Occupational class and cause specific mortality in middle aged men in 11 European countries: comparison of population based studies

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Abstract

Objectives: To compare countries in western Europe with respect to class differences in mortality from specific causes of death and to assess the contributions these causes make to class differences in total mortality.

Design: Comparison of cause of death in manual and non-manual classes, using data on mortality from national studies.

Setting: Eleven western European countries in the period 1980-9.

Subjects: Men aged 45-59 years at death.

Results: A north-south gradient was observed: mortality from ischaemic heart disease was strongly related to occupational class in England and Wales, Ireland, Finland, Sweden, Norway, and Denmark, but not in France, Switzerland, and Mediterranean countries. In the latter countries, cancers other than lung cancer and gastrointestinal diseases made a large contribution to class differences in total mortality. Inequalities in lung cancer, cerebrovascular disease, and external causes of death also varied greatly between countries.

Conclusions: These variations in cause specific mortality indicate large differences between countries in the contribution that disease specific risk factors like smoking and alcohol consumption make to socioeconomic inequalities in mortality. The mortality advantage of people in higher occupational classes is independent of the precise diseases and risk factors involved.

Introduction

Socioeconomic differences in morbidity and mortality have been observed in all European countries for which data are available.[1 2] Health inequalities are a common theme in all European countries, but it is uncertain whether this is a theme with major variations.

There are several reasons for an interest in the degree to which health inequalities are similar or dissimilar in the different European countries. Large dissimilarities would imply that socioeconomic inequalities in health are highly sensitive to specific national circumstances. Further study might show which circumstances are most influential and could identify circumstances that could be modified through intervention.

A second reason relates to the international exchange of research findings and experiences with health policies. An example is the findings from explanatory studies, most of which are from the United Kingdom and Nordic countries.[1 2] Combining research findings from different countries can provide a more comprehensive picture of the causes of health inequalities, but this is possible only to the extent that the patterns and causes of health inequalities are similar in these countries. Some degree of similarity is also required when extrapolating these findings to other parts of Europe.

Several studies have compared countries with respect to the magnitude of inequalities in mortality.[3–6] We recently found higher mortality in manual classes than non-manual classes in 11 Western European countries.[7–9] For men aged 45-59 years, these mortality differences were approximately equal in most countries; larger differences were observed for Finland and, especially, France (fig 1). Larger differences were also observed for Ireland, but only in absolute terms. Class differences in mortality among men aged 30-44 were relatively large in Finland, Sweden, and Norway (no data for France).[7–9]

Only a few studies have compared socioeconomic differences in mortality according to cause of death.[3 4] A study that compared Hungary to northern Europe found that the association with educational level was relatively weak for cardiovascular disease but relatively strong for other causes of death.[3] This suggested that risk factors for cardiovascular disease (for example, tobacco consumption) made a smaller contribution to mortality differences in Hungary than in northern Europe.

The present study compares 11 countries from the northern and southern part of western Europe. It compares occupational class differences in mortality from specific causes of death and assesses the contributions these causes make to class differences in total mortality among men aged 45-59.

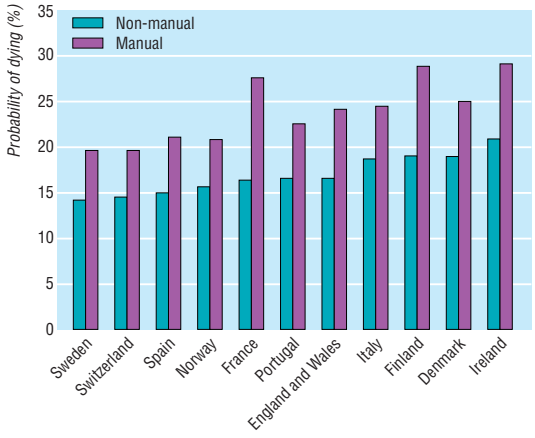

Fig 1 Probability of men in non-manual and manual classes dying between the ages 45 and 65[7 9]

Methods

This study is part of a larger project on socioeconomic differences in morbidity and mortality in Europe.[7 8] Table 1 shows data sources. Data on mortality by occupational class and cause of death were obtained from longitudinal studies or from cross sectional studies. Longitudinal studies consisted of follow up (of a representative sample) of the national population censuses carried out around 1981. Most follow up studies covered the period 1980-9, but Sweden and Italy had shorter periods. The cross sectional studies were of the "unlinked" type,[9] with the death registry providing the number of deaths according to occupational class as registered on death certificates and the population census providing the corresponding number of people at risk according to the same occupational classes. All cross sectional studies were centred on the national population censuses around 1981.

