Equality of opportunity is linked to lower mortality in Europe

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ABSTRACT

Background This study investigates if intergenerational equality of opportunity is linked to mortality in 30 European countries. Equality of opportunity may lead to greater returns on health investments and, consequently, improved health outcomes. In turn, a perceived lack of fairness in the distribution of life chances and limited possibilities for upward intergenerational mobility can cause anxiety among individuals and gradually compromise their health.

Methods We used information on 163 467 individuals' and their parents' Socio-Economic Index of Occupational Status from a large survey data set—the European Social Survey—to generate three complementary measures of equality of opportunity. We then linked these to administrative data on total, gender-specific and cause-specific mortality rates assembled by Eurostat from the national statistical offices.

Results We found that lower equality of opportunity, measured by the attainment of individuals from the lowest and highest quartiles of socioeconomic status and by the overall intergenerational correlation in socioeconomic status, was related to higher mortality rates, particularly in relation to diseases of the nervous system and the sense organs, diseases of the respiratory system and external causes of mortality. Our measures of equality of opportunity were more consistently linked with mortality of men than women.

Conclusion Equality of opportunity may be an important explanation of mortality that warrants further research. Measures that aim at facilitating intergenerational social mobility can be justified not only via normative considerations of equality of opportunity but also in terms of individuals' chances to enjoy healthy lives.

INTRODUCTION

For the best part of the 20th century, children in western welfare democracies could expect to do far better than their parents in terms of educational attainment, income and wealth, but in many countries this is no longer the case.[1,2] One of the proposed explanations for this trend is an inverse relationship between income inequality and social mobility.[3,4] The recent availability of high-quality data on intergenerational income mobility in the USA[5,6] has also allowed social epidemiologists to investigate the links between economic opportunity and health.[7–9] These studies suggest that various health outcomes, including rates of mortality, are better in counties with greater income mobility. It is unclear, however, whether these associations also hold in other countries.

In this study, we investigate if equality of opportunity is linked to mortality in Europe. We are not aware of any studies on this topic at a population level, but there is an established research tradition on the health consequences of individuals' social mobility experiences.[10,11] However, it is unknown how individual-level experiences translate into macro-level associations between equality of opportunity and mortality. We are therefore interested in not only how individuals' health is affected by experiencing intergenerational social mobility but also whether there are spillover effects of living in environments with varying levels of opportunities. In fact, the notion of equality of opportunity is a relative concept and its potential effect on health can be only explored on a societal level.

The concept of equality of opportunity may encompass many dimensions other than intergenerational social mobility. In this study, however, we operationalise equality of opportunity with the degree to which parental socioeconomic status is associated with children's socioeconomic status in adult life. Two main mechanisms have previously been proposed to explain a possible association between equality of opportunity and health. First, according to the economic theory of health capital, individuals have an incentive to invest in their health to realise potential gains from being healthy.[12] Perceptions of equality of opportunity in more socially fluid environments may increase health investments among individuals from disadvantaged backgrounds because future possibilities make it more likely that the socioeconomic benefits of being healthier such as obtaining a quality job with high salary will actually materialise.[8] Second, as the degree of social integration at a societal level plays a pivotal role for health,[13] a perceived lack of fairness in the distribution of life chances and limited possibilities for upward intergenerational mobility can cause anxiety among individuals[14] and gradually compromise their health.[7]

The studies on the USA found that the average rank in the national income distribution attained by individuals born to families in the bottom national income quartile is negatively associated with mortality. However, a number of questions remain unanswered. First, are opportunities of the most disadvantaged individuals driving these results or is equality of opportunity for all related to mortality? Second, are there gender differences in these associations? Third, what specific mechanisms link equality of opportunity and mortality? To answer these questions, we make use of a large survey data set to generate three complementary measures of equality of opportunity and link them

