Education, health and mortality across the world: evidence from the ATHLOS project

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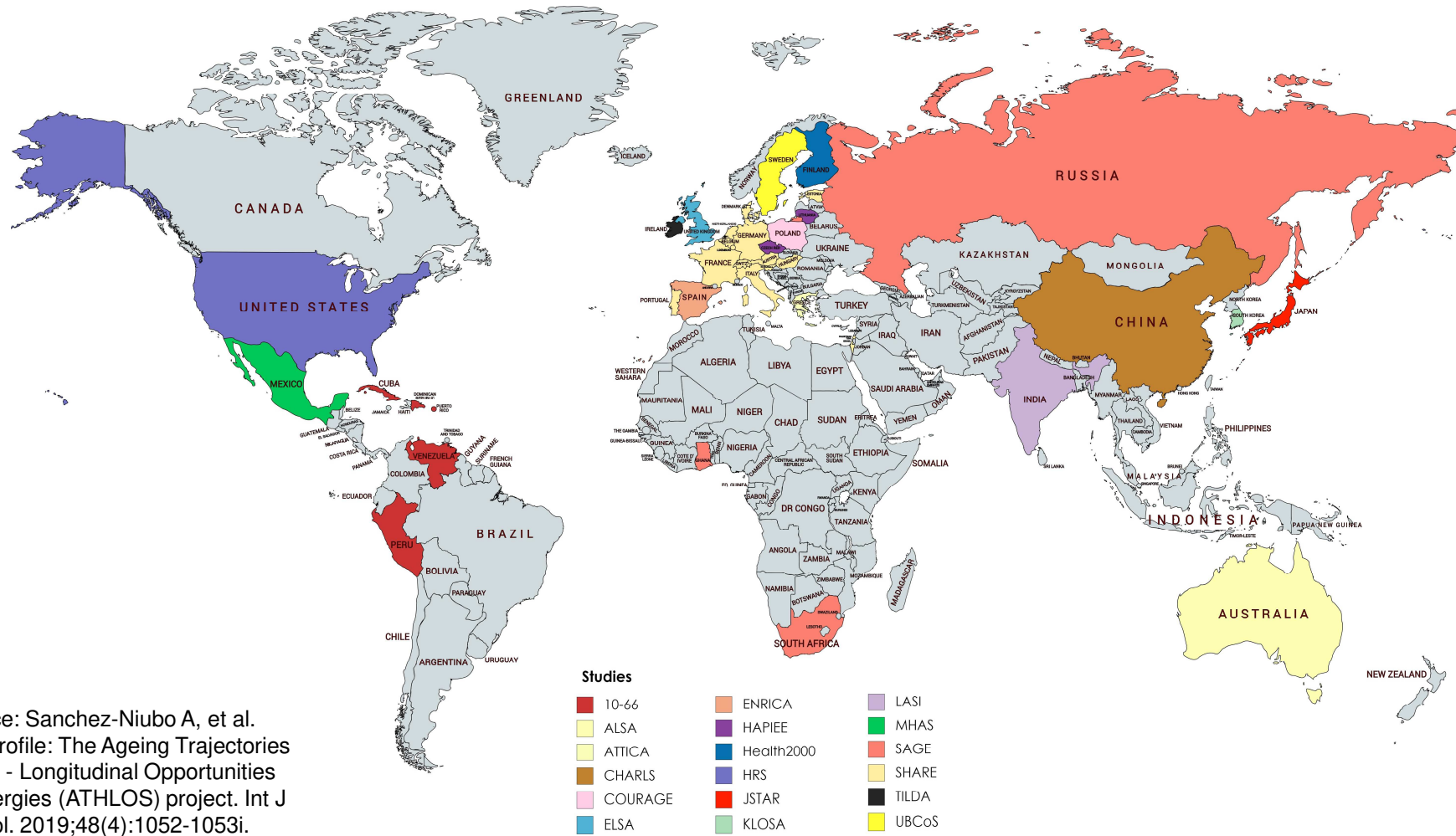
European Commission

Ageing Trajectories of Health: Longitudinal Opportunities and Synergies (ATHLOS)

- To achieve a better understanding of ageing by identifying trajectories of healthy ageing and relevant risk factors and determinants

  - Harmonised data from 17 ageing cohort studies across the world (N=411,000+)
  - Developed a common measure for healthy ageing
  - Examined trajectories of healthy ageing and relevant risk factors and determinants

Reference: Sanchez-Niubo A, et al. Cohort Profile: The Ageing Trajectories of Health - Longitudinal Opportunities and Synergies (ATHLOS) project. Int J Epidemiol. 2019;48(4):1052-1053i.

