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Relationships between morbidity, mortality and severe material deprivation in Europe

- Demographic ageing puts public pension systems under pressure
 - Considerable increase in life expectancy and (in most cases) health expectancy in all European countries over the last 20 years
- Is extending working lives the solution?
- Substantial differences in life expectancy persist and have even widened between socio-economic status (SES) groups

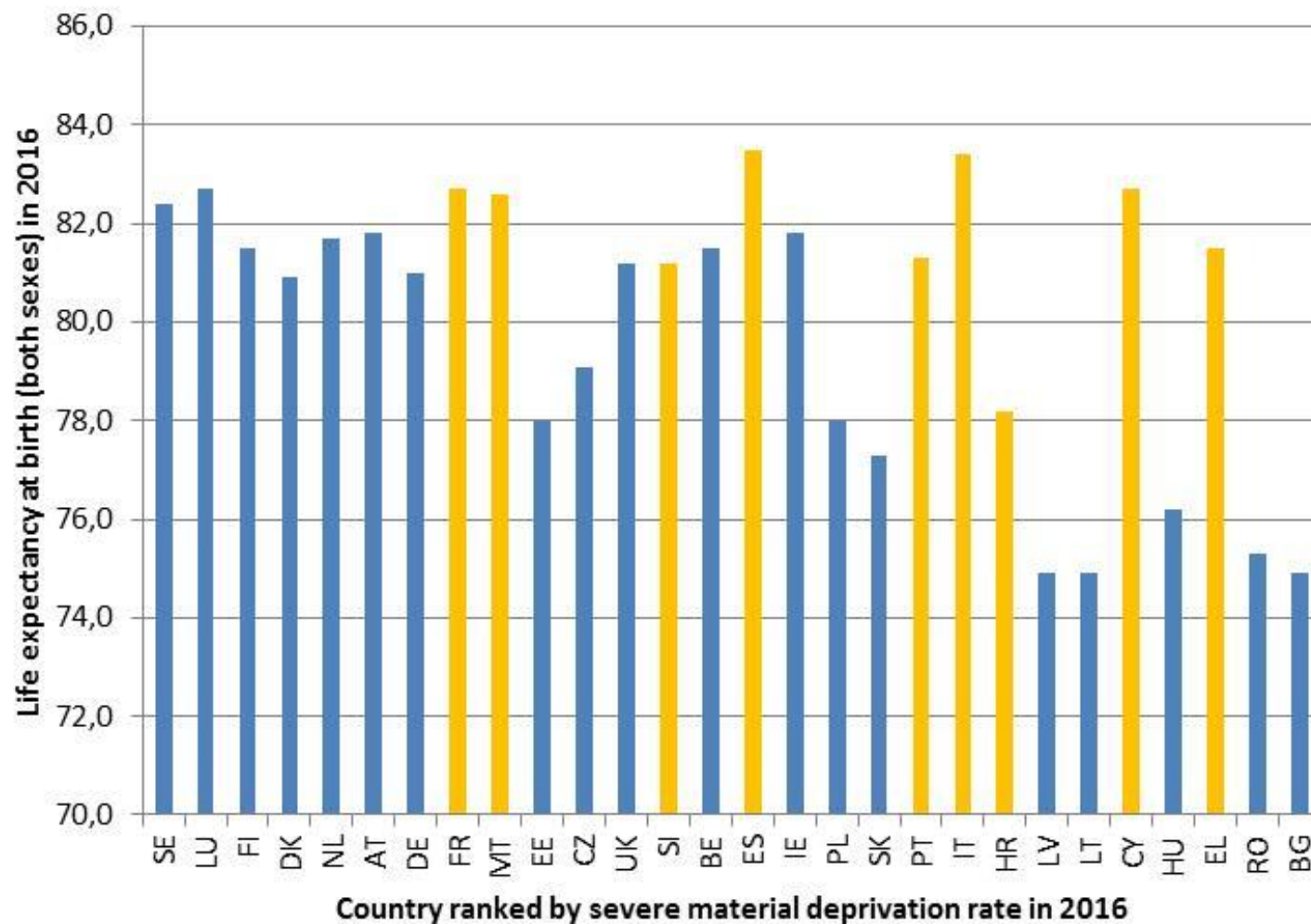
- No data available for some countries
- Available data differ in terms of target population, period, SES measurement and mortality indicator
- Even if SES breakdowns are technically comparable, they are not necessarily so in terms of social meaning
 - Income quintiles: belonging to the poorest 20 percent of the income distributions has a very different real meaning in Romania than in Sweden
 - Educational levels: having a university degree is much more selective in older than in younger generations
 - Occupational classes are often male-biased

