

# Occupational Class and Ischemic Heart Disease Mortality in the United States and 11 European Countries

## ABSTRACT

**Objectives.** Twelve countries were compared with respect to occupational class differences in ischemic heart disease mortality in order to identify factors that are associated with smaller or larger mortality differences.

**Methods.** Data on mortality by occupational class among men aged 30 to 64 years were obtained from national longitudinal or cross-sectional studies for the 1980s. A common occupational class scheme was applied to most countries. Potential effects of the main data problems were evaluated quantitatively.

**Results.** A north-south contrast existed within Europe. In England and Wales, Ireland, and Nordic countries, manual classes had higher mortality rates than nonmanual classes. In France, Switzerland, and Mediterranean countries, manual classes had mortality rates as low as, or lower than, those among nonmanual classes. Compared with Northern Europe, mortality differences in the United States were smaller (among men aged 30-44 years) or about as large (among men aged 45-64 years).

**Conclusions.** The results underline the highly variable nature of socioeconomic inequalities in ischemic heart disease mortality. These inequalities appear to be highly sensitive to social gradients in behavioral risk factors. These risk factor gradients are determined by cultural as well as socioeconomic developments. (*Am J Public Health*. 1999;89:47-53)

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Much attention in health inequalities research has been given to ischemic heart disease.<sup>1-3</sup> The interest in this disease was stimulated by the observation that differences in ischemic heart disease mortality between socioeconomic groups have greatly increased during the last decades and that these increases have contributed much to the widening of the gap in all-cause mortality.<sup>4-14</sup>

The increasing differences in ischemic heart disease mortality raise questions regarding variations across regions or countries. Is a strong geographic variability also observed? If so, why are socioeconomic differences in ischemic heart disease mortality smaller in some countries than in others? Research on these questions might identify factors that are susceptible to change through intervention and thus show possible ways to reverse the unfavorable trends over the past decades.

No previous study has compared countries with respect to socioeconomic differences in ischemic heart disease mortality, but a few studies have looked at mortality from all cardiovascular diseases.<sup>15-17</sup> For example, Valkonen compared England and Wales, Denmark, Norway, Finland, and Hungary with respect to mortality differences by educational level in the 1970s.<sup>15</sup> Differences in cardiovascular disease mortality among men and women aged 35 to 54 years were about equally large in the 4 northern European countries and relatively small in Hungary. No comparative studies on differences in cardiovascular disease mortality included data from the United States.

Our objective in this study was to compare 11 western European countries and the United States with respect to socioeconomic differences in ischemic heart disease mortal-

ity. For the United States, we used data from the National Longitudinal Mortality Study for the period 1979 to 1989.<sup>18</sup> For Europe, we used data that had been acquired as part of an international project on socioeconomic differences in morbidity and mortality in Europe.<sup>19-21</sup> In this project, data on mortality by occupational class were available for 11 western European countries. Every effort was made to make the data from different countries as comparable as possible by, among others methods, use of centralized data acquisition and analysis.

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## Methods

### Data

Data on mortality by occupational class and cause of death were obtained from longitudinal studies and, if no longitudinal data were available, from cross-sectional studies.<sup>19-21</sup> Longitudinal studies were available for Finland, Sweden, Norway, Denmark, England and Wales, Italy (the city of Turin), and the United States. These studies consisted of a mortality follow-up of a representative sample of the populations enumerated in the national population censuses of circa 1981. Most follow-up covered the period of 1980 to 1989. Data from cross-sectional studies could be obtained for Ireland, France, Switzerland, Spain, and Portugal. These studies were of the "unlinked" type,<sup>22</sup> 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 persons at risk according to the same occupational classes. All cross-sectional studies used data based on the national population censuses of 1981.

For studies that classified men according to their age at death, the age groups 30 to 44 years and 45 to 59 years were selected. For longitudinal studies with a follow-up period of about 10 years, the birth cohorts aged 25 to 39 years and 40 to 54 years at the start of follow-up were selected. With a follow-up period of 10 years, it was also possible to study mortality differences at the age of about 60 to 64 years by following men aged 55 to 59 years at the start of the follow-up period. Data for this age group could also be derived from the Swiss cross-sectional study because occupational information was available for nearly all men aged 60 to 64 years. For Spain, no reliable occupational data were available for men aged 30 to 44 years.