Table 1 Descriptive statistics

	Mean	SD	Min	Max
Dependent variables				
ln death rate (total)	5.9	1.36	3.58	9.39
ln death rate (females)	5.5	1.44	3.06	9.30
ln death rate (males)	6.2	1.36	3.84	9.65
Key explanatory variables				
Mean achievement of bottom parental quartile	40.0	5.49	18.7	73.1
Mean achievement of top parental quartile	63.7	5.51	34.6	87.7
Correlation in socioeconomic status across parental and children's generation	0.32	0.11	−0.64	0.83
Controls				
Mean children's social status	42.4	3.74	24.5	52.6
Mean parental social status	40.5	5.72	22.7	54.8
Proportion of females	52.1	5.09	32.7	87.7
Proportion with higher education	28.2	13.8	0.00	71.3
Mean household income	10.7	0.88	7.44	16.9
Proportion of unemployed	6.06	5.16	0.00	34.5
Mean social trust	4.80	0.74	2.56	7.99
Proportion of ethnic minority	4.75	4.11	0.00	30.9
Proportion religious	63.6	19.6	10.2	100.0
Proportion married	64.9	15.1	8.55	94.1
Proportion living in city	64.0	10.5	22.9	97.2
Mean political attitude	4.98	0.49	2.83	6.87
Mean household size	2.81	0.66	1.29	4.85
Proportion of households with children	46.4	25.4	0.00	92.0
Proportion doing housework	21.1	12.0	0.00	73.6
Further variables of interest				
Mean age	50.2	15.3	26.4	82.4
Year	2006.1	2.83	2002.0	2010.0
Number of individual observations in macro-level observations	161.8	57.7	9.00	323.0

Total number of observations is 1200. Mean column reports averages of the means/proportions for year, age group and country combinations. Death rates taken from Eurostat, all other variables taken from ESS. For ESS data, means and SD are computed using population and design weights. ISEI scores are derived using the ISKO Stata package and coding from the ESS-DEVO project.[40] Real household incomes are derived by taking the mid-points of the categorical show cards given to participants in the ESS survey. We then convert these values to 2010 EURs. For top values for which no mid-points are available, we make use of a procedure described in previous research.[41]

ESS, European Social Survey; ISEI, International Socio-Economic Index of Occupational Status.

to administrative data on mortality derived from the national statistical offices of the analysed European countries.

METHODS

Data sets

We obtained data from two types of sources. First, we used five waves of the nationally representative European Social Survey (ESS) collected in 2002–2010. These data provided us with 163 467 individual-level observations from which we derived explanatory variables. For our outcome variables, we used data on mortality rates from national administrative sources assembled by Eurostat (see online supplementary materials table S1). Although we could not obtain information on deaths specifically for those individuals included in ESS, to match ESS and mortality data we gathered biennial death rates for 12 five-year age groups from 25 to 84, which were nested in 30 countries (see online

supplementary table S2 in online supplementary materials). We calculated quantities of interest from ESS for each survey year, age group and country for which Eurostat mortality data were available. After listwise deletion of observations with missing information, 1200 observations remained for our analysis. The distribution of cell sizes used to compute these survey year-age group-country observations, together with relevant statistics, is shown in online supplementary material, figure S1. To ensure representativeness, we applied design (accounting for differences in inclusion probabilities) and population (correcting for different population sizes) weights for ESS data and population weights for administrative mortality data.

Explanatory variables

We operationalised equality of opportunity as intergenerational mobility in socioeconomic status, assuming that the degree to which individual socioeconomic status depends on parental socioeconomic status is a good indicator of equality of opportunity.[15] We measured parental and individual socioeconomic status with the International Socio-Economic Index of Occupational Status (ISEI). ISEI scores are widely used in comparative social and health research and were originally derived by estimating values of a latent variable determined by occupation which minimised the direct effect of education on income.[16 17]

For our first measure of equality of opportunity, we calculated the mean percentile in the socioeconomic status distribution attained by the children's generation whose parents were in the bottom quartile of the parental distribution. This measure closely corresponds to the measure of equality of opportunity used in the studies for the USA.[7 8] We also calculated analogous quantities, recently employed in the World Bank's study of mobility,[2] relating to those in the top quartile of the parental distribution. In addition, we calculated standard correlation coefficients between parental socioeconomic status percentile and children's socioeconomic status percentile.[3] We calculated all quantities of interest within each year, age group and country combination.

Outcome measures

Our main outcome variable was the 3-year moving average of crude all-cause death rates per 100 000 individuals. This is obtained for each age group and for each year under consideration. We additionally obtained all-cause death rates separately for men and women and death rates specific to major groupings in the 10th Revision of International Statistical Classification of Diseases and Related Health Problems (ICD-10).