The age group 45-59 years was used for studies that classified men according to their age at death. For longitudinal studies with a follow up period of about 10 years, the birth cohort aged 40-54 years at the start of follow up was used

Nine causes of death were distinguished. As shown in table 2, the share of these causes of death in the total number of deaths varies strongly between European countries. Ischaemic heart disease is the largest single cause of death in northern countries. In France and southern countries, cancers other than lung cancer and gastrointestinal diseases are relatively important. Other causes of death have different international patterns.

A common occupational class scheme, the EGP (Erikson-Goldthorpe-Portocarero) scheme, was applied to as many countries as possible.[10] This scheme was developed to facilitate international comparisons of social stratification and mobility and is therefore particularly suitable for this study. EGP conversion algorithms were applied to individual data on three aspects of jobs: occupational title (by three digit code), employment status (self employed or not), and supervisory status. These conversion schemes could not be applied to the data available for Denmark, Ireland, Italy, Spain, and Portugal, but data from these countries could be made broadly comparable to the EGP scheme at the level of three broad classes: non-manual classes (including self employed men), manual classes, and the class of farmers and farm labourers.

Table 1 Overview of sources of data

Country	Design	Period	Populations excluded	Observed No of deaths
Finland	Longitudinal	1981-90	None	39 090
Sweden	Longitudinal	1980-86	None	39 789
Norway	Longitudinal	1980-90	None	22 033
Denmark	Longitudinal	1981-90	None	34 400
England and Wales	Longitudinal	1981-89	None	2 703
Ireland	Cross sectional	1980-82	None	6 348
France	Cross sectional	1981-83	French born out of France; foreigners	133 415
	Longitudinal	1980-89	French born out of France; foreigners	15 016
Switzerland	Cross sectional	1979-82	Foreigners	13 317
Italy	Longitudinal	1981-82	Foreigners; people in institutions	8 325
Spain	Cross sectional	1980-82	Military	70 524
Portugal	Cross sectional	1980-82	Military	22 581

For most countries, there was insufficient information on the former occupation of economically inactive men; these were excluded from the analysis. Because this exclusion is likely to lead to an underestimation of mortality differences between occupational classes, we applied a procedure that gives an approximate correction for this underestimation.[8 9] This procedure is based on a formula that calculates correction factors as a function of the population share and the relative mortality level of the men that had to be excluded from analysis. The adjustment was made for each cause of death separately. The formula was found to perform well in several tests.[8 9]

Mortality differences by occupational class were measured by rate ratios and rate differences. Rate ratios compare mortality in manual classes with mortality in non-manual classes. Rate ratios were estimated by means of Poisson regression. The regression model included a term on the contrast between manual and non-manual classes. A series of terms representing five year age groups were added to control for age.

Rate differences were calculated as the absolute difference between mortality in manual and non-manual classes. Mortality rates were adjusted for age by the indirect method, with national age specific mortality rates as the standard. The rate differences for specific causes of death add up to the rate difference for total

Table 2 Proportion of deaths due to specific causes in men aged 45-59

Country	Lung cancer (ICD 162)	Other cancers (ICD 140-239)	Ischaemic heart disease (ICD 410-414)	Cerebrovascular disease (ICD 430-438)	Other cardiovascular diseases (ICD 390-459)	Respiratory diseases (ICD 460-519)	Gastrointestinal diseases (ICD 520-579)	Other diseases (ICD <800)	External causes (ICD 800-999)
Finland (n=39 090)	7.3	13.4	35.6	6.2	6.1	3.4	4.6	5.3	18.1
Sweden (n=39 789)	5.5	20.1	34.6	4.7	5.8	3.9	4.6	7.8	13.1
Norway (n=22 033)	7.1	19.9	34.2	4.2	5.4	2.9	3.5	10.9	11.9
Denmark (n= 34 400)	9.5	19.8	26.3	4.1	5.2	3.8	5.8	14.0	11.6
England and Wales (n=2703)	11.4	20.2	38.2	5.5	5.1	5.7	*	8.0	5.8
Ireland (n=6348)	8.3	18.0	39.0	5.6	5.7	7.2	2.8	5.6	7.8
France (n=133 415)	9.2	28.8	9.9	4.5	7.4	3.4	11.3	12.4	13.2
Switzerland (n=13 317)	11.9	21.5	20.7	3.5	9.8	3.4	6.4	7.8	15.0
Italy (n=8325)	‡	36.6	§	§	31.8	3.3	12.8	5.7	9.6
Spain (n=70 524)	8.3	23.5	14.4	6.8	10.4	6.1	12.3	8.3	9.8
Portugal (n=22 581)	4.2	18.7	11.3	11.4	6.2	6.2	13.2	13.4	15.4

*Combined with other diseases.
‡Combined with other cancers.
§Combined with other cardiovascular diseases.