- So far little attention has been paid to the impact of absolute poverty on mortality in contemporary Europe (extreme poverty: homeless people)
- EU-SILC is the official source for comparable poverty data in Europe (at-risk-of-poverty rate, material deprivation rate, etc.)
- EU-SILC has a longitudinal component which allows for mortality estimation ([Klotz and Göllner 2017](#))

- A person lives in a private household which **cannot afford** at least 4 items out of the following 9:
 - to pay their rent, mortgage or utility bills
 - to keep their home adequately warm
 - to face unexpected expenses
 - to eat meat or proteins regularly
 - to go on holiday
 - a television set
 - a washing machine
 - a car
 - a telephone

- Severe material deprivation (SMD) has the same definition across all European countries and over time*; it does not depend on the average standard of living in a society
- SMD is not a matter of choice
- Broad political consensus that SMD should be eliminated or at least reduced
- Prevalence of SMD in Europe in 2016: less than 1 percent in Sweden, more than 30 percent in Bulgaria

Ecological correlation



Own figure. Data queried from Eurostat webpage.

- On an ecological level, there is a clear association between SMD and mortality risk, except for Mediterranean countries
- Ecological correlation coefficient between SMD and life expectancy
 - 0.59 overall
 - 0.81 excluding Mediterranean countries
- What about the micro level?

1. Is there a substantial and statistically significant association between SMD and mortality risk?
2. Does mortality risk confirm the 3/4 cutoff point in the definition of SMD?

- EU-SILC User Database longitudinal data for 26 countries
- Observations from 2003 (earliest) to 2015; in most countries a person is traced over four years
- Annual vital status information (survived or died); measurement of covariates at baseline
- 743,000 individuals aged 35-79 years; 1.76m person years lived; 14,066 deaths
- Weighting of countries according to population size, uniform weights within each country and sex

- Proportional Hazards Regression (Cox 1972): Nonlinear, semiparametric model of mortality hazard of i 'th individual as a function of follow-up time t and covariates x

$$h(i, t) = h(t) \times HR(i)$$

$$HR(i) = \exp(x_i^T \beta)$$

- Hazard Ratio when SMD = 1 as indicator of excess mortality
- Covariates: Age, Sex, Country (fixed intercept), Period, (GALI)

Estimated mortality hazard ratios.


Predictor	Model without morbidity	
	Estimated hazard ratio	95 percent confidence interval
Age	1.10	(1.10-1.10)
Sex=Male	1.90	(1.83-1.97)
Calendar year	0.96	(0.96-0.97)
Severe material deprivation=Yes	1.69	(1.60-1.78)

All estimates are controlled for country fixed effects.

Estimated mortality hazard ratios.

