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Socioeconomic Differences in Mortality Among 27 Million Economically Active Germans: a Cross-sectional Analysis of the German Pension Fund Data

Pavel Grigoriev¹, Rembrandt Scholz¹, Vladimir M. Shkolnikov^{1,2}

¹ Max Planck Institute for Demographic Research, Germany

² National Research University Higher School of Economics, Russia

“Demographic trends in Russia: legacy of the Soviet era or a new tendency”

Higher School of Economics

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BACKGROUND AND AIM

- ✓ The **reduction of mortality disparities** across socioeconomic groups is an **important public health issue**.
- ✓ This research area is underexplored in Germany mainly because of the **lack of appropriate data**. Existing evidence is mostly based on sample surveys which are not designed to study mortality.
- ✓ **This is the first study** that uses a large administrative dataset of the German Pension Fund (DRV) to assess **mortality disparities** across almost the **entire economically** active German population.
- ✓ Previous studies based on the DRV data (von Gaudecker and Scholz, 2007; Shkolnikov et.al 2007; Kibele et al. 2013, Wenau et al. 2019) referred to the pensioners aged 65+ and males.
- ✓ This study examines mortality disparities in **working-age population** for **both males and females** using a broader range of SES characteristics, including **income, education, and employment** status.

- ✓ Initial work with raw data was done at the DRV research center located in Berlin. Pension records on living individuals were linked to the corresponding death records using the **personal identification number**.
- ✓ Data were released in the form of a **frequency table**: deaths and the corresponding exposures were classified according to all possible combinations of socio-demographic variables of interest.
- ✓ Two DRV datasets at our disposal:
 - 1) Pension contributions paid by the economically active insured population (AKV*)
 - 2) Pension recipients who left work due to disability (EMR**)