Table 3 Mortality rate ratio (95% confidence interval) comparing manual classes to non-manual classes for major groups of causes of death in men aged 45-59

Country	All causes	Neoplasms	Cardiovascular diseases	All other diseases	External causes
Finland	1.53 (1.49 to 1.56)	1.39 (1.32 to 1.47)	1.48 (1.42 to 1.53)	1.60 (1.48 to 1.70)	1.76 (1.66 to 1.87)
Sweden	1.41 (1.38 to 1.44)	1.18 (1.13 to 1.23)	1.36 (1.31 to 1.40)	1.83 (1.72 to 1.93)	1.76 (1.65 to 1.87)
Norway	1.34 (1.30 to 1.39)	1.25 (1.18 to 1.33)	1.34 (1.27 to 1.40)	1.51 (1.40 to 1.63)	1.42 (1.29 to 1.54)
Denmark	1.33 (1.30 to 1.36)	1.21 (1.16 to 1.26)	1.28 (1.23 to 1.33)	1.62 (1.54 to 1.70)	1.36 (1.27 to 1.45)
England and Wales	1.44 (1.33 to 1.56)	1.21 (1.05 to 1.39)	1.52 (1.36 to 1.71)	1.74 (1.40 to 2.16)	1.74 (1.24 to 2.46)
Ireland	1.38 (1.30 to 1.46)	1.39 (1.24 to 1.55)	1.27 (1.17 to 1.38)	1.66 (1.43 to 1.93)	1.66 (1.33 to 2.07)
France*	1.71 (1.66 to 1.77)	1.71 (1.61 to 1.82)	1.35 (1.26 to 1.45)	2.09 (1.97 to 2.22)	1.72 (1.57 to 1.88)
Switzerland	1.35 (1.29 to 1.39)	1.44 (1.35 to 1.54)	1.08 (1.01 to 1.15)	1.75 (1.60 to 1.91)	1.39 (1.26 to 1.53)
Italy	1.35 (1.28 to 1.42)	1.43 (1.31 to 1.55)	1.17 (1.07 to 1.28)	1.60 (1.43 to 1.80)	1.22 (1.03 to 1.46)
Spain	1.37 (1.34 to 1.39)	1.33 (1.29 to 1.38)	1.19 (1.15 to 1.22)	1.52 (1.46 to 1.57)	1.80 (1.68 to 1.93)
Portugal	1.36 (1.31 to 1.40)	1.12 (1.05 to 1.21)	1.03 (0.97 to 1.10)	1.65 (1.55 to 1.76)	2.15 (1.94 to 2.38)

*Confidence intervals for specific causes of death are estimates.

Table 4 Mortality rate ratio comparing manual classes to non-manual classes for specific causes of death in men aged 45-59

Country	Lung cancer	Other cancers	Ischaemic heart disease	Cerebrovascular disease	Other cardiovascular disease	Respiratory disease	Gastrointestinal causes	Other diseases
Finland	2.20*	1.14*	1.47*	1.55*	1.52*	2.37*	1.37*	1.50*
Sweden	1.46*	1.11*	1.36*	1.31*	1.42*	1.91*	1.58*	1.95*
Norway	1.62*	1.15*	1.35*	1.21*	1.31*	1.68*	1.42*	1.49*
Denmark	1.51*	1.09*	1.28*	1.28*	1.28*	2.30*	1.65*	1.48*
England and Wales	1.54*	1.07	1.50*	1.74*	1.46*	2.13*	†	1.49*
Ireland	1.95*	1.17*	1.23*	1.57*	1.40	2.00*	1.08	1.67*
France	1.65*	1.75*	1.14	1.61*	1.54*	2.63*	2.20*	1.89*
Switzerland	1.73*	1.29*	0.96	1.43*	1.26	2.31*	1.62*	1.69*
Italy‡	‡	‡	‡	‡	‡	1.63*	1.78*	1.23
Spain	1.38*	1.31*	0.98	1.18*	1.68*	1.89*	1.43*	1.42*
Portugal	1.07	1.15*	0.76*	1.44*	1.14	2.13*	1.59*	1.54*

*P<0.05 for difference from 1.00.
†Combined with other diseases.
‡No distinction could be made between specific neoplasms or specific cardiovascular diseases.

mortality. Thus, dividing the rate difference for a specific cause of death by the difference for total mortality yields a measure of the contribution that this cause makes to the rate difference for total mortality.

Results

Table 3 presents manual versus non-manual rate ratios for total mortality and broad groups of cause of death. Rate ratios for total mortality are between 1.33 and 1.44, except for Finland (1.53) and France (1.71). Broad cause of death groups show pronounced variations between countries. Differences are small for neoplasms in Sweden, Norway, Denmark, England and Wales, and Portugal; for cardiovascular diseases in Switzerland and the Mediterranean countries; and for external causes of death in Norway, Denmark, Switzerland, and Italy.