# 17 cohort studies included in the ATHLOS project (38 countries)

Reference: Sanchez-Niubo A, et al. Cohort Profile: The Ageing Trajectories of Health - Longitudinal Opportunities and Synergies (ATHLOS) project. Int J Epidemiol. 2019;48(4):1052-1053i.

Studies

- 10-66
- ALSA
- ATTICA
- CHARLS
- COURAGE
- ELSA
- ENRICA
- HAPIEE
- Health2000
- HRS
- JSTAR
- KLOSA
- LASI
- MHAS
- SAGE
- SHARE
- TILDA
- UBCoS

ATHLOS Healthy Ageing Score

41 items on health and functional limitations
- Functional ability: ADL, IADL, mobility
- Cognitive function
- Physical functioning: gait speed, walking
- Sensory impairment: visual, hearing
- Sleep problems, pain, energy

Harmonised into binary variables (yes vs no difficulties; normal vs abnormal)
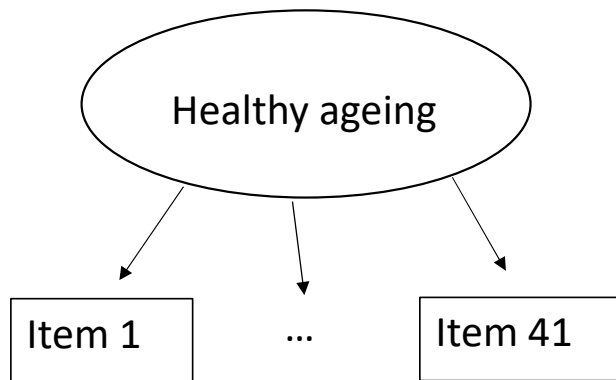
Item Response Theory (IRT) model to estimate underlying latent construct of healthy ageing (score range 0-100)

Healthy ageing

Item 1   ...   Item 41

Reference: Sanchez-Niubo A, et al. Development of a common scale for measuring healthy ageing across the world: results from the ATHLOS consortium. Int J Epidemiol. 2021;50(3):880-892.

Education measure in ATHLOS

- Harmonised education qualification (available in 17 cohort studies, N=326,256)

| ATHLOS education	Total	High income	Low and middle income	Eight longitudinal studies
Less than primary	13%	7%	31%	9%
Primary	23%	21%	30%	23%
Secondary	47%	52%	31%	50%
Tertiary	17%	20%	8%	18%

Education and trajectories of healthy ageing

- Eight cohort studies with at least three waves (N=141,214)
    - Australian Longitudinal Study of Ageing (ALSA)
    - English Longitudinal Study of Ageing (ELSA)
    - Study on Cardiovascular Health, Nutrition and Frailty in Older Adults in Spain (ENRICA)
    - Health and Retirement Study (HRS)
    - Japanese Study of Ageing and Retirement (JSTAR)
    - Korean Longitudinal Study of Ageing (KLOSA)
    - Mexican Health and Ageing Study (MHAS)
    - Survey of Health Ageing and Retirement in Europe (SHARE)

- Education: low (primary or less), middle (secondary), high (tertiary)

Reference: Wu YT, et al. Education and wealth inequalities in healthy ageing in eight harmonised cohorts in the ATHLOS consortium: a population-based study. Lancet Public Health. 2020;5(7):e386-e394.