* *Aktiv Versicherte*

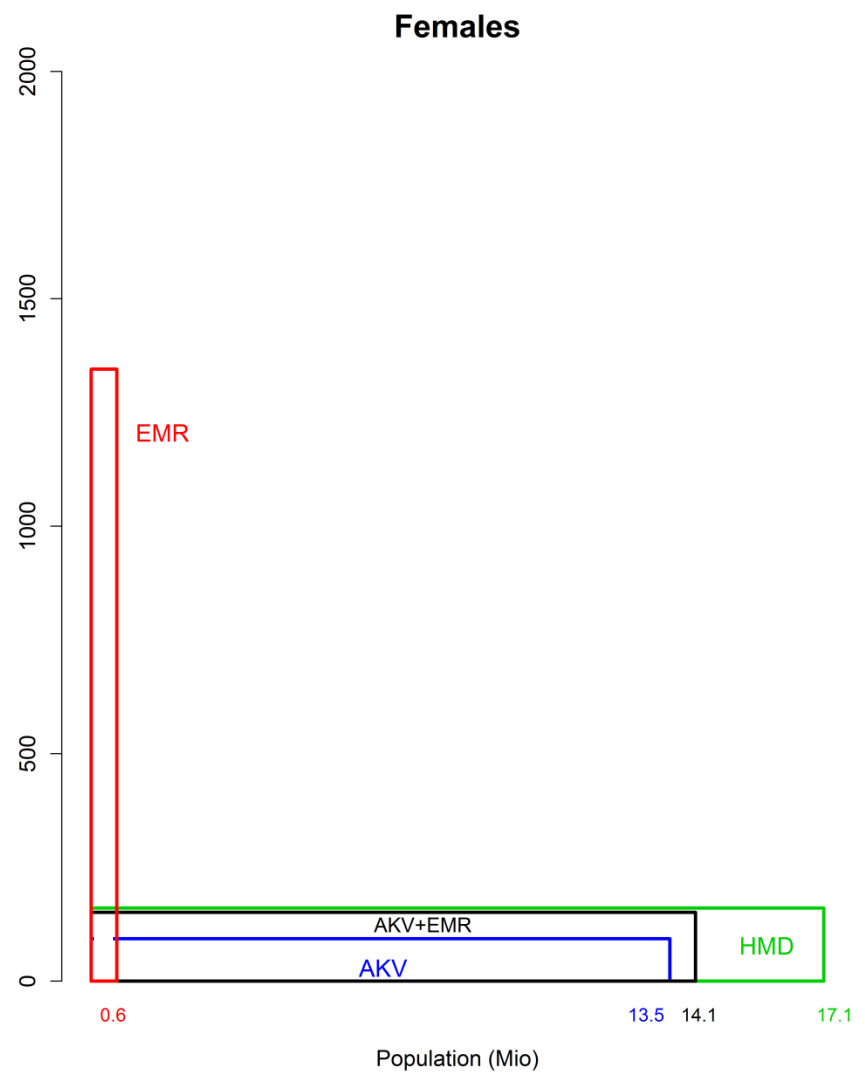
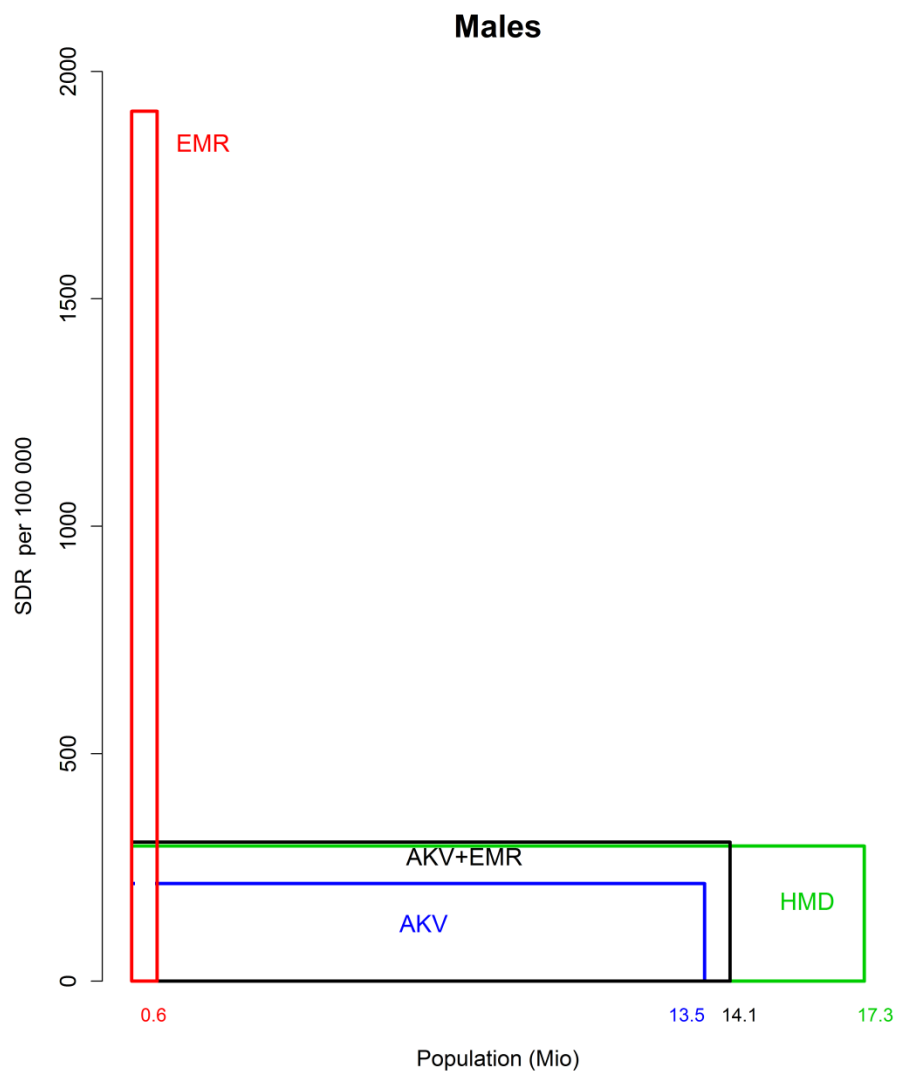
** *Erwerbsminderungsrenten*

DATA (CONT.)