Table 4 presents manual versus non-manual rate ratios for specific causes of death. Mortality from ischaemic heart disease was strongly related to low occupational class in England and Wales, Ireland, and the Nordic countries. France, Switzerland, and Spain showed large differences for cancers other than lung cancer. Class differences in mortality from lung cancer were largest in Finland and Ireland; differences for cerebrovascular disease were largest in England and Wales; and those for gastrointestinal diseases were largest in France and Italy.

Figure 2 presents the contribution that broad groups of causes of death make to the difference in total mortality between manual and non-manual workers. Neoplasms contribute 27-44% of mortality differences in Ireland, France, Switzerland, Italy, and Spain. Cardiovascular diseases contribute 30-54% of the mortality differences in England and Wales, Ireland, and the Nordic countries. The contribution of external causes ranges from less than 10% in Italy and England and Wales to 21% in Sweden, 24% in Finland, and 33% in Portugal.

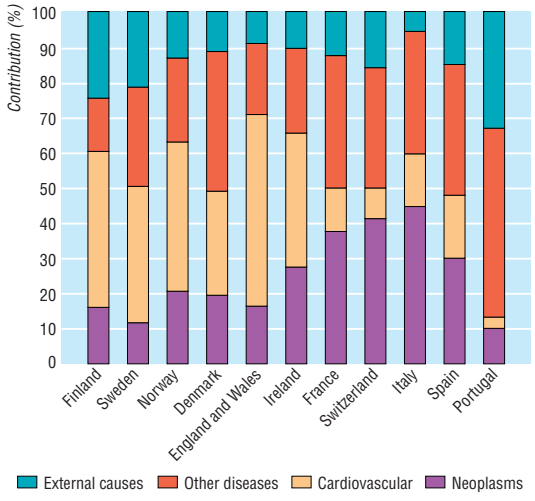

Fig 2 Contribution of broad causes of death to difference in total mortality of men aged 45-59 in manual and non-manual classes

Table 5 Contribution (percentage) of specific causes of death to the difference between manual and non-manual classes in total mortality. Men 45-59 years

Country	Lung cancer	Other cancers	Ischaemic heart disease	Cerebrovascular disease	Other cardiovascular disease	Respiratory disease	Gastrointestinal disease	Other diseases	External causes	Risk difference for total mortality*
Finland	12.8	4.2	31.8	6.5	5.9	6.9	3.8	5.0	24.4	9.8
Sweden	5.9	6.0	30.1	3.5	5.3	6.7	5.6	15.0	21.2	5.6
Norway	11.7	9.3	34.7	2.9	5.0	4.8	4.0	14.9	13.4	5.2
Denmark	14.0	5.8	22.0	3.2	4.1	10.2	10.3	18.6	11.9	6.3
England and Wales	13.1	3.3	41.7	8.1	5.1	11.1	†	9.0	8.4	7.5
Ireland	18.7	8.3	25.4	7.4	5.7	14.7	0.8	8.1	11.0	8.1
France	8.6	29.2	2.7	3.9	5.8	6.0	16.7	14.7	12.4	11.5
Switzerland	22.8	19.1	–0.3	4.2	7.4	9.1	10.7	13.7	16.0	5.0
Italy	‡	44.3	§	§	15.6	5.1	24.4	3.8	6.3	6.0
Spain	8.9	20.8	–0.1	4.0	17.0	11.7	15.2	9.7	14.8	5.8
Portugal	1.3	8.9	–11.3	13.0	2.6	15.0	19.8	16.3	33.1	6.1

*Absolute difference between manual and non-manual classes in the probability (%) of dying between the ages 45 and 64
†Combined with other diseases.
‡Combined with other cancers.
§Combined with other cardiovascular diseases.

Table 5 shows the contributions made by specific causes of death. The north-south gradient in the contribution of cardiovascular diseases can be attributed to ischaemic heart disease. In southern countries, a large part of the mortality difference between manual and non-manual classes is due to cancers other than lung cancer and gastrointestinal diseases. The contributions made by lung cancer were largest in Ireland and Switzerland; those made by cerebrovascular disease were largest in England and Wales, Ireland, and Portugal; and those made by respiratory diseases were largest in Ireland and Portugal.

Discussion

Reliability and comparability of data

We have identified three major problems with the reliability and comparability of the available data on mortality by occupational class: inaccurate distinctions between manual and non-manual classes as defined in the EGP scheme; biases resulting from the exclusion of economically inactive men; and biases inherent in "unlinked" cross sectional studies.[8 9] If these data problems are different for different causes of death, they will bias the contribution of causes of death to inequalities in all cause mortality. In a series of evaluations, we quantified the potential effect that these data problems could have on manual versus non-manual rate ratios.[8 9] The potential size of error was less than 20% in all countries except Ireland, Spain, and Portugal. The magnitude of error did not vary substantially by cause of death. These errors might explain some of our results, notably those for Ireland, Spain, and Portugal, but cannot account for the large variations between countries seen for several causes of death.

