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# Socioeconomic inequalities in morbidity and mortality in western Europe

Johan P Mackenbach, Anton E Kunst, Adriëne E J M Cavelaars, Feikje Groenhouf, José J M Geurts, and the EU Working Group on Socioeconomic Inequalities in Health\*

## Summary

**Background** Previous studies of variation in the magnitude of socioeconomic inequalities in health between countries have methodological drawbacks. We tried to overcome these difficulties in a large study that compared inequalities in morbidity and mortality between different countries in western Europe.

**Methods** Data on four indicators of self-reported morbidity by level of education, occupational class, and/or level of income were obtained for 11 countries, and years ranging from 1985 to 1992. Data on total mortality by level of education and/or occupational class were obtained for nine countries for about 1980 to about 1990. We calculated odds ratios or rate ratios to compare a broad lower with a broad upper socioeconomic group. We also calculated an absolute measure for inequalities in mortality, a risk difference, which takes into account differences between countries in average rates of illhealth.

**Findings** Inequalities in health were found in all countries. Odds ratios for morbidity ranged between about 1.5 and 2.5, and rate ratios for mortality between about 1.3 and 1.7. For men's perceived general health, for instance, inequalities by level of education in Norway were larger than in Switzerland or Spain (odds ratios [95% CI]: 2.57 [2.07–3.18], 1.60 [1.30–1.96], 1.65 [1.44–1.88], respectively). For mortality by occupational class, in men aged 30–44, the rate ratio was highest in Finland (1.76 [1.69–1.83]), although there was no large difference in the size of the inequality in those countries with data. For men aged 45–59, for whom France did have data, this country had the largest inequality (1.71 [1.66–1.77]). In the age-group 45–64, the absolute risk difference ranked Finland second after France (9.8% [9.1–10.4], 11.5% [10.7–12.4]), with Sweden and Norway coming out more favourably than on the basis of rate ratios. In a scatter-plot of average rank scores for morbidity versus mortality, Sweden and Norway had larger relative inequalities in health than most other countries for both measures; France fared badly for mortality but was average for morbidity.

**Interpretation** Our results challenge conventional views on the between-country pattern of inequalities in health in western European countries.

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\*Listed at end of article

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## Introduction

Socioeconomic inequalities in health have been reported to vary between countries,<sup>1–11</sup> although comparative studies have methodological drawbacks. Thus looking for conditions that reduce health inequalities is difficult. We have done a large between-country comparison of inequalities in mortality and morbidity in western Europe in which we tried to overcome some of these difficulties. Our full-length report was published in 1996.<sup>12</sup>

## Data and methods

### Morbidity

Data on morbidity were obtained from nationally representative health interview, level of living, or multipurpose surveys in 11 countries (table 1) over 1985–92 covering around 5000–132 000 (median about 11 000) respondents. Generally, institutionalised populations were excluded in the surveys. We report on persons aged 25–69. Great Britain comprises England, Wales, and Scotland. Germany means the former West Germany.

We selected four health indicators to compare countries: perceived general health (very good or good vs less than good), chronic conditions (none vs  $\geq 1$ ), long-term disability (none vs  $\geq 1$ ), and any long-standing health problem (no vs yes). We limited the analysis to common lists of nine chronic conditions and six disabilities.

### Mortality

Data on mortality were obtained from nationally representative longitudinal or “unlinked” cross-sectional studies in nine countries (table 3). In a few countries, foreigners, the institutionalised population, and/or military personnel were excluded. We report on the 30–59 age-group; because of heterogeneity by age, results are reported separately for 30–44 and 45–59. All ages are age at death.

Longitudinal studies in England and Wales, France, the four Nordic countries, and Italy linked census data from about 1981 and mortality during a follow-up of 5–10 years. In all countries except England and Wales, complete census populations were followed up. In Italy, the follow-up was 6 months.

Unlinked cross-sectional studies in Switzerland and Spain compared deaths by socioeconomic status on death certificates (numerator) with population numbers by socioeconomic status during the census (denominator), both for about 1980–82.