Covariates

In adjusted models, for each age group, year and country combination, we generated from ESS a large array of covariates known to be associated with mortality: mean socioeconomic status in both the parental and children's generations[18 19]; the proportions of females and those who were married[20 21]; the proportion of those with higher education, mean levels of unemployment, proportion performing domestic work and mean real log household income[22–24]; the proportion of individuals who live in cities[25]; mean household size[26] and proportion of individuals with children[27]; mean social trust[28] and mean position on a subjective left-right scale[29]; the proportion of people from ethnic minorities[30] and the proportion of religious individuals.[31]

Table 2 Equality of opportunity and mortality

	β (CI 95%)	Change in death rate from 1 SD change in equality of opportunity, %	Change in death rate from complete absence of equality of opportunity to full equality of opportunity, %	R²
	Achievement of bottom quartile			
Total death rate				
M1: Unadjusted	**−0.20**[*] (−0.34 to 0.06)	−1.08	−9.42	0.01
M2: Adjusted	**−0.22**[*] (−0.35 to 0.10)	−1.23	−10.6	0.09
Females				
M3: Unadjusted	−0.08 (−0.22 to 0.07)	−0.42	−3.77	0.01
M4: Adjusted	**−0.16**[*] (−0.27 to 0.04)	−0.86	−7.54	0.22
Males				
M5: Unadjusted	**−0.24**[*] (−0.40 to 0.09)	−1.32	−11.4	0.01
M6: Adjusted	**−0.25**[*] (−0.39 to 0.11)	−1.38	−11.9	0.07
	Achievement of top quartile			
Total death rate				
M1: Unadjusted	0.16 (−0.025 to 0.352)	0.91	−8.52	0.01
M2: Adjusted	**0.18†** (0.007 to 0.352)	0.99	−9.38	0.08
Females				
M3: Unadjusted	0.07 (−0.102 to 0.244)	0.39	−3.61	0.01
M4: Adjusted	0.10 (−0.039 to 0.246)	0.57	−5.31	0.21
Males				
M5: Unadjusted	0.18 (−0.036 to 0.400)	1.01	−9.54	0.01
M6: Adjusted	**0.21†** (0.005 to 0.408)	1.14	−10.9	0.06
	Correlation of parental and child achievement			
Total death rate				
M1: Unadjusted	**0.09†** (0.01 to 0.17)	0.98	−9.11	0.01
M2: Adjusted	**0.10**[*] (0.02 to 0.18)	1.13	−10.5	0.09
Females				
M3: Unadjusted	0.03 (−0.04 to 0.10)	0.31	−2.81	0.01
M4: Adjusted	**0.06†** (0.01 to 0.13)	0.74	−6.76	0.22
Males				
M5: Unadjusted	**0.11**[*] (0.01 to 0.20)	1.21	−11.3	0.01
M6: Adjusted	**0.11**[*] (0.03 to 0.20)	1.30	−12.2	0.06

Total number of observations is 1200. CIs are computed using heteroskedasticity-robust SEs corrected for clustering at the age group-year level. Regressions are population weighted. Regressors from ESS are additionally design-weighted. Unadjusted estimates include year, age group and country fixed effects. Adjusted estimates additionally include all controls described in Methods section and in table 1. Respective absence of equality of opportunity is defined as a mean achievement of 12.5 of those coming from the bottom quartile, or a mean achievement of 87.5 of those coming from the top quartile, or a correlation of 1 between achievement in parental generation and achievement in children's generation. Respective full equality of opportunity is defined as a mean achievement of 50 of those in the bottom quartile, or a mean attainment of 50 of those coming from the top quartile, or a correlation of 0 between attainment in parental generation and attainment in children's generation. Reported R^2 are 'within' R^2. Significant associations (uncorrected, at 5% level) are shown in bold. Analyses were conducted using the REGHDFE Stata package.[42]
*Significant at table-wide false discovery rate of 5% (using Benjamini-Hochberg method).
†Significant at a table-wide false discovery rate of 10%.
ESS, European Social Survey.