A common occupational class scheme, the Erikson–Goldthorpe–Portocarero scheme, was applied to as many countries as possible.<sup>23-25</sup> This scheme was developed in order to facilitate international comparisons of social stratification and mobility and is therefore particularly suited to our purposes. Where possible, social class conversion algorithms were applied to individual-level data on the following aspects of the jobs that men perform: occupational title (by 3-digit code), employment status (self-employed or not), and supervisory status (e.g., number of subordinates). Mortality data were available for Denmark, Ireland, Spain, and Portugal on the basis of national occupational class schemes. These national schemes could be made com-

parable to the Erikson–Goldthorpe–Portocarero scheme at the level of 3 broad classes: nonmanual classes (including self-employed men), manual classes, and agricultural classes (farmers and farm laborers).

Detailed data on the distribution of men by occupational class are presented elsewhere.<sup>20,21</sup> In most countries, 45% to 50% of the male working population are in nonmanual classes, about as many men are in manual classes, and 5% to 10% of all men work in agriculture. Manual classes form the largest group in the United States, England and Wales, Finland, Spain, and Portugal. The proportion of men working in agriculture increases with age. In Finland, Ireland, Italy, Spain, and Portugal, more than 15% of all men work in agriculture.

For most countries, there was insufficient information on the former occupation of economically inactive men (retired, disabled, unemployed, etc.). These men therefore had to be excluded from the analysis. Because their exclusion is likely to lead to an underestimation of the magnitude of mortality differences between occupational classes,<sup>21,26</sup> we developed a procedure that largely corrects for this underestimation.<sup>20,21</sup> This formula was found to perform well in a large number of tests.<sup>20,21</sup>

### Analysis

The relative mortality level of men in specific occupational classes was measured by means of standardized mortality ratios, with the national age-specific mortality rates as the standard. The magnitude of inequalities in mortality was quantified by a summary index with a straightforward interpretation: the rate ratio that compares the mortality rate of manual classes with the mortality rate of nonmanual classes (including self-employed men).

The manual vs nonmanual distinction is not entirely hierarchical because, according to most criteria, some manual workers have a higher socioeconomic position than do routine nonmanual workers or self-employed men.<sup>24</sup> A clearly hierarchical distinction can, however, be obtained by comparing manual classes with the class of professionals, large employers, administrators, and managers.<sup>24</sup> We therefore included a rate ratio that corresponds to this distinction. In most countries, 25% to 35% of all men are in this upper nonmanual class.

Rate ratios and their 95% confidence intervals were estimated by means of Poisson regression analysis. The regression model included a term that represented the contrast between manual and (upper) nonmanual classes. A series of terms represent-

ing 5-year age groups was included in the regression model in order to control for different age compositions of manual and (upper) nonmanual classes. Rate ratios for the United States were also adjusted for race/ethnicity (Hispanics, other White, Black, other non-White).

## Results

Of all deaths among men aged 45 to 59 years, the proportion attributable to ischemic heart disease was between 34% and 39% in most northern European countries and between 10% and 21% in southern European countries (Table 1). The proportion in the United States and Denmark was intermediate (about 27%). In most countries, the proportion of deaths attributable to ischemic heart disease was smaller among men aged 30 to 44 years and slightly larger among men aged 60 to 64 years.

Table 1 presents the pattern of variations in ischemic heart disease mortality by occupational class based on standardized mortality ratios. In the 4 Nordic countries, England and Wales, and the United States, the mortality rates for nonmanual classes were lower than the national average, whereas the rates for manual classes were higher than average. This mortality difference decreases with rising age. In Ireland and southern European countries, the mortality rates for nonmanual classes were not consistently lower than the national average. Manual classes in most of these countries had mortality rates close to the national average. In several countries, ischemic heart disease mortality rates for workers in agriculture were lower than the rates for the manual and nonmanual classes. Relatively high ischemic heart disease mortality rates were observed for agricultural workers aged 30 to 44 years in Finland and Portugal and for those aged 60 to 64 years in the United States.

Table 2 presents the rate ratios that quantify the size of the ischemic heart disease mortality differences between manual and nonmanual classes. Among men aged 45 to 59 years (for whom data were available for all countries), mortality differences were consistently larger in northern European countries than in southern European countries. In the latter countries, rate ratios were close to 1, implying a near-equality in the mortality levels of manual and nonmanual classes. In Portugal, the highest mortality rates were observed for nonmanual classes. The rate ratio for the United States was close to those for Sweden, Norway, Denmark, and Ireland. Larger rate ratios were observed for England

**TABLE 1—Ischemic Heart Disease (IHD) Mortality by Occupational Class Among Men Aged 30–44, 45–59, and 60–64 Years at Death**