- ✓ The main analysis is based on the **AKV dataset** (economically active) because it is not feasible to classify EMR population by SES.
- ✓ AKV data cover the majority (but not all) of the German population. Individuals who are not obliged to pay or not having any pension contributions (civil servants, self-employed, housewives) are not included!
- ✓ **Final dataset** : 27.1 million person-years of exposure and 42 thousand deaths occurred in 2013, population aged 30-59.

DRV-HMD COMPARISON

SDR and corresponding population size (million) by data source, ages 30–59, 2013



VARIABLES

Age: control variable

Region: *East / West*

Nationality (current citizenship): *foreign / German*

Employment: *employed / unemployed*

Income: quintile of the current earning points distribution

Education: *higher / secondary education / lower / unknown*

No redistribution of 'unknown' category!

METHODS

- ✓ Age-standardized mortality rate (SDR) as absolute measure.
- ✓ The **model-based** mortality rate ratio (MRR) from the Poisson regression model fitted using function *glm* from R package *lme4*.
- ✓ Two-dimensional (joint) *relative mortality risk* (**combined MRR**) on the basis of **mutually adjusted MRRs** for all combinations of the values of two SES variables (education and income).
In total, 20 different combinations.

Standardized death rate (SDR) and model-based mortality rate ratio (MRR) by socio-demographic categories; 2013, ages 30–59 (males)

	SDR per 100,000	MRR	
		Model 1 (age adjusted)	Model 2 (fully adjusted)
Region			
East	251.5	1.00 (ref)	1.00 (ref)
West	200.4	0.79***(0.77-0.82)	1.04***(1.01-1.07)
Unknown	455.4	1.82***(1.67-1.98)	2.56***(2.34-2.79)
Nationality			
Foreign	154.8	1.00 (ref)	1.00 (ref)
Germany	217.8	1.41***(1.35-1.47)	2.03***(1.94-2.12)
Employment			
Employed	149.2	1.00 (ref)	1.00 (ref)
Unemployed	478.1	3.22***(3.15-3.30)	2.09***(2.03-2.15)
Education			
Higher	113.8	1.00 (ref)	1.00 (ref)
Secondary	152.9	1.36***(1.30-1.43)	1.12***(1.07-1.18)
Lower	187.8	1.67***(1.60-1.75)	1.29***(1.23-1.35)
Unknown	305.4	2.72***(2.61-2.84)	1.57***(1.50-1.64)
Income quintile			
1	469.4	4.66***(4.48-4.85)	2.49***(2.37-2.61)
2	233.5	2.33***(2.24-2.43)	1.66***(1.59-1.75)
3	171.3	1.71***(1.63-1.79)	1.46***(1.39-1.53)
4	139.5	1.39***(1.33-1.46)	1.28***(1.22-1.34)
5	100.4	1.00 (ref)	1.00 (ref)