Statistical analysis

Given substantial unobserved variation across survey years, age groups and countries, we include fixed effects for each of these variables that account for period, cohort and context-specific characteristics, respectively. Since death rates are log-normally distributed across age, we worked with the natural logarithm of mortality. After fitting models with all-cause mortality for both genders combined, we ran models with mortality rates separately for men and women. We also tested how equality of opportunity was associated with specific causes of mortality. Throughout, we calculated heteroscedasticity-robust standard errors (SEs) clustered at the age group and year level.[32] In addition to standardly used confidence intervals (CIs), we also present information on whether reported coefficients are significant at a 10% or 5%

table-wide false discovery rate using the Benjamini-Hochberg method. The exact specifications of our models are described in online supplementary materials, page 1.

In further models, we accounted for leads of equality of opportunity as measured by individuals who were 5 and 10 years older than the groups whose mortality was under consideration. We also tested how lags in equality of opportunity, as measured by groups 5 to 10 years younger, affect contemporaneous mortality rates. Our reason for employing this procedure is as follows. If the theoretical perspective was correct that the mortality-reducing effect of equality of opportunity runs via increased health investments due to anticipation of upward mobility, we had to expect that leads in equality of opportunity also had negative effects on mortality. If, however, the alternative perspective

was more accurate, that the effects of equality of opportunity run via reducing long-lasting stress, anxiety and feelings of unfairness, we had to expect that lags in equality of opportunity negatively affect mortality outcomes.

RESULTS
Equality of opportunity in Europe
The mean score of our first measure of equality of opportunity was 40.0 (min–max 18.7–73.1; see table 1). This means that individuals born to parents situated in the lowest quartile of the distribution in socioeconomic status can expect to find themselves in the 40th percentile of their generation's social status distribution. A complete absence of equality of opportunity would yield a mean attainment in the 12.5th percentile (the expected percentile of children with parents in the bottom 25th percentile when parental percentile perfectly predicts children's percentile). Further, mean attainment of those born to parents in the highest quartile of the distribution in socioeconomic status was 64.0. Perfect equality of opportunity would yield a mean attainment in the 50th percentile (the expected percentile when children's percentile is independent of parental percentile), indicating that opportunity was unequally distributed at both the lower and higher end of socioeconomic status. Similarly, we observed a mean correlation between parental and children's social status of 0.32. Perfect equality of opportunity would imply a zero expected correlation. We could not identify obvious trends in any of our measures of equality of opportunity across years and age groups (see online supplementary figures S2-S4 in online supplementary materials).

Associations between equality of opportunity and mortality
Table 2 shows point estimates for our three measures of equality of opportunity when the outcome variable was total all-cause logged mortality rates; estimates for these measures are also shown separately by gender. Both the first and third measure of equality of opportunity had statistically significant associations with mortality in the unadjusted models. We found that a 1 SD increase in achievement for the bottom quartile was associated with a 1.1% decrease in the total mortality rate ($\beta=-0.20$, CI$=-0.34$ to -0.06). In model 2, which adjusts for the covariates, this association was even stronger with a regression coefficient of -0.22 (CI$=-0.35$ to -0.10). Attainment of the top quartile was significantly and positively related to mortality in the adjusted model 2 ($\beta=0.18$, CI$=0.01$ to 0.35) only. The correlation coefficient of socioeconomic status between parents and offspring was significantly and positively associated with mortality rates in both models. Results for model 2 implied a 10.5% reduction in mortality when moving from complete absence of, to full equality of opportunity ($\beta=0.10$, CI$=0.02$ to 0.18).

We also performed separate analyses for men and women. For women, the coefficients of equality of opportunity were only significant in adjusted models for the attainment of bottom quartile and intergenerational correlation of socioeconomic status. For men, we found statistically significant associations in models for all three measures of equality of opportunity. Moreover, in adjusted models, the magnitude of the coefficient was higher for men (eg, in model 6: $\beta=-0.25$, CI$=-0.39$ to -0.11) than for women (in model 4: $\beta=-0.16$, CI$=-0.27$ to -0.04).