### Socioeconomic status

We used three indicators of socioeconomic status: education (morbidity and mortality; men, women), occupational class (morbidity and mortality; men), and income (morbidity only; men, women). Education was measured as the highest level (general, technical, vocational) successfully completed. Using OECD guidelines,<sup>13</sup> we reclassified the original individual data into four classes (no or only primary, and lower, upper, and post secondary).

Occupational class was measured with the Erikson-Goldthorpe scheme.<sup>14,15</sup> We reclassified the original individual data into this scheme, which was then collapsed into three classes (non-manual, farmers, manual). This was done for men only; we could not measure occupational class of women in an internationally comparable way. In most studies, there was insufficient

Country	Odds ratio (95% CI)*			
	Perceived general health†	Long-term disabilities‡	Chronic conditions§	Any long-standing health problem¶
Norway	2.57 (2.07–3.18)	2.39 (1.74–3.28)	..	..
Netherlands	2.22 (1.91–2.58)	2.29 (1.84–2.86)	1.48 (1.27–1.73)	1.44 (1.26–1.64)
Sweden	2.11 (1.68–2.65)	..	1.85 (1.52–2.25)	..
Italy	2.08 (1.94–2.23)	..	1.80 (1.69–1.91)	..
France	2.03 (1.58–2.62)	..	..	..
Great Britain	2.02 (1.79–2.28)	..	..	1.49 (1.32–1.67)
Denmark	2.00 (1.54–2.61)	1.64 (1.12–2.42)	..	1.53 (1.22–1.93)
Finland	1.96 (1.70–2.27)	1.67 (1.38–2.01)	..	1.40 (1.22–1.62)
Spain	1.65 (1.44–1.88)	..	1.44 (1.27–1.65)	..
Switzerland	1.60 (1.30–1.96)	1.28 (1.05–1.56)	..	..
Germany (W)	1.55 (1.16–2.07)	1.69 (1.31–2.17)	1.51 (1.32–1.73)	..

\*Up to lower secondary vs upper secondary education and higher. †Very good or good vs less-than-good. ‡No serious difficulties vs one or more serious difficulties with: climbing stairs, walking, carrying bag, reading newspaper, conversation with more than two persons, or dressing. §No chronic conditions vs one or more of: cancer, diabetes mellitus, respiratory diseases, heart diseases, stroke, liver/gallbladder diseases, kidney/urinary tract diseases, stomach/duodenum ulcer, musculoskeletal diseases. ¶No vs yes.

Table 1: Morbidity by level of education for men aged 25–69: ordered by odds ratio for perceived general health

information on the former occupation of economically inactive men, which may bias estimates of inequalities because inactive men have higher mortality and come from lower occupational classes.<sup>16</sup> We therefore adjusted by the proportion of inactive men by occupational class, and the mortality rate ratio of inactive versus active men. Details on this procedure are available from JPM or *The Lancet*.

Income was measured by adding all income components of all household members, and by adjusting the result for household size (equivalent household income = total household income ÷ [household size]<sup>0.36</sup>).<sup>17</sup>

### Analysis

Many summary measures for socioeconomic inequalities in health have been used.<sup>11,16,18</sup> We used several measures, which gave similar results. The first was age-adjusted odds ratios for morbidity or rate ratios for mortality, which compared a broad lower with a broad upper socioeconomic group.

The second type was more complex, also taking into account the population distribution across socioeconomic groups: the relative index of inequality and the index of dissimilarity. The relative index of inequality was used for education and income, and is an odds ratio (logistic regression, morbidity) or a rate ratio (Poisson regression, mortality). It expresses the risk of illhealth for those at the bottom of the social hierarchy compared with those at top.<sup>2,16,18</sup> We adjusted for age (nominal variable, 5-year age-groups) in the regression. The dissimilarity index was used for inequalities by occupational class. It expresses the proportion of all cases of illhealth within the population that would have to be redistributed to achieve equality.<sup>16,18</sup> Age was adjusted for by calculating the index from age-adjusted morbidity and mortality.