The 'effect' of education on trajectories of healthy ageing

(A) Baseline

(B) Baseline + slope
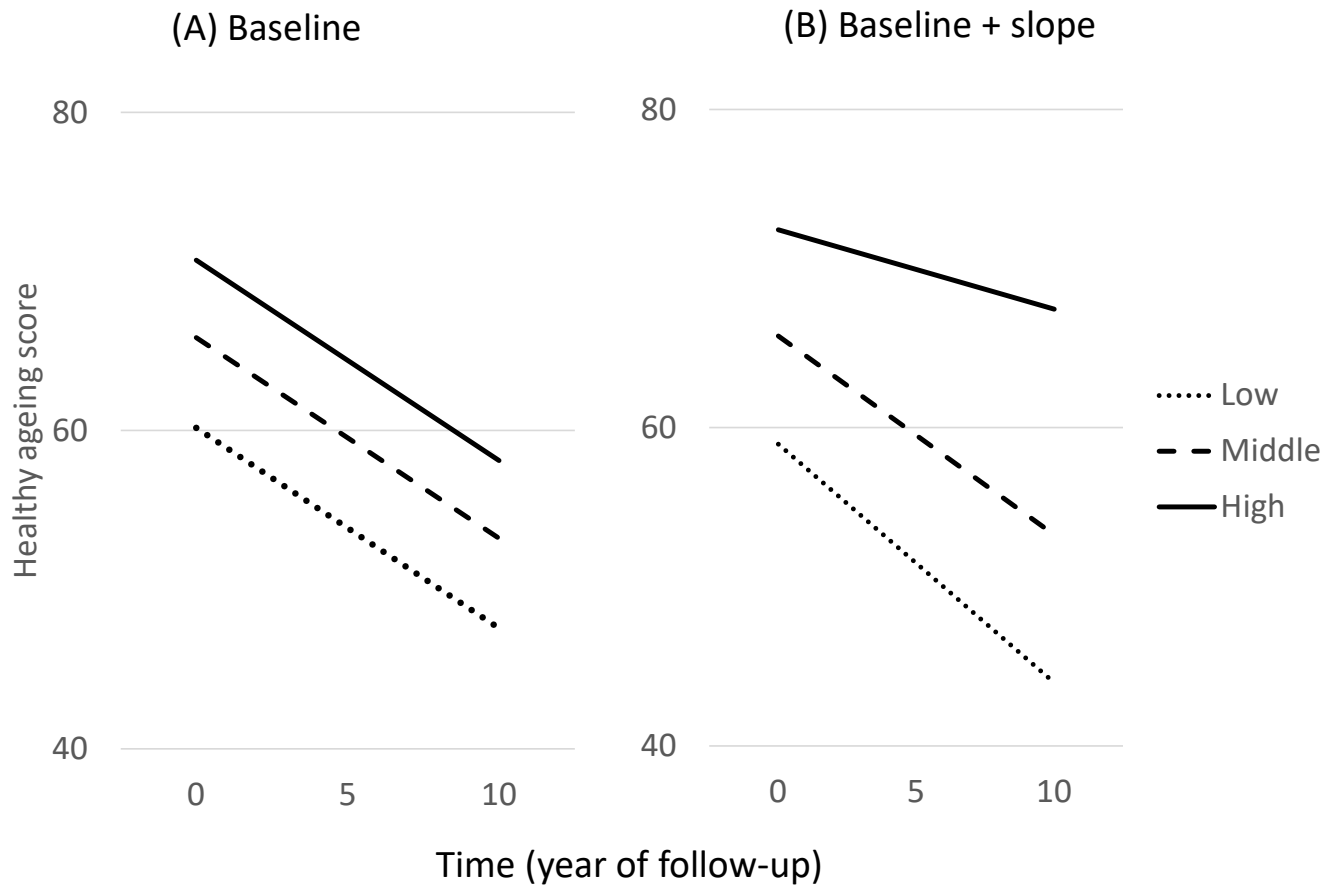
- Multilevel modelling
- Modelled by year of follow-up; centred at age 70
- Adjusted for age, sex, cohort study
- The overall population and potential variation across studies