Country	Age Group	Proportion of Total Number of Deaths Attributable to IHD, %	Standardized Mortality Ratio (SMR) <sup>a</sup>		
			Nonmanual Classes	Manual Classes	Workers in Agriculture
Finland	30–44	12.1	0.67	1.27	1.23
	45–59	35.6	0.80	1.17	0.97
	60–64	40.7	0.88	1.11	0.96
Sweden	30–44	7.8	0.76	1.34	1.00
	45–59	34.6	0.87	1.19	0.77
Norway	30–44	14.4	0.76	1.34	0.97
	45–59	34.2	0.87	1.17	0.86
	60–64	37.4	0.90	1.14	0.84
Denmark	30–44	9.3	0.85	1.26	0.65
	45–59	26.3	0.93	1.19	0.65
	60–64	30.1	0.97	1.12	0.72
England/Wales	30–44	21.9	0.75	1.26	0.88
	45–59	38.2	0.80	1.21	0.60
	60–64	37.6	0.88	1.10	0.87
Ireland	30–44	19.7	0.91	1.29	0.66
	45–59	39.0	1.00	1.23	0.75
France	30–44	4.9	0.95	1.13	0.59
	45–59	9.9	1.06	1.03	0.72
Switzerland	30–44	9.1	1.00	1.03	0.80
	45–59	20.7	1.06	1.02	0.65
	60–64	21.8	1.00	1.06	0.98
Italy (Turin)	30–44	10.0	0.86	1.15	... <sup>b</sup>
	45–59	20.4	0.97	1.04	...
	60–64	17.5	1.07	0.91	...
Spain	45–59	14.4	1.07	1.06	0.83
Portugal	30–44	5.6	1.03	0.83	1.48
	45–59	11.3	1.21	0.93	0.84
United States	30–44	10.0	0.88	1.18	0.45
	45–59	27.5	0.88	1.14	0.89
	60–64	28.8	0.90	1.10	1.07

Note. Analysis based on data from longitudinal and cross-sectional studies using national population censuses of 1981. Follow-up for most of the longitudinal studies covered the period of 1980 to 1989.

<sup>a</sup>National average in each age group is 1.00.

<sup>b</sup>No estimates were made for the few agricultural workers living in the city of Turin.

and Wales and Finland; the difference between these ratios and the ratio for the United States was, however, not statistically significant.

The north-south contrast is more marked for mortality differences among men aged 30 to 44 years. Large rate ratios were observed for Finland, Sweden, Norway, and England and Wales. The rate ratio for the United States was intermediate between those for the northern and southern parts of Europe. Among men aged 60 to 64 years, class differences in ischemic heart disease mortality were small in the northern European countries. A rate ratio smaller than 1 was observed for Italy (Turin) but not for Switzerland. The rate ratio for the United States was close to those for northern Europe.

Table 3 presents ischemic heart disease mortality rate ratios in which manual classes

were compared not with all nonmanual classes but only with the class of professionals, large employers, administrators, and managers. These estimates were made only for those countries in which occupational classes could be defined with reference to the Erikson-Goldthorpe-Portocarero scheme. Nearly every rate ratio in Table 3 is larger than the corresponding manual vs nonmanual rate ratio given in Table 2. More important, use of this more discriminatory inequality measure yielded the same north-south contrast within Europe as the one observed in Table 2. Rate ratios for the United States, again, were intermediate, especially in the age group 30 to 44 years.

The size of inequalities in ischemic heart disease mortality among manual vs nonmanual classes appears to be strongly correlated to the contribution that ischemic

heart disease makes to all-cause mortality (Figure 1). The manual vs nonmanual difference is small in all countries where 20% or less of all deaths among men aged 45 to 59 years are attributable to ischemic heart disease. The largest inequalities in ischemic heart disease mortality are observed in countries where more than 35% of all deaths are attributable to ischemic heart disease. If national levels of ischemic heart disease mortality were taken into account in the inequality estimates—for example, by calculating the absolute difference between death rates for manual and nonmanual classes—the north-south contrast within Europe would be even starker.

## Discussion

### Evaluation of Data Problems

Elsewhere, we carefully evaluated the results of this study in terms of problems with the reliability and international comparability of data on mortality by occupational class.<sup>20,21</sup> We identified 3 principal data problems: the use of occupational class schemes other than the Erikson-Goldthorpe-Portocarero scheme, our approximate correction for the exclusion of economically inactive men, and the “numerator/denominator” bias that is inherent to unlinked cross-sectional studies.<sup>20,21</sup> We quantified the potential effect of these data problems on estimates of manual vs nonmanual mortality rate ratios.<sup>20,21</sup> The potential size of error in the estimates for Sweden and England and Wales was 10% or less. This implies that a rate ratio of, say, 1.40 is under- or over-estimated by no more than 0.14 units. The potential size of error was also modest for Finland, Norway, Denmark, and the United States (15% or less), slightly larger for France, Switzerland, and Italy (about 20% or less), and largest for Ireland, Spain, and Portugal (about 35% or less). The numerator/denominator bias could be especially large in Ireland, Spain, and Portugal.