Both sets quantify relative inequalities in illhealth between socioeconomic groups. Because countries may differ in their average rates of illhealth, the international rank based on these relative inequalities will not necessarily be the same as that based on absolute measures, such as a morbidity or mortality rate difference. Because of subtle differences between countries in

	Number of observations	Average rank	Range
Sweden	10	2.5†	1–3
Norway	8	2.4	2–3
Denmark	9	2.3	1–3
Great Britain	10	2.2	2–3
France	5	2.0	2–2
Netherlands	20	2.0	1–3
Italy	4	2.0	1–3
Finland	12	1.8	1–2
Spain	4	1.5	1–2
Germany (W)	14	1.4‡	1–2
Switzerland	6	1.2†	1–2

\*Scores based on international rank: approximate bottom (1), middle (2), or top tertile (3); tinted box=expected value of 2.0. †p<0.05, ‡p<0.01.

Table 2: Overview for morbidity: ordered by average ranks\*

population, design, and data collection, which influence the average rates of illhealth, it is impossible to calculate valid measures of absolute inequalities in morbidity or mortality within the datasets we used. For mortality, however, our estimates of relative inequalities could be combined with data on average mortality levels from national mortality registrations, as published by WHO,<sup>19</sup> to illustrate the effect of choosing absolute instead of relative measures of inequality.

For morbidity and mortality, the results on relative inequalities were summarised by classifying each country into the approximate bottom, middle, or top tertiles bottom (1), middle (2), or top (3) tertiles of the rank order for the 11 or 9 countries. The average rank for each country was calculated, and permutation tests<sup>20</sup> were used to assess whether, given the total observations for a country, this average was significantly higher or lower than that (2.0) expected under the null hypothesis of no differences between countries.

## Results

### Morbidity

For inequalities in morbidity within countries, for men, the odds ratios by level of education ranged from about 1.3 to 2.6 (table 1). For perceived general health, for instance, eight of the 11 countries had odds ratios of almost 2 or higher. The 95% CIs indicate that inequalities for this measure were larger in Norway than in Switzerland or Spain. For long-term disabilities we could not obtain data for all the countries, but Switzerland was better off than Norway or the Netherlands.

The relative index of inequality also showed variation between countries for perceived general health by education (figure 1). For men, inequalities were larger in Great Britain, the four Nordic countries, the Netherlands, and Italy than in Germany. Spain was better off than Norway, the Netherlands, and Italy. By the same index, in women, inequalities within Sweden were greater than those in Germany, Switzerland, Italy, and Spain (figure 1).

We have summarised all the results for morbidity in table 2; odds ratios and relative indices of inequality or of dissimilarity produced the same average rank. The average ranged between 1.2 for Switzerland (most of its six observations fell in the bottom tertile, p<0.05) and 2.5 for Sweden (most of its ten observations fell in the middle or top tertile, p<0.05). Germany's 14 observations also produced a low average rank (p<0.01).

### Mortality

We had fewer observations for mortality. Within countries, and for both age-groups of men (30–44 and 45–59),