Modelling results: adjusted for age, gender and study

	Education	
	Model A	Model B
	Coeff. (95% CI)	Coeff. (95% CI)
Baseline score	60.18 (59.96, 60.41)	58.97 (58.85, 59.48)
Low: primary or less	Ref.	Ref.
Middle: secondary	5.66 (5.49, 5.83)	6.80 (6.44, 7.15)
High: tertiary	10.54 (10.31, 10.77)	13.48 (13.02, 13.94)
Decline rate	-1.26 (-1.28, -1.24)	-1.28 (-1.31, -1.25)
Low: primary or less		Ref.
Middle: secondary		0.01 (-0.03, 0.04)
High: tertiary		0.04 (0.00, 0.09)

Reference: Wu YT, et al. Education and wealth inequalities in healthy ageing in eight harmonised cohorts in the ATHLOS consortium: a population-based study. Lancet Public Health. 2020;5(7):e386-e394.

Differential impacts of education on baseline scores across cohorts: adjusted for age and sex
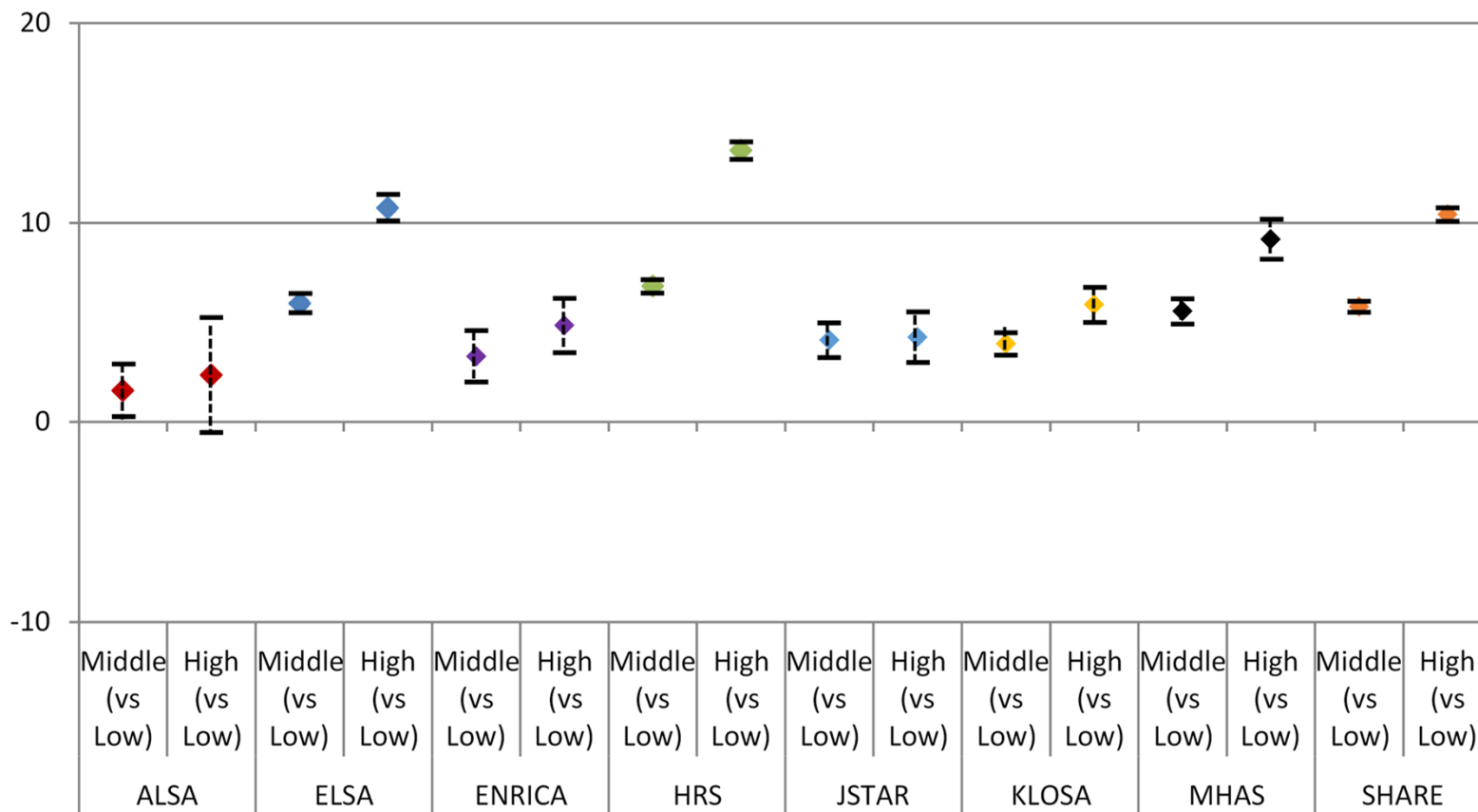
Reference: Wu YT, et al. Education and wealth inequalities in healthy ageing in eight harmonised cohorts in the ATHLOS consortium: a population-based study. Lancet Public Health. 2020;5(7):e386-e394.