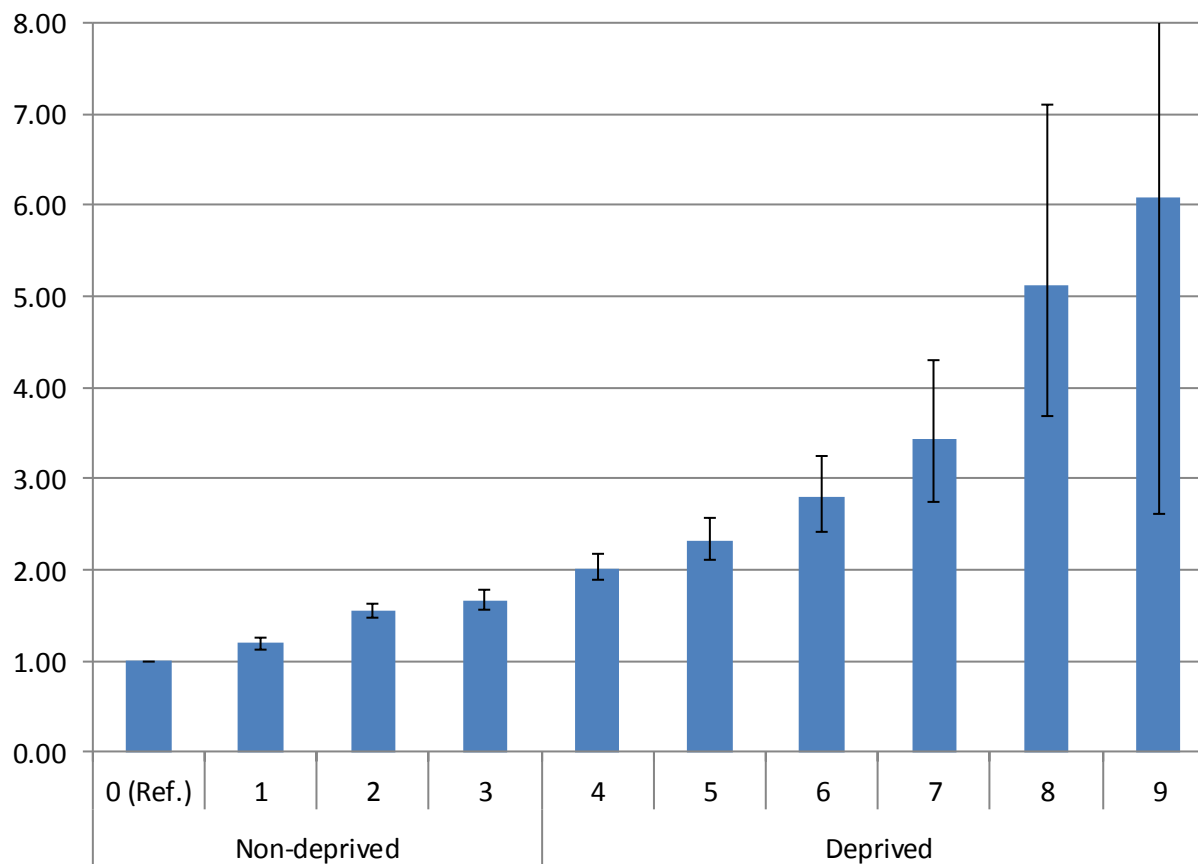
Predictor	Model without morbidity	
	Estimated hazard ratio	95 percent confidence interval
Age	1.10	(1.10-1.10)
Sex=Male	1.90	(1.83-1.97)
Calendar year	0.96	(0.96-0.97)
Severe material deprivation=Yes	1.69	(1.60-1.78)

All estimates are controlled for country fixed effects.



Being severely materially deprived has the same statistical effect as being 5-6 years older

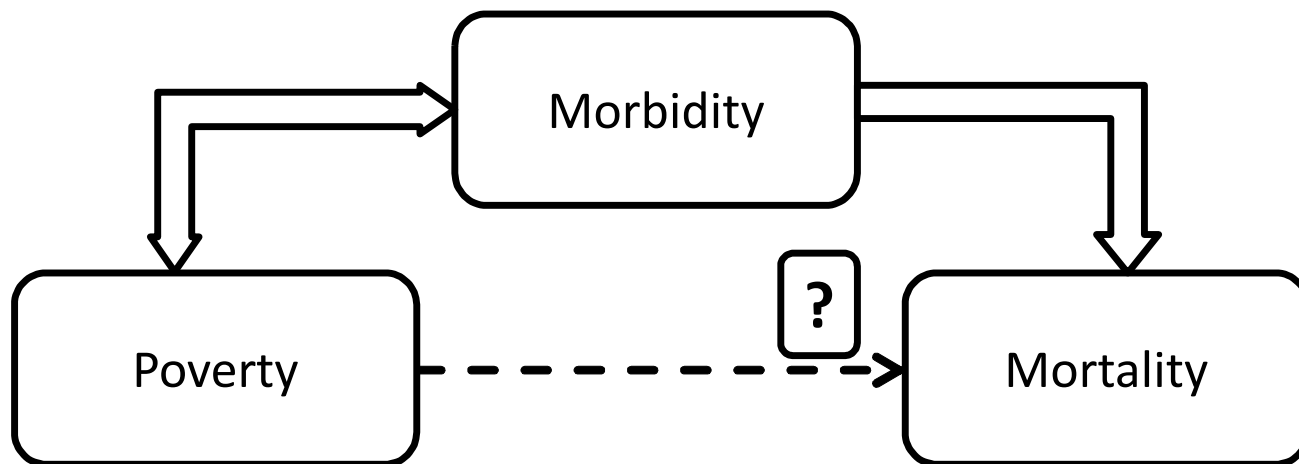
Estimated mortality hazard ratio by material deprivation score (0-9).



