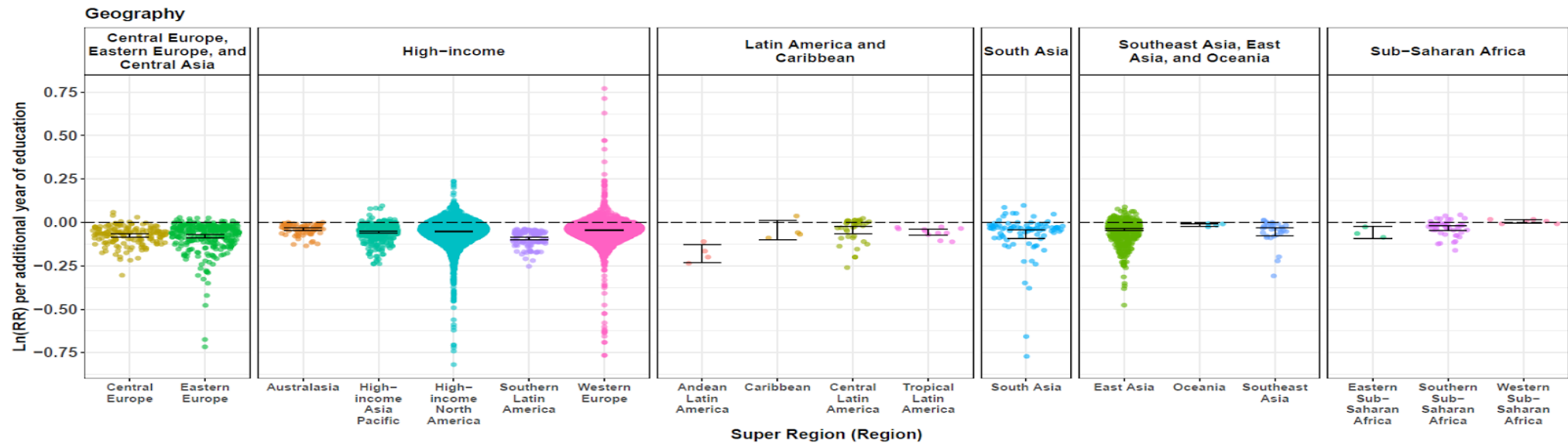
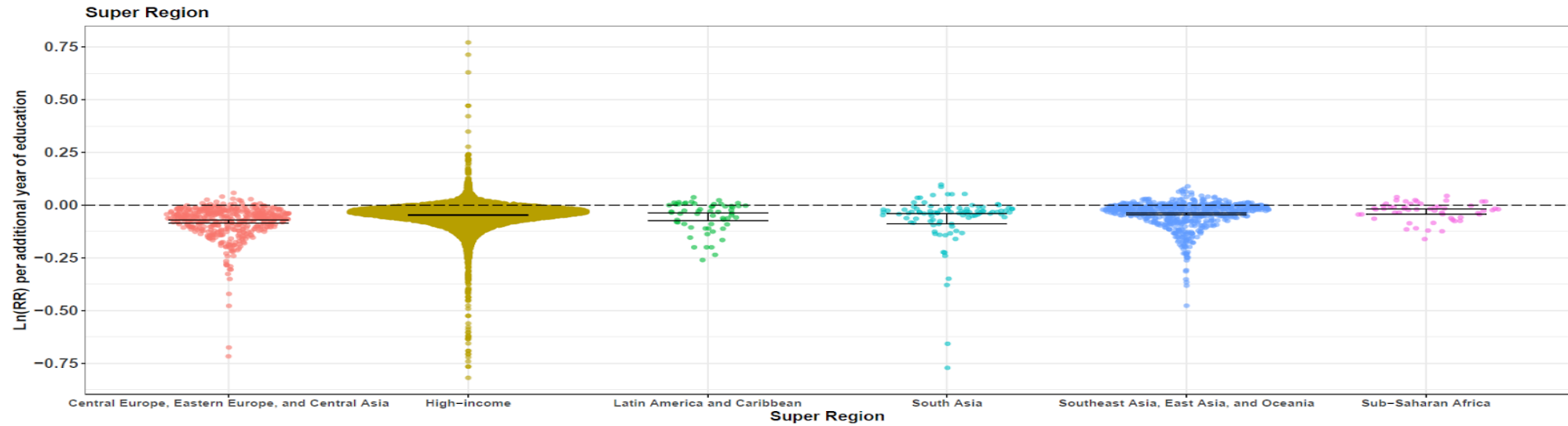
# Included studies by country