Three types of healthy ageing: 3-class growth mixture model
High stable (green, 71.4%), low stable (blue, 25.2%) and fast decline (red, 3.4%)
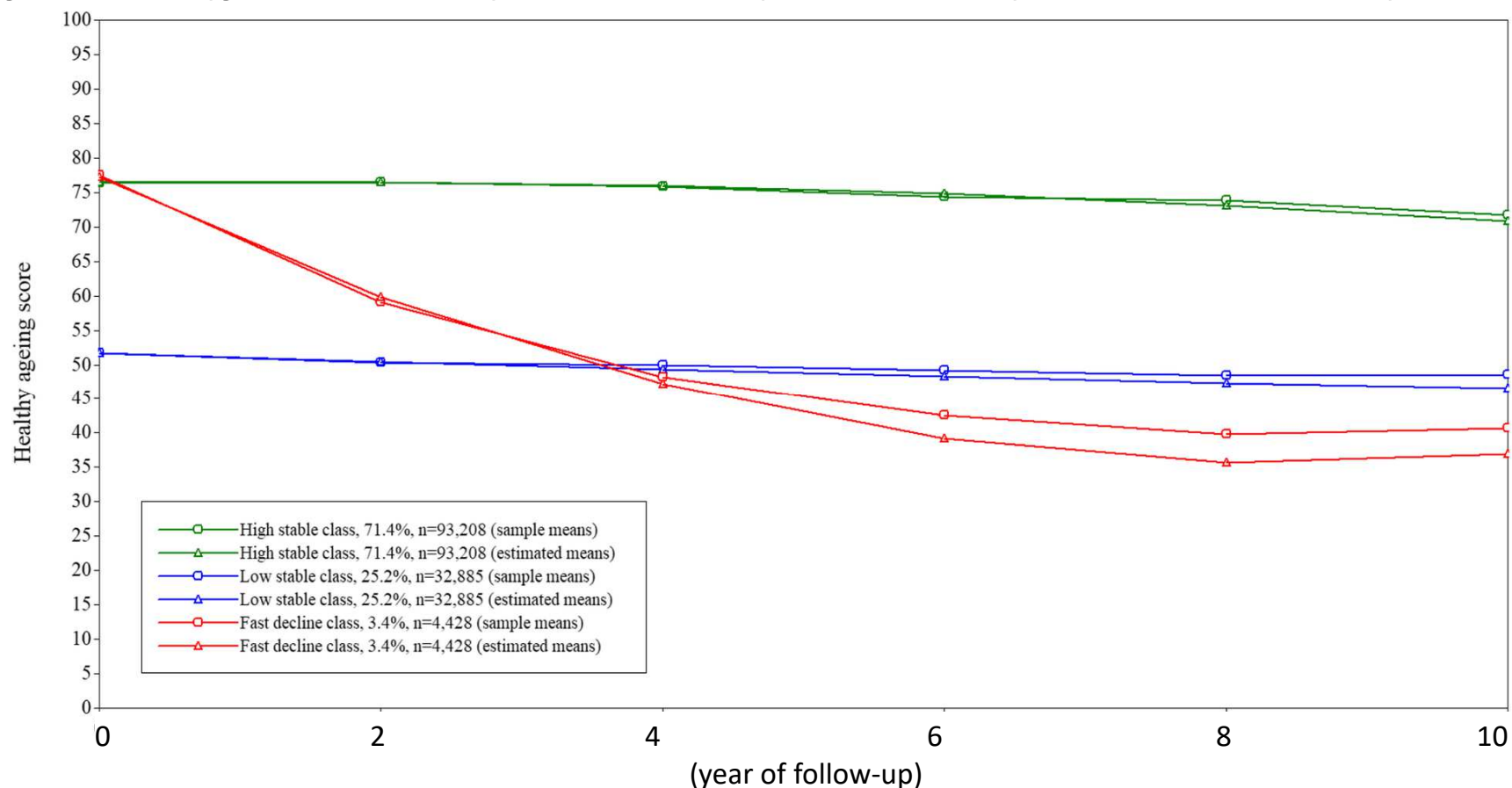
Reference: Moreno-Agostino D, et al. The impact of physical activity on healthy ageing trajectories: evidence from eight cohort studies. Int J Behav Nutr Phys Act. 2020;17(1):92.