Models control for age, sex, period and country fixed effects. Including 95 percent confidence interval.
Vertical axis cut off at 8.

- Excess mortality of the severely materially deprived is substantial and highly significant
- A relative mortality risk of 1.69 corresponds to a life expectancy disadvantage of 5-6 years
- Mortality risk increases continuously with the material deprivation score; the difference between 3 items and 4 items is statistically significant

3. Is the association between SMD and mortality still substantial and statistically significant when we adjust for different morbidity levels between SMD and non-SMD populations? (confounding, reverse causation)



Global Activity Limitations Instrument (GALI; PH030)

For at least the past six months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been...

- (1) severely limited*
- (2) limited by not severely*
- (3) not limited at all*

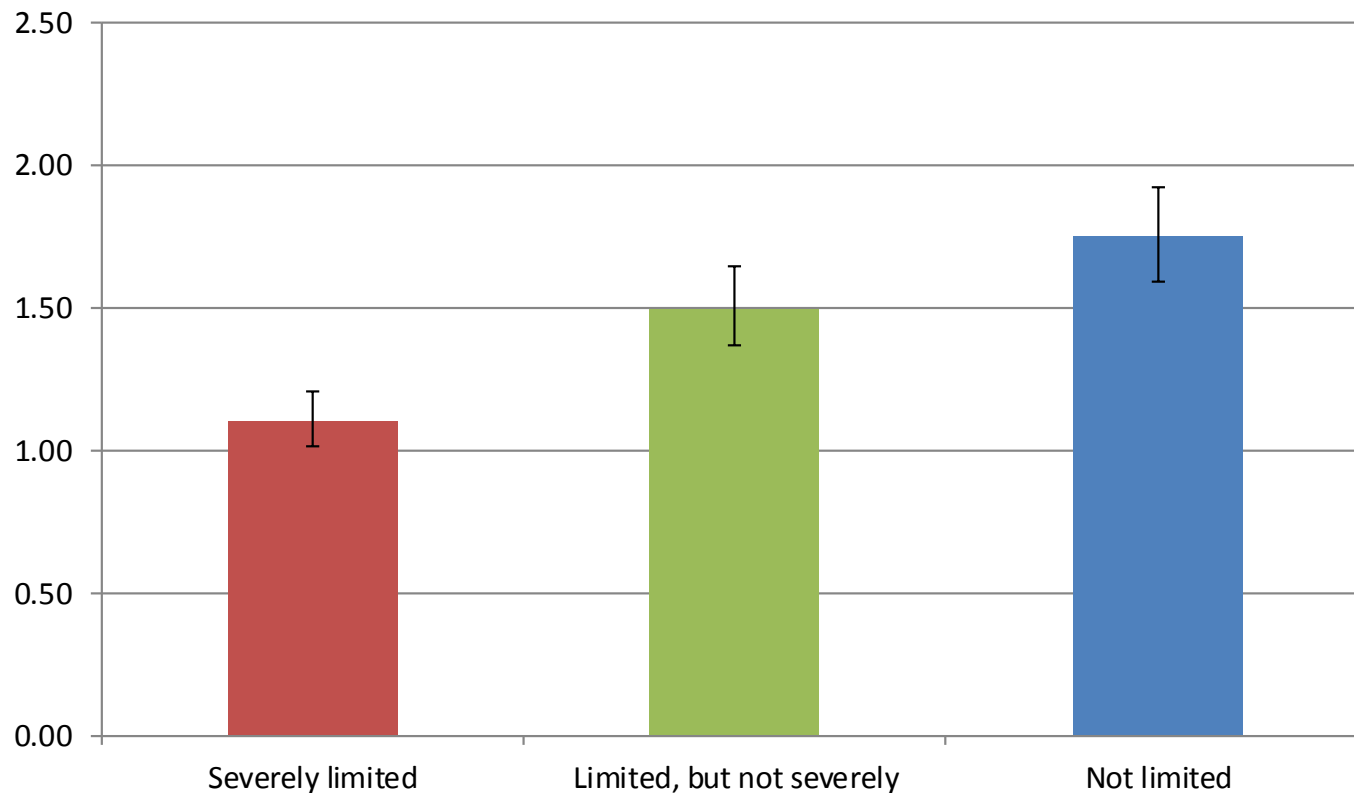
→ Extended model and stratification by GALI

Estimated mortality hazard ratios.