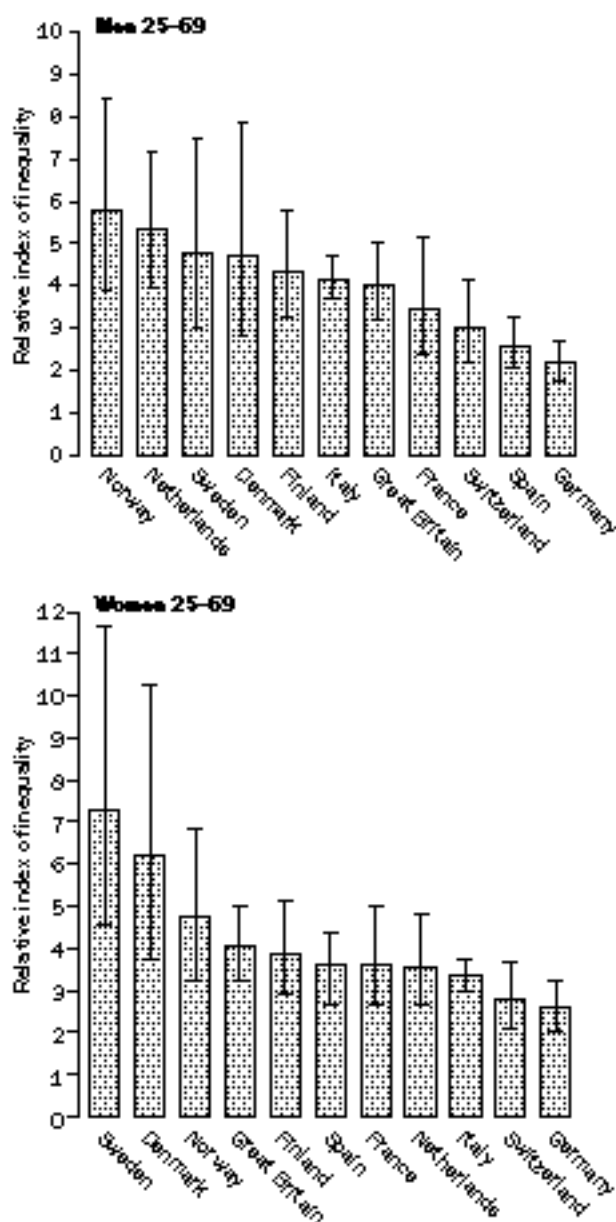


Figure 1: Relative index of inequality for perceived general health by level of education (95% CI)

mortality was higher for manual compared with non-manual occupations (rate ratios 1.33–1.76), but there was little difference in the size of this inequality between countries (table 3). At age 30–44, the manual/non-manual rate ratio was highest in Finland, followed by Sweden and Norway. Unfortunately, no data for France were available in this age-group. In the higher age-group, the rate ratio was highest in France, followed by Finland. Similar patterns were seen with educational inequalities in mortality, and with relative indices of inequality or of dissimilarity.

In the third column of table 3 we illustrate the effect of using a measure of absolute inequality. Because Sweden and Norway have low mortality rates among middle-aged men, these countries showed more favourable positions on an absolute measure. The reverse applied to Finland, which has the highest mortality among middle-aged men and whose position became even more unfavourable. France, however, still led the international league.

Country	Rate ratio (95% CI)*		Risk difference (95% CI)* †
	30–44 years	45–59 years	45–64 years
France	..	1.71 (1.66–1.77)	11.5 (10.7–12.4)
Finland	1.76 (1.69–1.83)	1.53 (1.49–1.56)	9.8 (9.1–10.4)
England/Wales	1.46 (1.24–1.74)	1.44 (1.33–1.56)	7.5 (5.6–9.6)
Denmark	1.53 (1.47–1.59)	1.33 (1.30–1.36)	6.3 (5.7–6.9)
Italy	1.35 (1.28–1.42)	1.35 (1.25–1.46)	6.0 (4.8–7.3)
Spain	..	1.37 (1.34–1.39)	5.8 (5.3–6.1)
Sweden	1.67 (1.59–1.75)	1.41 (1.38–1.44)	5.6 (5.2–6.0)
Norway	1.65 (1.57–1.74)	1.34 (1.30–1.39)	5.2 (4.6–6.0)
Switzerland	1.45 (1.36–1.55)	1.34 (1.29–1.39)	5.0 (4.3–5.8)
Netherlands	..	..	..
Germany (W)	..	..	..

\*Adjusted for exclusion of economically inactive men (details available from JPM or *The Lancet*). †Expressed as % dying between ages of 45 and 65, calculated from national average probability of dying between these ages in 1984 and standardised mortality ratio of manual and non-manual occupations. No data for Netherlands and Germany.