Education and types of healthy ageing trajectories (adjusted for age and sex)

Education level	High stable OR (95% CI)	Low stable OR (95% CI)	Fast decline OR (95% CI)
Middle (vs low)	(ref.)	0.52 (0.50, 0.55)	0.95 (0.83, 1.09)
High (vs low)	(ref.)	0.24 (0.22, 0.26)	0.57 (0.46, 0.70)

Low education: primary or less; Middle: secondary; High: tertiary

Education and mortality

- 12 cohort studies (N=179,044 in 28 countries)
- Education: secondary education or more vs primary education or less
- Cox regression model by countries+ meta analysis
- Adjusted for age and sex

- Pooled estimate 0.72 (0.68, 0.76)
- Heterogeneity I-sq.= 49.9%

Reference: Wu YT, et al. Sex differences in mortality: results from a population-based study of 12 longitudinal cohorts. CMAJ. 2021;193(11):E361-E370.

Country	Hazard ratio (95% CI)
Australia	0.86 (0.77, 0.96)
Austria	0.89 (0.67, 1.18)
Belgium	0.92 (0.74, 1.14)
China	0.67 (0.56, 0.80)
Cuba	0.78 (0.65, 0.94)
Czech Republic	0.54 (0.44, 0.68)
Denmark	0.81 (0.64, 1.03)
Dominican Republic	0.80 (0.57, 1.14)
Estonia	0.66 (0.49, 0.89)
France	0.56 (0.44, 0.70)
Germany	0.42 (0.17, 1.03)
Greece	0.69 (0.51, 0.93)
Israel	0.63 (0.50, 0.80)
Italy	0.75 (0.59, 0.97)
Japan	0.75 (0.49, 1.17)
Mexico	1.02 (0.63, 1.65)
Netherlands	0.73 (0.54, 0.97)
Peru	0.59 (0.41, 0.85)
Poland	0.66 (0.54, 0.79)
Puerto Rico	0.59 (0.46, 0.76)
Solvenia	0.40 (0.22, 0.75)
South Korea	0.77 (0.64, 0.91)
Spain	0.79 (0.67, 0.93)
Sweden	0.71 (0.59, 0.86)
Switzerland	0.94 (0.61, 1.45)
UK	0.65 (0.60, 0.71)
USA	0.73 (0.71, 0.76)
Venezuela	0.80 (0.52, 1.23)
Overall (I-squared = 49.9%)	0.72 (0.68, 0.76)

0.125   1   8

Summary

- Education was positively associated with healthy ageing but the effect was mainly found in the baseline.

- Higher education was associated with reduced risk of mortality in later life.

- The effect sizes varied across cohort studies/countries.

- A lifecourse approach: cumulative disadvantage due to low education

Acknowledgement

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- Dr Albert Sanchez Niubo

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- Moreno-Agostino D, Daskalopoulou C, Wu YT, Koukounari A, Haro JM, Tyrovolas S, Panagiotakos DB, Prince M, Prina AM. The impact of physical activity on healthy ageing trajectories: evidence from eight cohort studies. Int J Behav Nutr Phys Act. 2020;17(1):92. doi: 10.1186/s12966-020-00995-8.

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