Predictor	Model without morbidity		Model with morbidity	
	Estimated hazard ratio	95 percent confidence interval	Estimated hazard ratio	95 percent confidence interval
Age	1.10	(1.10-1.10)	1.08	(1.08-1.09)
Sex=Male	1.90	(1.83-1.97)	1.98	(1.91-2.05)
Calendar year	0.96	(0.96-0.97)	0.96	(0.95-0.97)
Severe material deprivation=Yes	1.69	(1.60-1.78)	1.39	(1.32-1.47)
Global activity limitation instrument			0.47	(0.46-0.48)

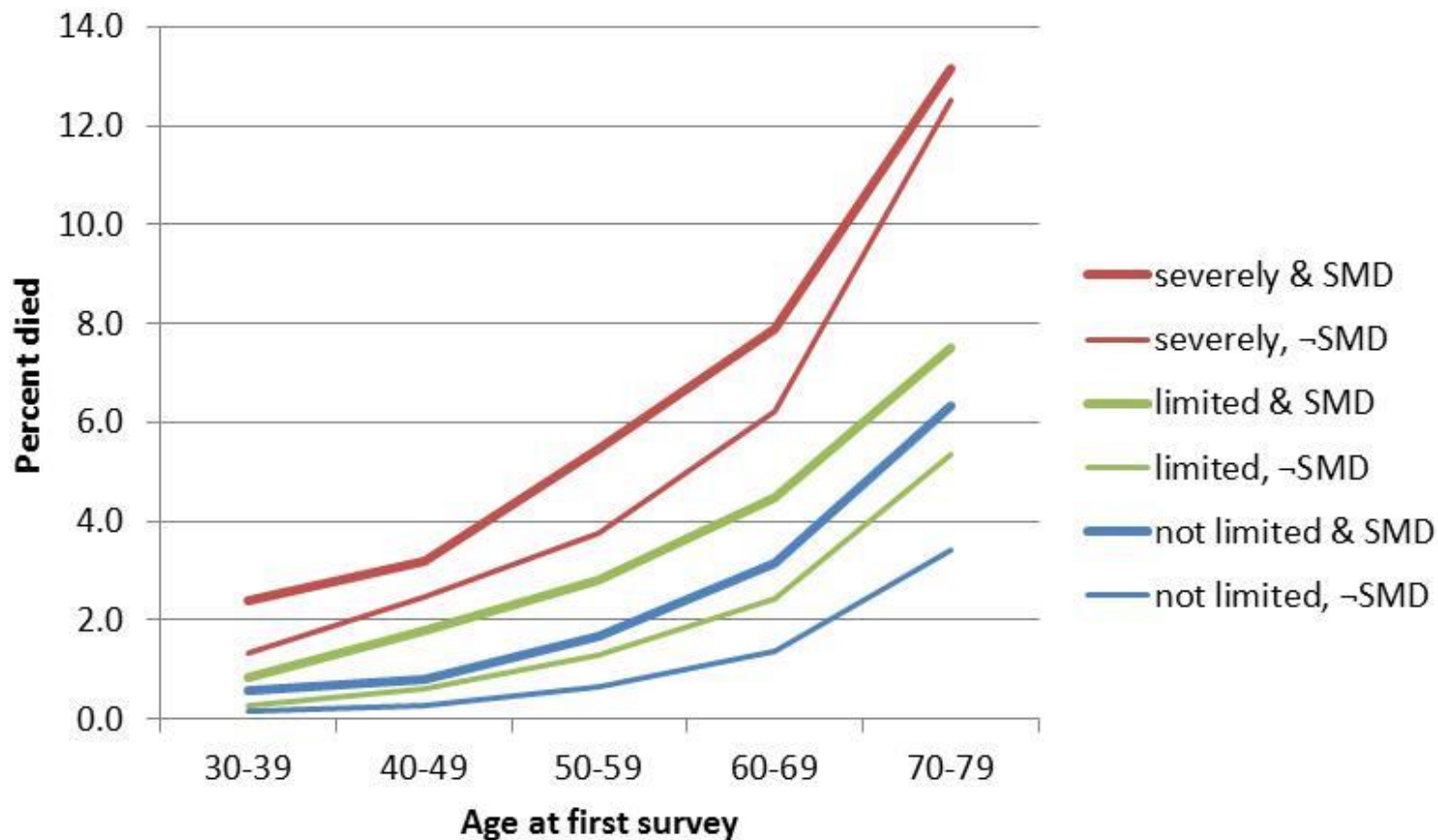
All estimates are controlled for country fixed effects.