Equality of opportunity and causes of mortality
Table 3 shows how our three measures of equality of opportunity were associated with mortality rates for eight major causes

Table 3 Equality of opportunity and causes of mortality

	Attainment of bottom quartile		Attainment of top quartile		Correlation of parental and children's attainment	
	β (CI 95%)	R²	β (CI 95%)	R²	β (CI 95%)	R²
Infectious and parasitic diseases	M1: −0.22 (−0.70 to 0.25)	0.18	M1: 0.35† (−0.01 to 0.71)	0.18	M1: 0.20† (−0.01 to 0.40)	0.18
Malignant neoplasms	M2: −0.14† (−0.28 to 0.01)	0.07	M2: **0.19*** (0.06 to 0.32)	0.07	M2: 0.07† (−0.00 to 0.14)	0.07
Endocrine, nutritional and metabolic diseases	M3: −0.23 (−0.55 to 0.08)	0.23	M3: −0.04 (−0.36 to 0.29)	0.23	M3: 0.11 (−0.03 to 0.25)	0.23
Mental and behavioural disorders	M4: −0.15 (−0.91 to 0.62)	0.13	M4: 0.38 (−0.48 to 1.24)	0.14	M4: 0.09 (−0.31 to 0.49)	0.13
Diseases of the nervous system and the sense organs	M5: **−0.28*** (−0.48 to 0.09)	0.24	M5: 0.19 (−0.04 to 0.42)	0.24	M5: **0.16*** (0.06 to 0.26)	0.24
Diseases of the circulatory system	M6: −0.14 (−0.29 to 0.01)	0.20	M6: **0.21†** (0.02 to 0.39)	0.20	M6: 0.08 (−0.02 to 0.18)	0.20
Diseases of the respiratory system	M7: **−0.46*** (−0.76 to 0.16)	0.26	M7: **0.46*** (0.18 to 0.74)	0.26	M7: **0.28*** (0.14 to 0.42)	0.27
External causes of morbidity and mortality	M8: **−0.25*** (−0.44 to 0.07)	0.17	M8: 0.24† (−0.01 to 0.48)	0.17	M8: **0.14†** (0.02 to 0.25)	0.17

Total number of observations is 1200. CIs are computed using heteroskedasticity-robust SEs corrected for clustering at the age group-year level. Regressions are population weighted. Regressors from ESS are additionally design-weighted. All models include year, age group and country fixed effects and all controls described in Methods section and in table 1. Reported R² are 'within' R². Significant associations (uncorrected, at 5% level) are shown in bold.
Analyses were conducted using the REGHDFE Stata package.[42]
*Significant at table-wide false discovery rate of 5% (using Benjamini-Hochberg method).
†Significant at a table-wide false discovery rate of 10%.
ESS, European Social Survey.

Table 4 Lags and leads in equality of opportunity and mortality

	Attainment of bottom quartile		Attainment of top quartile		Correlation of parental and children's attainment	
	β (CI 95%)	R^2	β (CI 95%)	R^2	β (CI 95%)	R^2
Lags of equality of opportunity						
Contemporaneous	M1: **−0.23*** (−0.36 to 0.10)		M1: **0.28*** (0.11 to 0.46)		M1: **0.13*** (0.05 to 0.20)	
Five years younger	M1: **−0.21*** (−0.37 to 0.05)		M1: **0.25*** (0.08 to 0.43)		M1: **0.12*** (0.05 to 0.20)	
Ten years younger	M1: **−0.28*** (−0.45 to 0.12)		M1: 0.10 (−0.07 to 0.27)		M1: **0.12*** (0.04 to 0.20)	
Total effect	M1: **−0.72*** (−0.98 to 0.46)	0.16	M1: **0.64*** (0.35 to 0.93)	0.154	M1: **0.37*** (0.23 to 0.50)	0.16
Leads of equality of opportunity						
Contemporaneous	M2: **−0.20*** (−0.34 to 0.06)		M2: 0.15 (−0.03 to 0.33)		M2: 0.07 (−0.02 to 0.157)	
Five years older	M2: −0.06 (−0.22 to 0.10)		M2: **0.22*** (0.03 to 0.41)		M2: 0.08 (−0.02 to 0.175)	
Ten years older	M2: −0.09 (−0.23 to 0.06)		M2: **0.23*** (0.06 to 0.40)		M2: **0.10*** (0.01 to 0.181)	
Total effect	M2: **−0.35*** (−0.61 to 0.09)	0.09	M2: **0.60*** (0.28 to 0.92)	0.108	M2: **0.24*** (0.09 to 0.401)	0.10