Potentially the largest problem relates to the exclusion of economically inactive men from the datasets of most countries. Their exclusion causes an underestimation of mortality differences by occupational class, and this underestimation is larger for chronic diseases such as respiratory diseases.[8] However, we have corrected for the exclusion of inactive men by using correction factors that could be calculated for each cause of death separately.[8] It is highly unlikely that any remaining bias can explain the marked variations in the patterns that we found.

The comparability of registrations of the cause of death is another area of concern. Even though there are differences between European countries in the registration of causes of death, this is not necessarily a problem in this study. Registration problems could bias the results only if the degree of misclassification varied by occupational class and, in addition, if this possible association between misclassification and occupational class varied between countries. Perhaps most problematic are deaths registered as caused by ischaemic heart disease, a proportion of which may have been assigned to other disease categories. If misclassification occurs more commonly in deaths among lower occupational classes, the relative mortality of these classes might be underestimated. Can this problem explain the fact that mortality from ischaemic heart disease was not correlated to social class in southern countries? The data presented in table 3 allow estimation of the effect of adding other cardiovascular diseases (but not cerebrovascular disease) to ischaemic heart disease. This more robust group of causes of death also shows a clear north-south gradient.

Explaining variations between countries

Relatively large class differences in total mortality occurred in Finland and, especially, France. Data from a French study showed that the large differences in mortality from cancers other than lung cancer and gastrointestinal diseases in that country can be attributed to cancers of the upper digestive tract and to liver cirrhosis, respectively.[11] These diseases have excessive alcohol consumption as a common risk factor. This finding implies that alcohol consumption should be included in explanations of the exceptionally large class differences in mortality in France.

In Finland, external causes of death make a relatively large contribution. This large contribution is also in part related to alcohol consumption. Alcohol related mortality has been estimated to account for at least 24% of the difference in life expectancy between manual classes and upper non-manual classes in Finland.[12] Specific drinking patterns, with episodes of drunkenness interspersed with periods of abstinence, increase the incidence of violent deaths (including suicide, homicide, accidental falls, drowning, and alcohol poisoning) rather than deaths from chronic diseases.[13]

In southern European countries, death rates from ischaemic heart disease hardly differed between manual and non-manual classes. This is probably related to the low mortality from ischaemic heart disease in southern European countries.[14] Specific factors have protected men from southern European countries against ischaemic heart disease: the traditional diet, with frequent consumption of fresh vegetables, fruits, fish, and vegetable oil, and the traditionally moderate levels of alcohol consumption.[15] There is evidence that these factors have protected lower socioeconomic groups in particular.[16 17]

Smoking may have had an additional role. Marked inverse social gradients in smoking emerged in northern Europe in the 1960s or before, but in southern Europe these gradients emerged only during the 1980s.[16–18] Inverse class gradients in smoking existed in Switzerland in the early 1980s but were weaker than in northern Europe.[19]

Despite the lack of clear social gradients in smoking in southern Europe in the early 1980s, class differences in deaths from lung cancer were about as large in France, Switzerland, and Spain as they were in northern countries (table 4). Other risk factors for lung cancer (psychosocial factors or high exposure to carcinogenic substances at work) seem to have increased deaths from lung cancer among male manual workers in southern countries.[20]

In the early 1980s European countries differed in the degree to which health care was accessible to lower occupational classes.[21] Financial barriers were generally larger in France, Switzerland, and Spain than in more northern countries.[21] If reduced access to health care affected the survival of lower socioeconomic groups, that effect would be clearest for causes of death that are amenable to medical intervention. An example is cerebrovascular disease, in which adequate detection and control of hypertension can lower mortality. However, class differences in mortality from cerebrovascular disease are not larger in France, Switzerland, or Spain than in countries with more equal access to healthcare services.

Implications of crossnational variations

Specific national circumstances seem to be able to strongly influence the magnitude, pattern, and causes of socioeconomic inequalities in health. The prevalence, at the national level, of risk factors that have the potential to strengthen the links between socioeconomic disadvantage and premature death seem to be particularly important. This was illustrated by the alcohol consumption patterns in France and Finland. Conversely, mortality differences in Mediterranean countries seem to have been mitigated by dietary habits and drinking patterns that traditionally protected men from lower classes against ischaemic heart disease.

The international variations observed here impose limits on the exchange of research findings from one country to another. This applies, for example, to studies assessing the extent to which inequalities in mortality can be attributed to risk factors for cardiovascular disease.[22] The similarity that was observed among northern European countries supports the frequently made assumption that results of studies from one country apply to other northern countries, but they should not be extended to France, Switzerland, or Mediterranean countries. These countries need their own explanatory studies, which, lamentably, are rare.[1 2]

The same caution is needed with countries' exchange of experiences with interventions that aim at improving the health of disadvantaged groups by reducing the prevalence of specific risk factors for disease. Our results for causes of death related to smoking suggest that a reduction in smoking rates may have much larger effects on health inequalities in England and Wales than in Sweden or France. The prevention of alcohol misuse by men in manual classes deserves a higher priority in France and Finland than elsewhere.