P<0.01***; 0.01<*P*<0.05**

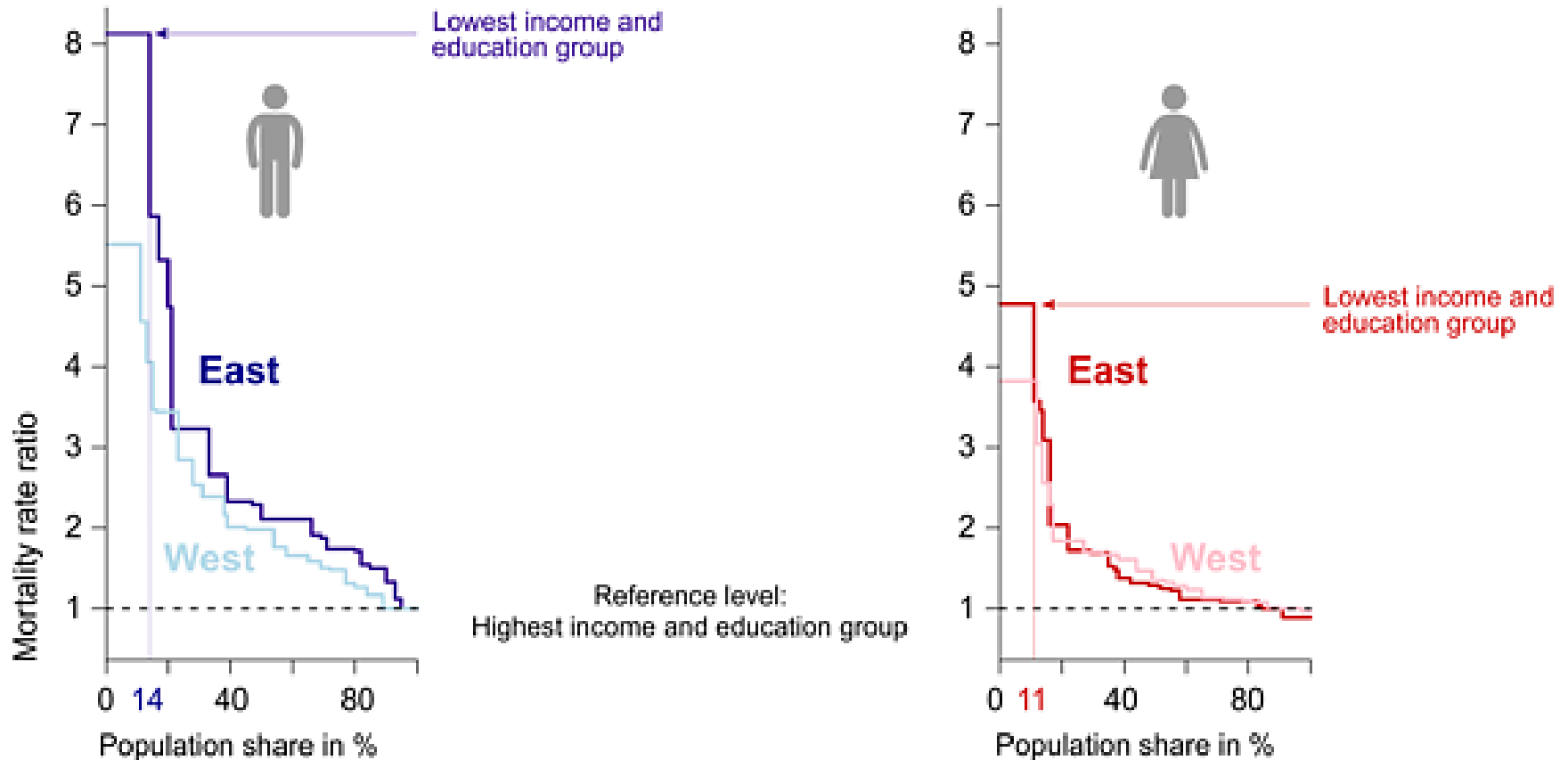
Standardized death rate (SDR) and model-based mortality rate ratio (MRR) by socio-demographic categories; 2013, ages 30–59 (females)