Table 3: Mortality by occupational class in men in manual versus non-manual occupations: ordered by risk differences

Table 4 is a general overview based on rank scores for relative inequalities. France had a significantly larger-than-average inequality in mortality ( $p < 0.05$ ).

#### Morbidity and mortality

We have combined the overall results for relative inequalities in morbidity and mortality in one scatter-plot (figure 2). Sweden and Norway had larger inequalities than most other countries in both morbidity and mortality, whereas Switzerland and Spain had smaller-than-average inequalities in both outcomes. France had the largest inequality in mortality but average inequality in morbidity.

#### Discussion

Countries in western Europe were generally similar in the size of socioeconomic inequalities in health. In all countries, risks of morbidity and mortality were higher in the lower socioeconomic groups. Surprisingly, we found that relative inequalities were larger than average in Sweden and Norway (both for morbidity and mortality). France had the highest inequality for mortality.

Large inequalities for morbidity have been reported in the Nordic countries and the Netherlands,<sup>1,4</sup> but one study found smaller inequalities in Sweden than in England and Wales during the early 1980s.<sup>7,9</sup> The discrepancy is due at least in part to the use of a crude summary measure for inequalities in health in this earlier study, because a more sophisticated measure produced different results.<sup>11</sup> Sweden had small inequalities when inequalities in perceived general health by level of income

	Number of observations	Average rank	Range
France	3	3.0*	3–3
Sweden	2	2.5	2–3
Norway	6	2.3	1–3
Finland	6	2.3	2–3
England/Wales	2	2.0	2–2
Denmark	6	1.8	1–2
Switzerland	2	1.5	1–2
Italy	6	1.5	1–3
Spain	1	1.0	..
Netherlands	0	..	..
Germany (W)	0	..	..

\* $p < 0.05$ . Tinted box=expected value of 2.0.

Table 4: Overview for mortality: ordered by average ranks\*

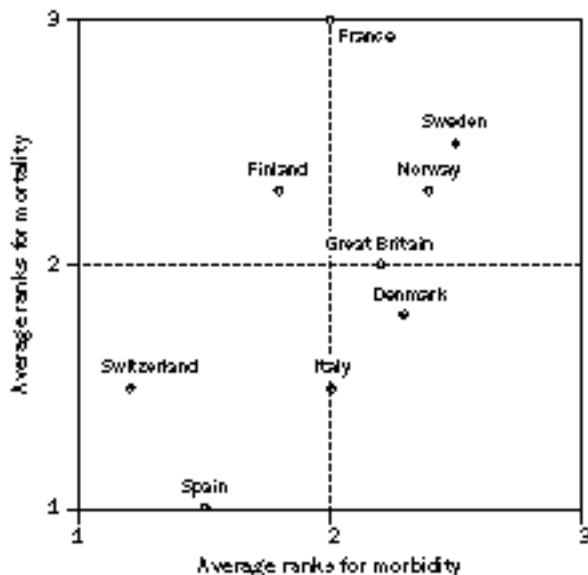


Figure 2: Average ranks for morbidity and mortality

between nine countries during the late 1980s were compared.<sup>21</sup> We also found small income-related inequalities in Sweden (detailed results not shown, but Sweden was in the bottom or middle tertile for these indicators). Our study showed that the favourable position of Sweden for income-related inequalities in health was more than balanced by unfavourable positions for inequalities related to education and occupation. This finding suggests that welfare policies may affect one dimension of socioeconomic inequalities in health (eg, income-related inequalities), leaving others untouched, and that differences between countries might show up not so much as generalised differences for all three socioeconomic indicators but as differences in the pattern of inequalities.

For mortality, there were also differences between our results and those of previous studies. The earlier reports from the 1970s generally suggested that relative inequalities in mortality in the Nordic countries (excluding Finland) were small,<sup>2,3,6,8-10</sup> whereas we found them to be large. Previous studies did not adjust for the exclusion of economically inactive men, which has a strong effect on the relative position of Nordic countries. The previous studies were also more fragmentary. For example, in one study, Italy had large inequalities in mortality by level of education.<sup>2</sup> These data applied to young men and we found this to be the only exception among the six available observations on inequalities in mortality for Italy; the other five gave small inequalities.