Persistence of the gap in premature death

Despite the large variations between countries in class differences in mortality from specific causes of death, differences in total mortality were similar in most western European countries. There is a parallel with trends over time in northern Europe. Large socioeconomic differences in total mortality existed when infectious diseases and other "old" diseases dominated mortality patterns. Later, when "diseases of affluence" and other degenerative diseases became the major causes of premature death, the mortality advantage of higher occupational classes persisted. Higher classes thus seemed to have changed their life styles and living conditions in ways that protected them against the new causes of death. This adjustment process was clearest for ischaemic heart disease.[23 24]

This paper shows that in southern countries higher occupational classes have also maintained a higher chance of reaching old age. They achieved this not so much by preventing death from ischaemic heart disease but by preventing premature death from diseases that were more important in their own country, such as alcohol related diseases.

The factors that allow the higher occupational classes to avoid premature death can obviously not be restricted to disease specific risk factors alone, but need to involve factors or mechanisms that determine the distribution of these risk factors over occupational classes. These "fundamental causes" [25] can be of various kinds.

Recent literature has emphasised the potential importance of psychosocial stress.[26–29] Chronic stress is expected to increase the risk of premature death directly through the immune and neuroendocrine systems and indirectly through adverse behavioural responses such as smoking, excessive drinking, and violence.[26–29] Cultural and behavioural responses to chronic stress may vary from country to country, as is suggested by variations between countries in national patterns of causes of death. Similarly, exposure to chronic stress in disadvantaged groups may increase their risk of different causes of death in different parts of Europe.

A complementary perspective emphasises the process of social achievement and access to resources.[25 30–33] Members of higher occupational classes have access to a wide array of resources, including the resources that are needed to achieve a desired occupational position (such as higher education and a favourable socioeconomic background) and the resources that accrue to those who have attained a high position (high income, job security, and sense of

control).[33] This enables higher occupational classes to protect themselves against premature death in a flexible way. Different epidemiological situations need different strategies for survival into old age, with the upper occupational classes being in the best position to identify and pursue the optimal survival strategies.

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Key messages

- Socioeconomic inequalities in total mortality among middle aged men are about equally large in most western European countries, with the exception of larger inequalities in France and Finland
- Inequalities in mortality from specific causes of death, and the contributions these causes make to inequalities in total mortality, vary between countries
- The contribution to inequalities in mortality of disease specific risk factors like smoking and alcohol consumption varies greatly between countries
- This variability imposes limits on the exchange of research findings and experiences with health policies between western European countries
- The similar size of inequalities in total mortality in most countries underlines the generalised ability of higher occupational classes to better avoid premature death