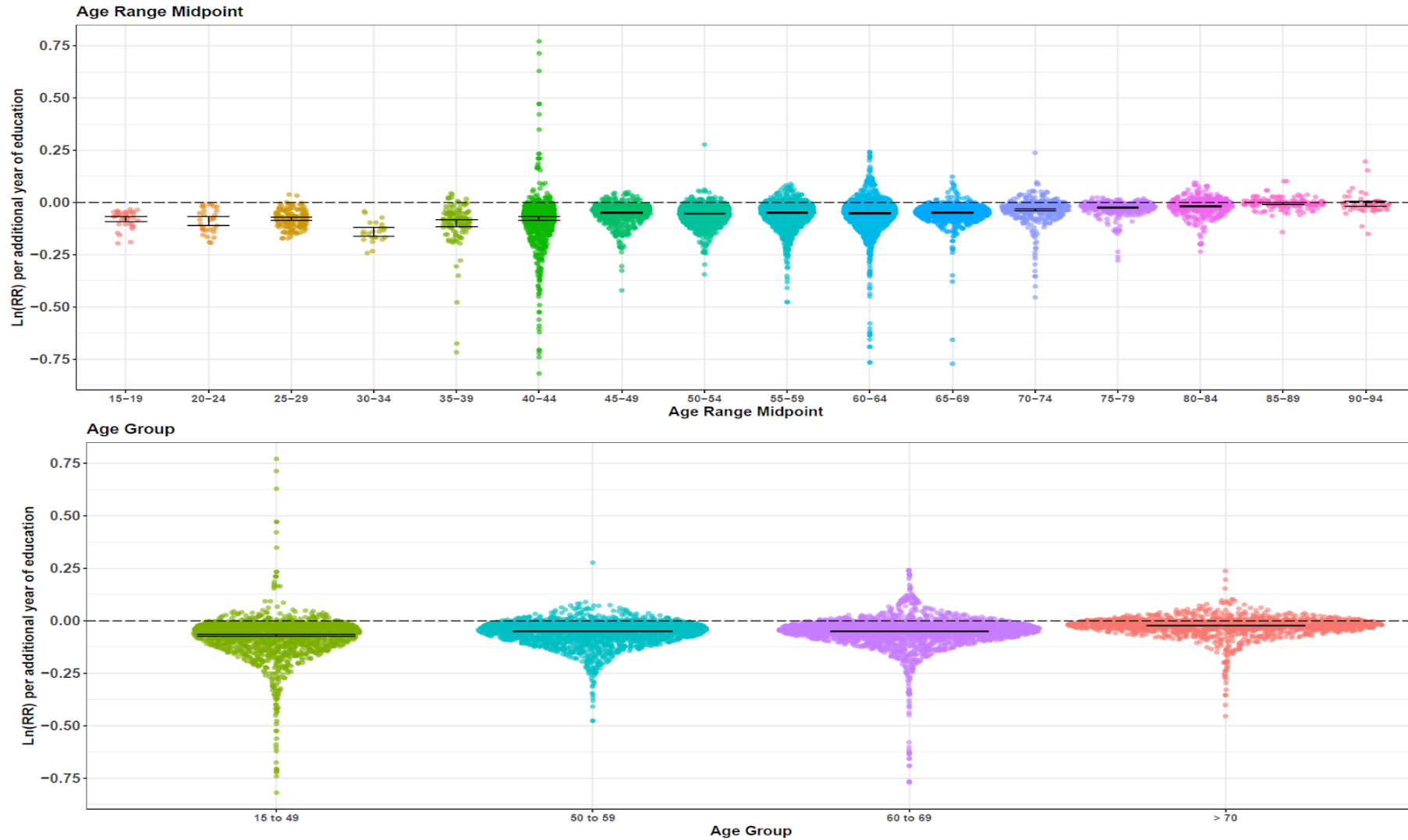
# Profile of included studies

- Over 80% of the studies examined inequalities in the last 30 years.
- Covered cohorts starting as early as 1921.
- The most common study design was retrospective cohort (71%) and almost half of the studies had a follow up time of more than 10 years.
- Main study level controls – age (67%), sex (34-44%), race/ethnicity (28-82%), marital status (23%), wealth (22-58), behavioral (30-34%) and biomedical (23-27%).
- GBD high-income super-region accounted for 85-15% of observations used in meta-analysis.