Total number of observations is 1000 (N is lower than in previous tables due to inclusion of lags). CIs are computed using heteroskedasticity-robust SEs corrected for clustering at the age group-year level. Regressions are population weighted. Regressors from ESS are additionally design-weighted. All models include year, age group and country fixed effects and all controls described in Methods section and in table 1. Reported R^2 are 'within' R^2. Significant associations (uncorrected, at 5% level) are shown in bold.
Analyses were conducted using the REGHDFE Stata package[42].
*Significant at table-wide false discovery rate of 5% (using Benjamini-Hochberg method).
ESS, European Social Survey.

of death by the ICD-10 classification of mortality. Three major causes were significantly associated with at least two measures of equality of opportunity. First, mortality due to diseases of the nervous system and the sense organs was associated with both the attainment of the bottom quartile (β=−0.28, CI=−0.48 to −0.09) and the correlation between parental and children's socioeconomic status (β=0.16, CI=0.06 to 0.26). Second, mortality due to diseases of the respiratory system was related to all three measures of equality of opportunity (eg, β=−0.46, CI=−0.76 to −0.16 in model 7). Finally, mortality due to external causes was linked to the attainment of the bottom quartile (β=−0.25, CI=0.44 to 0.07) and the overall correlation of parental and children's socioeconomic status (β=0.14, CI=0.02 to 0.25).

Lags and leads in equality of opportunity

Table 4 demonstrates how mortality rates were associated with equality of opportunity observed in older and younger age groups. The sum of the lags/leads and the contemporaneous estimates gives the total effect of equality of opportunity. The contemporaneous measures of equality of opportunity remained significant when models included lags in equality of opportunity. Each lagged coefficient had the same sign as contemporaneous equality of opportunity. All lags but one were statistically significant. This resulted in much larger total effects for equality of opportunity than those reported in table 2. These estimates imply that, for example, a 1 SD change in the attainment of the bottom quartile was associated with a 3.9% change in mortality. Including leads in equality of opportunity yielded comparably large total effects for the attainment of the top quartile, but not for our other measures.

Robustness checks

We conducted a number of robustness checks, which are shown in online supplementary materials. First, we re-estimated the CIs for the presented point estimates via bootstrapping (online supplementary tables S3-S5). Second, we removed from the sample those cases in which our three measures took values beyond what was expected by full equality of opportunity (81, 23 and 18 observations were respectively removed for each measure of equality of opportunity from online supplementary

table S6). Third, we verified that our results were unaffected by survey year-age group-country units with very few micro-level observations (ie, less than 50, resulting in 84 fewer macro-level observations in online supplementary table S7). Fourth, to test a potential issue with overcontrolling, we re-estimated the main results without accounting for the proportion of those with higher education (online supplementary tables S8-S10). Fifth, we fitted gender-specific models for cause-specific mortality as well as models that simultaneously included lags and leads in our measures of equality of opportunity (online supplementary tables S11-S15). These tests resulted in similar findings compared with those reported in the main analysis.

DISCUSSION

The operationalisation of equality of opportunity in this study complements measures used in previous research for the USA. We explored mortality outcomes not only with respect to the attainment of individuals coming from the lowest quartile of socioeconomic status but also how the attainment of individuals coming from the highest quartile of socioeconomic status and the overall intergenerational correlation in socioeconomic status were associated with mortality in 30 European countries.

We found that equality of opportunity, particularly the attainment of the lowest quartile and the overall intergenerational correlation in socioeconomic status, was negatively related to mortality rates. We also identified significant gender differences. All our measures of equality of opportunity were more consistently linked to mortality of men than that of women, suggesting that equality of opportunity primarily affects men's, rather than women's, health. There may be multiple reasons for this gender difference. Past research suggests that women's and men's mobility experiences differ significantly and that women's life chances are less strongly related to their social origins and are more likely to be shaped by other conditions, such as marriage markets, than is the case for men's life chances.[33][34] Further, men and women also tend to differ in their understanding and assessment of the causes behind their own successes and failures in life.[35] For instance, it might be that men who live in environments with higher equality of opportunity and who experience

upward intergenerational mobility are more likely than women to exhibit lower levels of psychological distress.[10]