1 Mielck A, Giraldes M do R, eds. *Inequalities in health and health care: review of selected publications from 18 western European countries.* Münster: Waxmann, 1993.
2 Illsley R, Svensson P-G, eds. Social inequalities in health [special issue]. *Soc Sci Med* 1990;31:223-40.
3 Valkonen T. Adult mortality and level of education: a comparison of six countries. In: Fox AJ, ed. *Health inequalities in European countries.* Aldershot: Gower, 1989:142-62.
4 Leclerc A, Lert F, Fabien C. Differential mortality: some comparisons between England and Wales, Finland and France, based on inequalities measures. *Int J Epidemiol* 1990;19:1001-10.
5 Vågerö D, Lundberg O. Health inequalities in Britain and Sweden. *Lancet* 1989;ii:35-6.
6 Kunst AK, Mackenbach JP. The size of mortality differences associated with educational level in nine industrialized countries. *Am J Public Health* 1994;84:932-7.
7 Mackenbach JP, Kunst AK, Cavelaars AEJM, Groenhof F, Geurts JJM, EU Working Group on Socio-economic Inequalities in Health. Socio-economic inequalities in morbidity and mortality in Western Europe: a comparative study. *Lancet* 1997;349:1655-9.
8 Kunst AK, Cavelaars AEJM, Groenhof F, Geurts JJM, Mackenbach JP, EU Working Group on Socio-economic Inequalities in Health. *Socio-economic inequalities in morbidity and mortality in Europe: a comparative study.* Rotterdam: Erasmus University, 1996.
9 Kunst AK, Groenhof F, Mackenbach JP and EU Working Group on Socio-economic Inequalities in Health. Occupational class and mortality among men 30 to 64 years in 11 European countries. *Soc Sci Med* (in press).
10 Bartley M, Carpenter L, Dunnell K, Fitzpatrick R. Measuring inequalities in health: an analysis of mortality patterns using two social classifications. *Sociology of Health and Illness* 1996;18:455-75.
11 Desplanques G. *La mortalité des adults: résultats de 2 etudes longitudinales (période 1955-1980).* Paris: INSEE, 1984.
12 Mäkelä P, Valkonen T, Martelin T. Contribution of deaths related to alcohol use to socio-economic variation in mortality: register-based follow up study. *BMJ* (in press).
13 Poikolainen K. Risk of alcohol-related hospital admission in men as predicted by marital status and social class. *J Stud Alcohol* 1983;44:986-95.
14 Uemura K, Pisa Z. Trends in cardiovascular disease mortality in industrialized countries since 1950. *World Health Statist Q* 1988;41:155-78.
15 Kushi LH, Lenart EB, Willett WC. Health implications of Mediterranean diets in light of contemporary knowledge. 1. Plant foods and dairy products. *Am J Clin Nutr* 1995;61(suppl):1407-15.
16 Comisión Científica de Estudios de las Desigualdades Sociales en Salud en España. *Desigualdades sociales en salud en España.* Madrid: Ministry of Health, 1996.
17 Cavelaars AEJM, Kunst AK, Mackenbach JP. Socio-economic inequalities in risk factors of morbidity and mortality in the European Community: an international comparison. *J Health Psychol* 1997;2:353-72.
18 Sasco AJ, Grizeau D, Pobel D, Chatard O, Danzon M. Tabagisme et classe social en France de 1974 à 1991. *Bull Cancer* 1994;81:355-9.
19 La Vecchia C, Gutzweiler F, Wietlisbach V. Sociocultural influences on smoking habits in Switzerland. *Int J Epidemiol* 1987;16:624-6.
20 Loon AJM van, Goldbohm RA, Brandt PA van den. Lung cancer: is there an association with socio-economic status in the Netherlands? *J Epidemiol Community Health* 1995;49:65-9.
21 Doorslaer E van, Wagstaff A, Rutten F. *Equity in the finance and delivery of health care: an international perspective.* Oxford: Oxford University Press, 1992.
22 Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: a review of the literature. *Circulation* 1993;88:1973-97.
23 Vågerö D, Lundberg O. Socio-economic mortality differentials among adults in Sweden. In: Lopez AD, Casselli G. Valkonen T, eds. *Adult mortality in developed countries: from description to explanation.* Oxford: Clarendon Press, 1995:223-42.
24 Marmot MG, Adelstein AM, Robinson N, Rose GA. Changing social class distribution of heart disease. *BMJ* 1978;ii:1109-12.
25 Link BG, Phelan J. Social conditions as fundamental causes of disease. *J Health Social Behaviour* 1995;(Special No):80-94.
26 Wilkinson RG. *Unhealthy societies: the afflictions of inequality.* London: Routledge, 1996.
27 Evans RG, Hodge M, Pless IB. If not genetics, then what? Biological pathways and population health. In: Evans RG, Barer ML, Marmor TR, eds. *Why are some people healthy and others not?* New York: Aldin de Gruytere, 1994:161-88.
28 Brunner E. The social and biological basis for cardiovascular disease. In: Blane D, Brunner E, Wilkinson R, eds. *Health and social organisation.* London: Routledge, 1996:272-99.
29 Adler NE, Boyce T, Chesney MA. Socioeconomic status and health: the challenge of the gradient. *Am Psychol* 1994;49:15-24.
30 Carroll D, Davey Smith G. Bennett P. Some observations on health and socioeconomic status. *J Health Psychol* 1996;1:23-39.
31 Vågerö D, Illsley R. Explaining health inequalities: beyond Black and Barker. A discussion of some issues emerging in the decade following the Black Report. *European Sociology Review* 1995;11:1-23.
32 Charlton BG, White M. Living on the margin: a salutogenic model for socio-economic differentials in health. *Public Health* 1995;109:235-43.
33 Kunst AK. Cross-national comparisons of socio-economic differences in mortality [dissertation]. Rotterdam: Erasmus University, 1997.

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Commentary: Unequal inequalities across Europe

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For Britain in particular, the paper by Kunst et al is timely. In autumn the independent inquiry on inequalities in health set up by the Labour government is due to report. Its recommendations will feed directly into a white paper on public health.

Systematic comparison of socioeconomic differences in mortality across countries has been undertaken only in the past decade.[1–5] There are considerable difficulties in making such comparisons.[6 7] Each country has tended to use its own classification of socioeconomic position, and these are not directly comparable. The study designs have also differed: some countries have longitudinal studies while others have only cross sectional data around censuses. Kunst et al resolved the first of these issues by using a classification of class that was specifically developed by sociologists for international comparisons.[8] Problems and differences in design, however, have not been avoided. As the authors admit, there may be systematic errors of over 20% in the estimates of the relative size of social class differences in three (Ireland, Spain, Portugal) of the five countries that used the cross sectional approach.