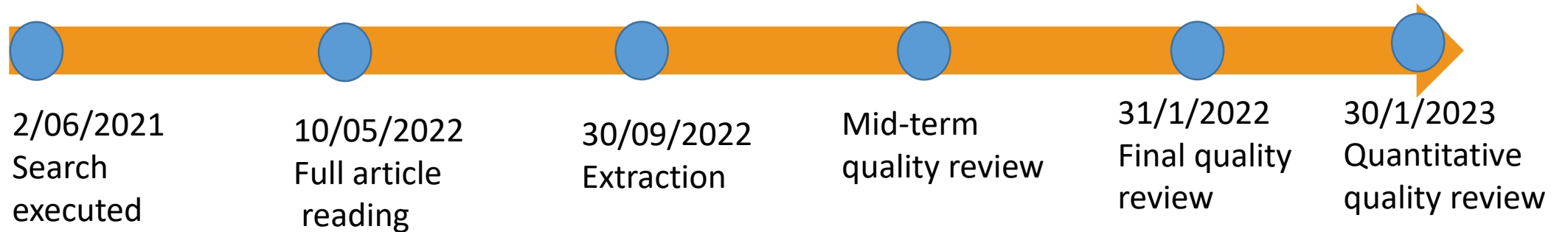
# Results – geography



# Results – age



# Adult cause-specific mortality review



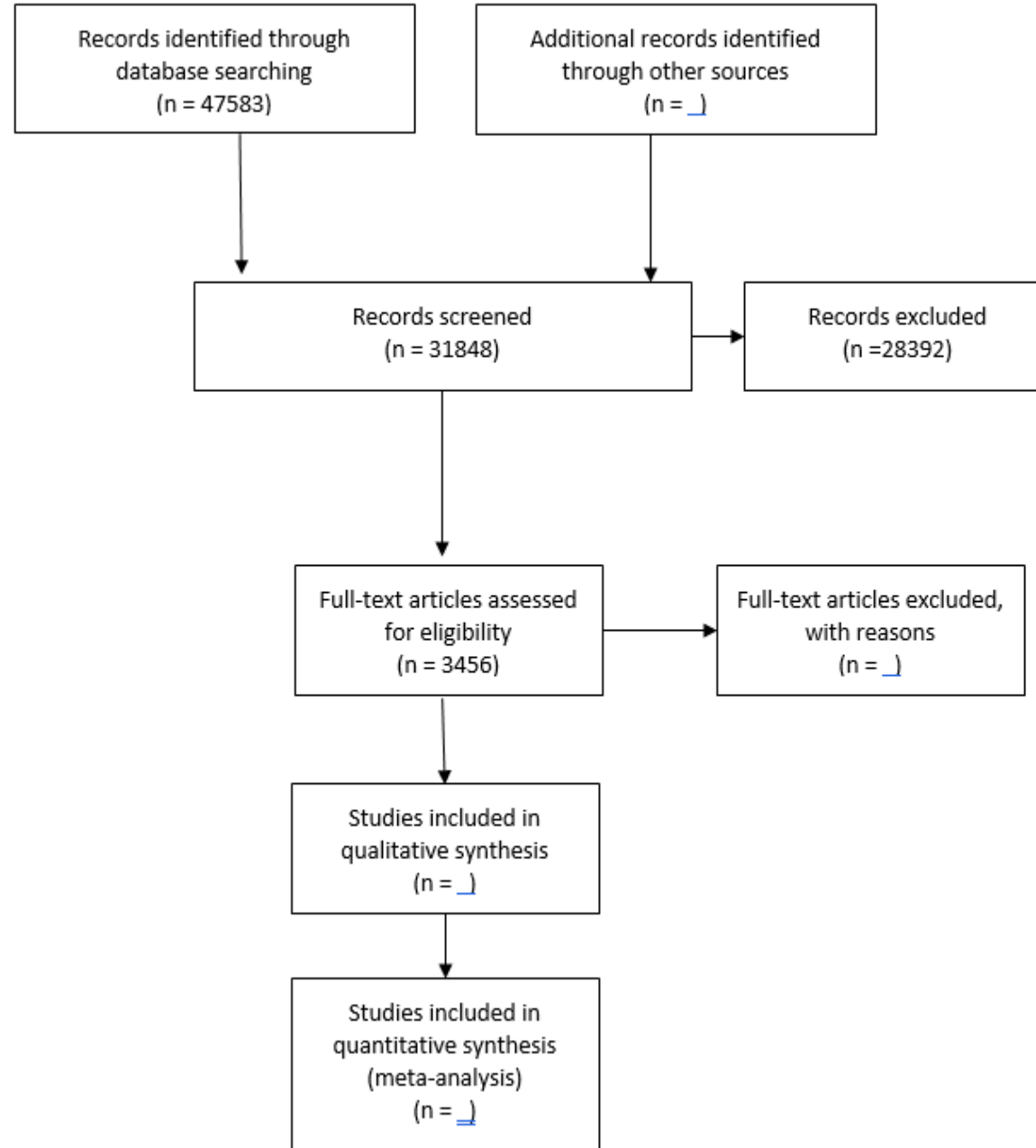


Identification

Screening

Eligibility

Included



## **The determinants of educational inequalities in mortality: a mediation analysis.**

Hanne Dahl Vonen, Mirza Balaj, Claire Henson, Lorena Donadello, Joseph Friedman, Talal Mohammad, Hunter York, Kristoffer Eikemo, Anna Gkiouleka, Anders Hult, Claire Degail, Celine Westby, Indrit Gradeci, Donata Stonkute, Kathryn Beck, Amanda Aronsson, Kam Sripada, Solvor Solhaug, Magnus Rom Jensen, Emmanuela Gakidou, Terje Andreas Eikemo