Our results were also surprising in that they challenge widely held views on the relation between societal characteristics and the size of inequalities in health.<sup>22,23</sup> Our data do not support the hypothesis that inequalities in health are smaller in countries whose social, economic, and health-care policies are more influenced by egalitarian principles, such as Sweden and Norway. It could be argued that these policies are reflected in the smaller absolute inequalities in mortality in these countries, but one would then have to assume that by bringing benefit to high and low socioeconomic groups, egalitarian policies reduce overall mortality. Although there is evidence to support this assumption,<sup>24</sup> it is still surprising that relative inequalities did not seem to have been affected.

Despite our efforts at comprehensiveness, our picture of socioeconomic inequalities in health between European countries was still fragmentary, because most national data-collection systems have incomplete cover and, for those aspects that are covered, the level of international comparability is often unacceptable, such that we could not use the data. Even in the data we did use, for morbidity, the results could be biased by between-country differences in general survey characteristics, such as the exclusion of certain groups (eg, foreigners), use of proxy interviews, non-response rates, and the survey years. However, we found no association between countries' survey characteristics and their inequalities in morbidity.<sup>12</sup> Nevertheless, the margins of uncertainty are probably wide.

The same applies to mortality. Comparability problems include possible inaccuracies of the adjustment procedure for the exclusion of economically inactive men, exclusion of other groups, use of an approximate Erikson-Goldthorpe algorithm in countries other than France, England and Wales, and Sweden, and the unlinked design used in Switzerland and Spain. Also, for some countries, data were used from the early 1980s instead of the entire 1980s, which, given the increase in mortality inequalities in many countries,<sup>25-28</sup> could have introduced underestimation. Unfortunately, due to an accumulation of several of these problems, the margins of uncertainty for the estimates of inequalities in mortality in Switzerland, Italy, and Spain—ie, the three countries with the lowest overall scores for mortality—are wider than those for other countries.<sup>12</sup> Thus we cannot entirely exclude that these low overall scores are artifactual. However, the same countries usually also had smaller inequalities in morbidity, which suggests that there is some truth in the overall pattern.

Inequalities in health are determined by socioeconomic differences in lifetime exposure to various factors, and the explanation of the international pattern that we saw should therefore not be sought in the late 1980s, but in the preceding decades. The need for an historical perspective is strengthened by the fact that inequalities in health are dynamic. This is particularly evident for mortality,<sup>25-28</sup> where the increasing gradients are partly due to widening inequalities in cardiovascular mortality, which in turn are related to cultural shifts in the distribution of behavioural risk factors, such as smoking and obesity,<sup>29</sup> and not necessarily to changes in the structure of society or in social, economic, or health-care policies.

The possible importance of such intervening developments is emphasised by analysis of causes of death: inequalities in mortality in the Nordic countries were determined by a socioeconomic gradient for cardiovascular mortality, whereas in Switzerland, Italy, and Spain there is almost no such gradient.<sup>12</sup> Socioeconomic gradients in smoking were also larger than average in Sweden and Norway, and smaller than average in Switzerland, Italy, and Spain.<sup>12</sup> Perhaps this is simply the result of differences in timing of the epidemic of cardiovascular disease and its risk factors, which implies that one should study the effect of egalitarian policies on inequalities in health controlling for "epidemiological time" rather than calendar time.

Another possible explanation derives from the fact that countries may differ in social mobility. In "open" societies, achieved social position is less dependent on the social class of one's parents, and more dependent on

personal characteristics, which may include health and health-related factors. Although differences between industrialised countries are small,<sup>30</sup> Sweden has higher rates of social mobility than other European countries<sup>14</sup> which could then paradoxically contribute to larger inequalities in health.

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