Differences in relation to the associations between equality of opportunity and specific causes of mortality can also inform our understanding of the mechanisms behind these associations. First, common modifiable causes of chronic respiratory diseases, such as tobacco use, unhealthy diet, physical inactivity, indoor and outdoor air pollution, allergens or occupational agents, are well known.[36] Low equality of opportunity might cause individuals born into disadvantaged circumstances to be exposed to such stressors for longer and thus to have a higher likelihood of developing respiratory diseases. Our second significant cause, diseases of the nervous system and the sense organs, is also largely shaped by social determinants. Smoking, diabetes and environmental risk factors, such as exposure to pesticides, are important explanations, while stress, physical inactivity and regular alcohol consumption are all risk factors for vascular disorders and one of its main components—vascular dementia.[37]

Perhaps the most explicit theoretical channel linking equality of opportunity and mortality is the last significant group of causes of mortality, which consist of deaths due to external causes, including intentional self-harm and assaults. The limited chances of upward social mobility are likely to be viewed even more unfair than high economic inequality in itself.[38] With the same mechanisms as the extensively investigated consequences of income inequality,[39] inequality of opportunity can affect suicidal behaviour through psychological aspects such as depression caused by hopelessness, economic stress and anxiety about future. Further, inequality of opportunity can facilitate tensions and consequently violence in society if individuals perceive their lack of upward mobility chances as unfair and unjust.[14]

Our findings in relation to the effects of lags and leads in equality of opportunity did not confirm that the main channel linking equality of opportunity and mortality runs through individuals' greater investment aspirations in health, as determined by prospects of upward mobility, which we operationalised as equality of opportunity among older age groups. The results, however, suggest that retrospective equality of opportunity for younger generations is more consistently associated with mortality rates than the prospective equality of opportunity of older generations. This may be explained via spillover effects, in which equality of opportunity among younger generations affects the health of older generations. A complementary explanation is that equality of opportunity for younger generations is indicative of intergenerational mobility patterns, which individuals themselves experienced in the past.

Limitations

The main limitation of this study is that we could not directly test the causal associations between equality of opportunity and mortality, but we doubt that data which would allow for the direct estimation of causal effects exist. Such data would have to include an exogenous shock that affects nothing but equality of opportunity. Neither conceptually nor empirically can we think of such a type of shock. In addition, low sample sizes used to compute measures for our 1200 units of analysis, and other well-known limitations of survey data (eg, unaccounted for non-response bias) could affect our results. Moreover, mortality rates are the only cross-nationally comparable administrative data for specific age groups across time in Europe. This is the main reason why we were unable to account for any other covariates of mortality based on administrative data. Future studies, instead of accounting for country fixed effects, might also investigate if the

What is already known on this subject

► The association between individuals' social mobility and health is well established. However, how the health consequences of individuals' intergenerational mobility translate into macro-level associations between equality of opportunity and mortality is imperfectly understood.
► Pioneering research for the USA suggests that county-level intergenerational income mobility is negatively associated with mortality. No other evidence from different countries exists to date.

What this study adds

► We explored how the attainment of individuals' socioeconomic status relative to their parents' socioeconomic status was associated with mortality in 30 European countries and found that equality of opportunity was negatively related to mortality rates.
► Intergenerational equality of opportunity was more consistently linked to mortality of men than that of women and especially to mortality due to external causes, including intentional self-harm and assaults.
► Our findings allow us to conclude that equality of opportunity is not only fair but it is also good for health.

links between equality of opportunity and mortality are moderated by specific contextual characteristics at the macro-level.

CONCLUSION AND POLICY IMPLICATIONS

Our finding that equality of opportunity is significantly associated with mortality, together with earlier evidence from the USA, allows us to conclude that equality of opportunity is not only fair but it is also good for health. Therefore, measures that aim at tackling barriers of various kinds that prevent population groups with disadvantaged social origins from experiencing intergenerational social mobility can be justified not only in virtue of normative considerations of equality of opportunity but also in terms of individuals' chances to enjoy long and healthy lives.

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