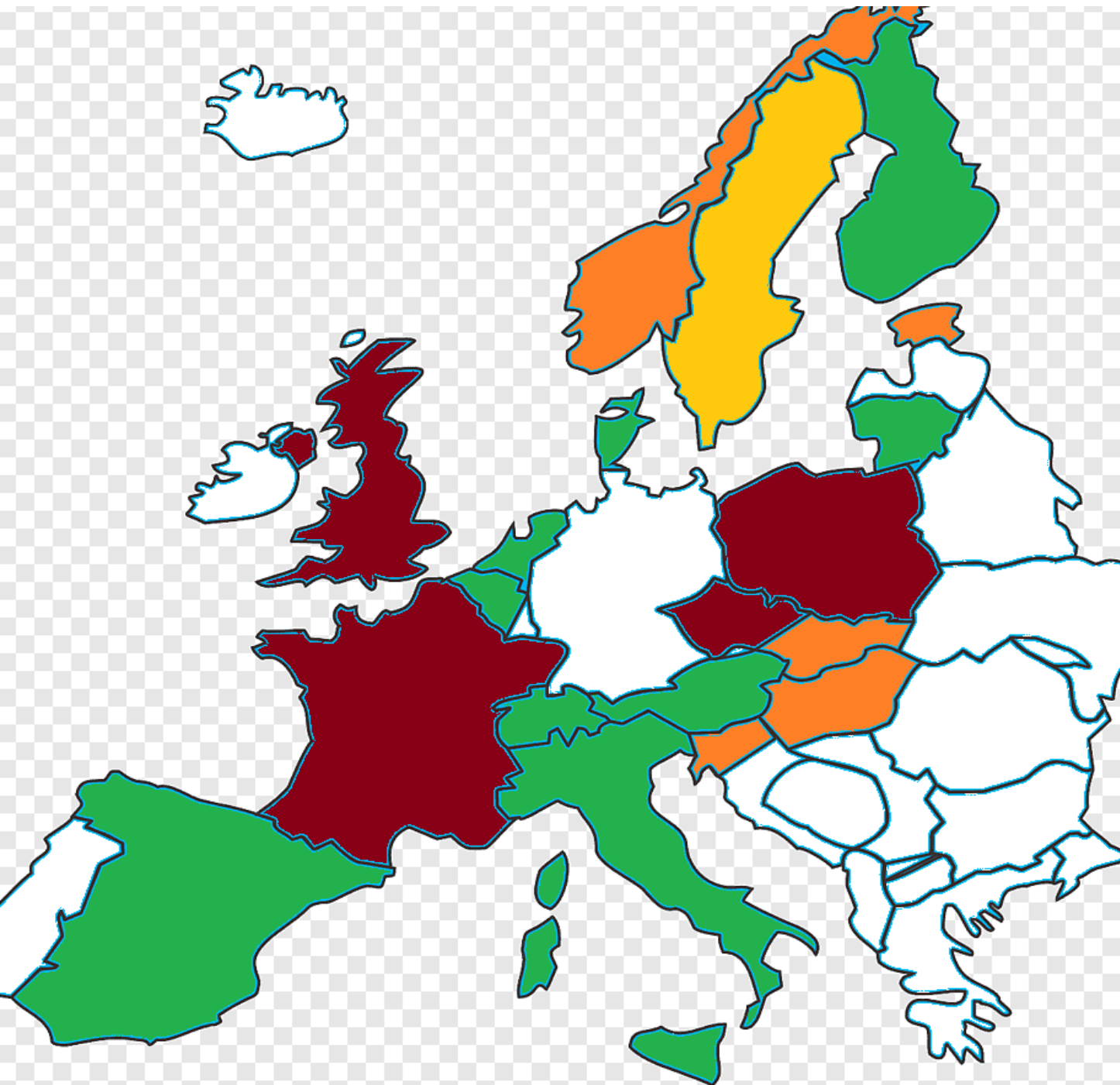
## CHAIN in mortality data collection

1. Collection and harmonization of 2015-2019 mortality data in 15 European countries
2. Trend and cohort analysis of social inequalities in cause-specific mortality



**Erasmus  
University  
Rotterdam**





1. Austria
2. Belgium
3. Czech Republic
4. Denmark
5. England & Wales
6. Estonia
7. Finland
8. France
8. Hungary
9. Italy-national
10. Italy-Turin
11. Lithuania
12. Netherlands
13. Norway
14. Poland
15. Slovakia
16. Slovenia
17. Spain national
18. Spain Barcelona
19. Sweden
20. Switzerland



1. **sex**
2. **5 year age-group**
3. marital status
4. country of birth
5. **educational level**
6. activity status
7. occupational class
8. **number of subjects enumerated at census**
9. **number of person-years at risk during the follow-up period**
10. **total number of deaths during the follow-up period**
13. number of cause-specific deaths



minimal  
variables  
available

some  
variables  
available

all  
variables  
available

## Next steps

- Testing for pattern of association between risk factors:
  - Mediation analysis
  - European comparative data (possible modelling of EHIS/ESS surveys for risk factors)
  - High-quality registry data (Norway, Sweden etc)
  - Build a socioeconomic contributor network with partners from global north and south.