	SDR per 100,000	MRR	
		Model 1 (age adjusted)	Model 2 (fully adjusted)
Region			
East	83.8	1.00 (ref)	1.00 (ref)
West	92.8	1.12***(1.07-1.17)	1.25***(1.19-1.31)
Unknown	343.8	4.12***(3.63-4.68)	4.80**(4.22-5.46)
Nationality			
Foreign	72.7	1.00 (ref)	1.00 (ref)
Germany	94.2	1.29***(1.21-1.39)	1.96***(1.83-2.11)
Employment			
Employed	72.4	1.00 (ref)	1.00 (ref)
Unemployed	188.9	2.62***(2.52-2.71)	2.01***(1.92-2.10)
Education			
Higher	59.2	1.00 (ref)	1.00 (ref)
Secondary	65.1	1.09**(1.02-1.17)	1.08**(1.01-1.16)
Lower	85.4	1.45***(1.35-1.55)	1.30***(1.21-1.40)
Unknown	127.9	2.15***(2.02-2.29)	1.60***(1.50-1.71)
Income quintile			
1	202.3	3.06***(2.90-3.23)	1.75***(1.64-1.86)
2	88.1	1.35***(1.27-1.43)	1.05(0.99-1.11)
3	72.4	1.11***(1.04-1.17)	0.92***(0.86-0.98)
4	73.0	1.11***(1.05-1.18)	1.01(0.95-1.08)
5	65.6	1.00 (ref)	1.00 (ref)

P<0.01***; 0.01<*P*<0.05**

INEQUALITY PROFILE

Influence of education and income on mortality



Example of combined MRR estimation: *East Germany, males*

MRR (secondary education)=1.12, MRR (income quintile 3)=1.55 =>

MRR combined=exp [ln (1.12) + ln (1.55)] =**1.74**. *Population share - 9%*.

SUMMARY OF MAIN FINDINGS

- ✓ Mortality disparities are strongly associated with inter-individual differences in income. Yet in the fully adjusted model, the income gradient persists among men and it is inconsistent among women.
- ✓ Educational gradient among males weakens once income is controlled for. This suggests that the relationship between income and male mortality is substantially mediated by education.
- ✓ The results support the existence of a “healthy migrant effect”. Foreigners are half as likely to die compared to German citizens.
- ✓ Being unemployed is associated with two-fold higher risk of premature mortality
- ✓ Substantial East disadvantage in male mortality vanishes after controlling for the individual characteristics.

CONCLUSION

- ✓ Low socioeconomic status is a major determinant of excess adult mortality in Germany.
- ✓ The persistent East-West gap in male adult mortality can be explained by the higher socioeconomic status of men living in the West (composition), rather than by contextual differences between the two parts of Germany.
- ✓ In the absence of more comprehensive population-level data, mortality disparities by SES in Germany should be further monitored using DRV data.

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ABSTRACT

Objectives To assess disparities in mortality by socioeconomic status in Germany.

Design and participants We analyse a large administrative dataset of the German Pension Fund (DRV), including 27 million person-years of exposure and 42 000 deaths in 2013. The data cover the economically active population, stratified by sex and by East and West.

Outcome measures Age-standardised mortality rates and Poisson regression mortality rate ratios (MRRs).

Results The risk of dying increases with decreasing income: the MRRs of the lowest to the highest income quintile are 4.66 (95% CI 4.48 to 4.85) among men and 3.06 (95% CI 2.90 to 3.23) among women. The impact of income attenuates after controlling for education and other explanatory variables, especially for females. In the fully controlled model for females, individual income is a weaker predictor of mortality, but there is a clear educational mortality gradient. In the fully controlled model, the MRRs of the unemployed to the employed are 2.09 (95% CI 2.03 to 2.15) among men and 2.01 (95% CI 1.92 to 2.10) among women. The risk of dying is around half as high among foreigners as among German citizens. The socioeconomic disparities are greater among East than West German men.

Strengths and limitations of this study

- Using a large administrative dataset of the German Pension Fund (DRV), this study provides the first population-level estimates on socioeconomic mortality differentials across the economically active population of Germany.
- Mortality disparities are assessed using a broad range of socioeconomic and demographic characteristics, including individual income, education, employment status, citizenship and region.
- The DRV data, particularly on individual income, are highly reliable because the information reported by employers serves as the basis for pension entitlements in the future.
- There is a relatively large share of missing values for the *education* variable, primarily because people who were unemployed or out of the labour market for other reasons had no employer to report the information on education.
- Our analyses do not cover individuals of working ages who are receiving pensions due to disability.