Estimated mortality hazard ratio stratified by GALI.



Models control for age, sex, period and country fixed effects. Including 95 percent confidence interval.

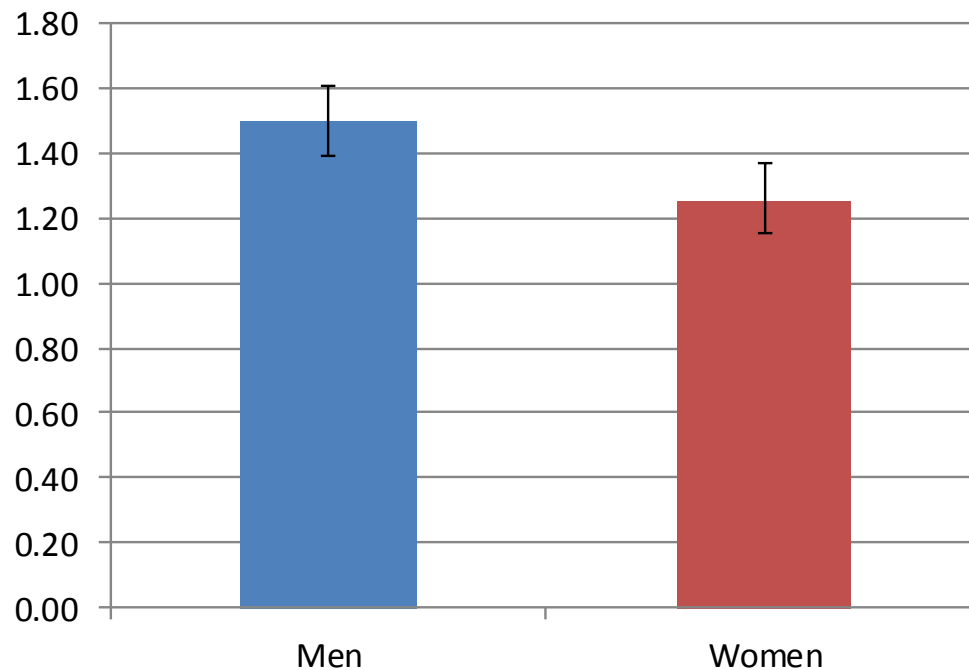
Relative frequency of deaths by GALI and SMD



- Overall, around 40 percent of excess mortality is mediated by higher morbidity levels in the SMD population (Baron and Kenny 1986). When adjusting for GALI, mortality of the deprived is 39 percent higher than on the non-deprived, still a substantial figure.
- The effect of SMD on mortality is modified by GALI. SMD increases relative mortality risk by 10 percent when severely limited, by 50 percent when limited but not severely, and by 75 percent when not limited. All hazard ratios are statistically significant.