Despite these shortcomings, this paper is based on the most internationally comparable set of data on social class differences in mortality ever produced. It is thus frustrating, although understandable, that many of the estimates are based on deaths that occurred up to 15 years ago. Over this period inequalities in mortality have widened considerably in Britain[9] and other countries, and it is not clear whether the international rankings, in particular, are the same in the 1990s as they were a decade earlier.

Although it has been suggested by previous work, the most important finding of the study is that in each country the strength of association between social class and mortality varies according to cause of death. In relative terms, the largest differences are in deaths from external causes (accidents and violence), while the smallest tend to be in neoplasms (in northern Europe) and cardiovascular disease (in southern Europe). This variation by cause, and the fact that it differs across regions of Europe, does not support a direct link between stress and general susceptibility to disease. Instead it suggests that specific proximal risk factors, such as smoking or alcohol, underlie the patterns found in each country. A public health strategy, however, needs to go beyond urging manual workers to change their lifestyle and address the complex social, psychological, and economic factors that underlie these patterns of behaviour.

In all countries, mortality from all causes is higher in manual than non-manual social classes. In relative and absolute terms England and Wales, Finland, and France have the largest social class differences. Intriguingly, in relative terms, Sweden does not seem to be doing as well as might be expected given its postwar commitment to equity. However, if countries are ranked according to the size of the absolute difference in mortality between classes, as has already been pointed out,[10] Sweden has almost the smallest difference. From a public health perspective, it is these absolute differences that are clearly the most important.

At the end, the authors set about considering how it is that upper social classes seem to be able always to achieve a mortality advantage, regardless of cause of death. This question is partly generated from their conclusion that, overall, countries show similar social class differences. However, this conclusion is at odds with their own data—which clearly show appreciable variation across countries. Within Europe as a whole there is evidence of even greater variation. The former communist countries of central and eastern Europe,[11] including Russia,[12] show larger socioeconomic differences in mortality than do countries in western Europe. This, together with the change in size of social class differences over time, shows that social class mortality differences are far from fixed.

There is much more to be done to understand the contribution of social structure, culture, and government policies to the international variations that Kunst et al have presented. Studying health trends and public health policies in different countries is an underutilised strategy that can do much to illuminate the national situation.[13]

1 Fox J. *Health inequalities in European countries.* Aldershot: Gower, 1989.
2 Leclerc A, Lert F, Fabien C. Differential mortality: some comparisons between England and Wales, Finland and France, based on inequality measures. *Int J Epidemiol* 1990;19:1001-10.
3 Kunst AK, Geurts JJ, van den Berg J. International variation in socioeconomic inequalities in self reported health. *J Epidemiol Community Health* 1995;49:117-23.
4 Kunst AK, Mackenbach JP. The size of mortality differences associated with educational level in nine industrialized countries. *Am J Public Health* 1994;84:932-7.
5 Mackenbach JP, Kunst AK, Cavelaars EJM, Groenhof F, Geurts JJM, EU Working Group on Socio-economic Inequalities in Health. Socio-economic inequalities in morbidity and mortality in western Europe. *Lancet* 1997;349:1655-9.
6 Valkonen T. Problems in the measurement and international comparisons of socio-economic differences in mortality. *Soc Sci Med* 1993;36: 409-18.
7 Quine S. Problems in comparing findings on social class cross-culturally—applied to infant mortality (Australia and Britain). *Soc Sci Med* 1990;30:1283-8.
8 Erikson R, Goldthorpe J. *The constant flux. A study of class mobility in industrial countries.* Oxford: Oxford University Press, 1992.
9 Drever F, Whitehead M. *Health inequalities: decennial supplement.* London: Office for National Statistics, 1997.
10 Vågerö D, Erikson R. Socioeconomic inequalities in morbidity and mortality in Western Europe [letter]. *Lancet* 1997;350:516.
11 Kunst A. Cross-national comparisons of socio-economic differences in mortality [dissertation]. Rotterdam: Erasmus University, 1997.
12 Shkolnikov V, Leon DA, Adamets S, Andreev E, Deev A. Educational level and adult mortality in Russia: an analysis of routine data 1979 to 1994. *Soc Sci Med* 1998 (in press).
13 McKee M. An agenda for public health research in Europe. *Eur J Pub Hlth* 1998;8:3-7.

Correction

Evaluation of reagent strips in detecting asymptomatic bacteriuria in early pregnancy: prospective case series

Several errors occurred in this paper by Douglas G Tincello and David H Richmond (7 February, pp 435-7). Three incorrect figures were cited from Etherington and James in the table: the sensitivity should have been 81.8%, and the positive and negative predictive values for all four tests in combination should have been 10.5% and 99.3% respectively. The third key message should have read "Commercially available reagent strips for testing urine do not perform to a sufficient standard."