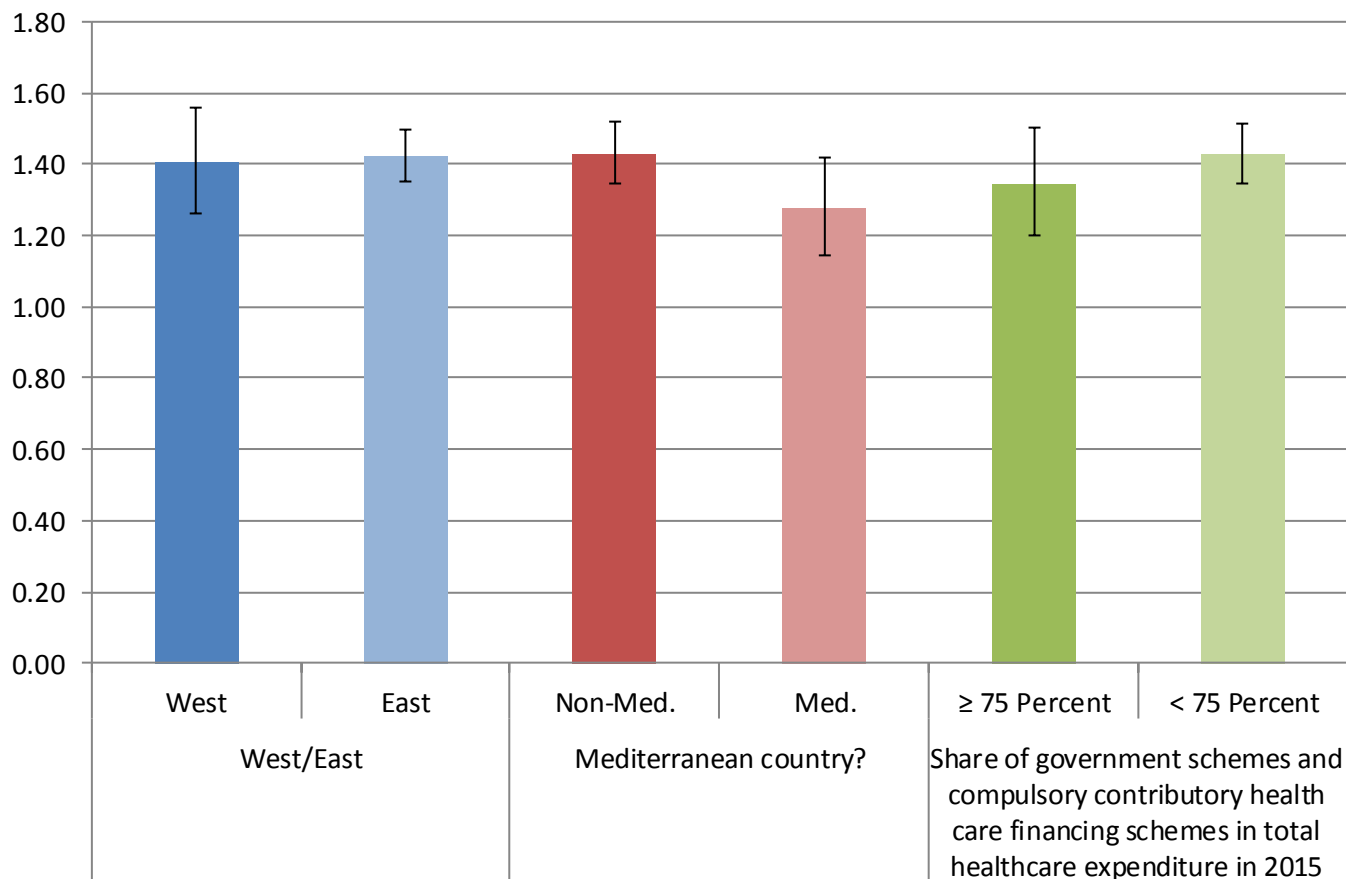
4. Is the impact of SMD on mortality, controlling for morbidity, different between
 - a. men and women?
 - b. groups of countries:
 - i. Western vs. Eastern Europe
 - ii. Mediterranean vs. non-Med. countries
 - iii. countries where government and compulsory contributory financing schemes make up less/more than 75% of total healthcare spending?

Estimated mortality hazard ratio for SMD by sex.



Models control for morbidity, age, period and country fixed effects.
Including 95 percent confidence interval.

Estimated mortality hazard ratio for SMD by groups of countries.



Models control for morbidity, sex, age, period and country fixed effects. Including 95 percent confidence interval.

- The relative effect of SMD on mortality, conditional on morbidity, is stronger among men than women.
- Differences between groups of countries are small, despite large disparities in SMD prevalence. Only for Mediterranean countries there seems to be a small advantage.

- The FACTAGE project: www.factage.eu
- Forthcoming paper: J. Klotz, T. Göllner and M. Till (2019):
“Relationships between morbidity, mortality and severe material deprivation in Europe”
- Pre-Conference Workshop “Estimating Mortality Risks by Socio-Economic Status from EU-SILC Longitudinal Data”
6th European User Conference for EU-Microdata,
Mannheim, 6 March 2019