This evaluation shows that the evidence for relatively small class differences in ischemic heart disease mortality in France, Switzerland, and Italy is strong. The ischemic heart disease mortality rate ratios for these 3 countries were substantially and consistently smaller than the rate ratios for northern European countries. The poorly comparable data for Spain and Portugal could not provide strong evidence for generalization based on geographic position, but the similarity between the results for all 5 southern European countries makes it highly likely that these countries share a common pattern of class variations in ischemic heart disease mortality.

**TABLE 2—Ischemic Heart Disease (IHD) Mortality Rate Ratios Comparing Manual Classes With Nonmanual Classes Among Men Aged 30–44, 45–59, and 60–64 Years at Death**

Country	30–44 Years Rate Ratio (95% CI)	45–59 Years Rate Ratio (95% CI)	60–64 Years Rate Ratio (95% CI)
Finland	1.91 (1.72, 2.12)	1.47 (1.41, 1.53)	1.26 (1.19, 1.33)
Sweden	1.80 (1.52, 2.15)	1.36 (1.31, 1.41)	... <sup>a</sup>
Norway	1.77 (1.55, 2.03)	1.35 (1.28, 1.43)	1.26 (1.19, 1.33)
Denmark	1.52 (1.35, 1.71)	1.28 (1.22, 1.34)	1.16 (1.10, 1.22)
England/Wales	1.68 (1.16, 2.44)	1.50 (1.32, 1.71)	1.26 (1.10, 1.45)
Ireland	1.42 (1.12, 1.80)	1.23 (1.12, 1.35)	... <sup>a</sup>
France	1.18 (1.08, 1.30)	0.96 (0.92, 1.00)	... <sup>a</sup>
Switzerland	1.03 (0.83, 1.29)	0.96 (0.89, 1.04)	1.07 (0.98, 1.18)
Italy (Turin)	1.35 (0.97, 1.88)	1.08 (0.95, 1.22)	0.85 (0.69, 1.06)
Spain	... <sup>a</sup>	0.98 (0.94, 1.03)	... <sup>a</sup>
Portugal	0.82 (0.66, 1.03)	0.76 (0.69, 0.84)	... <sup>a</sup>
United States	1.32 (0.91, 1.92)	1.25 (1.08, 1.44)	1.22 (1.03, 1.45)

Note. Analysis based on data from longitudinal and cross-sectional studies using national population censuses of 1981. Follow-up for most of the longitudinal studies covered the period of 1980 to 1989. CI = confidence interval.

<sup>a</sup>No data were available for these age groups.

Class differences in ischemic heart disease mortality in the United States were generally smaller than those in northern European countries. The difference between the rate ratios for the United States and northern European countries was in most cases within the margin of uncertainty of 15%. Therefore, the possibility cannot be excluded that class differences in ischemic heart disease mortality in the United States are as large as, instead of smaller than, those in northern Europe.

The comparability of cause-of-death registrations is another area of concern. Some deaths due to ischemic heart disease may be assigned to other causes of death, such as other heart diseases, other cardiovascular diseases, or sudden death.<sup>27</sup> If misreporting occurs more frequently for deaths among manual occupational classes than for deaths among nonmanual classes, the relative mortality level among manual classes would be underestimated. Can this problem explain the fact that no differences in ischemic heart disease mortality were observed in southern European countries? We tested this possibility by adding all other cardiovascular diseases to ischemic heart disease and assessing class differences in mortality from this more robust cause-of-death group. The results showed the same north-south contrast as was observed for ischemic heart disease mortality alone: manual vs nonmanual rate ratios for men aged 45 to 59 years were between 1.03 and 1.18 in southern Europe, between 1.25 and 1.52 in northern Europe, and 1.21 in the United States.

#### Comparison With Other Studies

In this study we used occupational class as the indicator of socioeconomic status,

because nationally representative data on mortality by educational level or income level are not available for most western European countries.<sup>3,19,20</sup> Even though occupation is one key indicator of socioeconomic status,<sup>28</sup> the restriction to this indicator raises the question of whether similar results would have been obtained for other socioeconomic indicators. National data on the association between educational level and ischemic heart disease mortality were available for Finland, Norway, Denmark, Italy, and the United States. An analysis of these data is presented elsewhere.<sup>29</sup> It appeared that the relative position of European countries was nearly the same for education as for occupational class. The position of the United States changed, however. Whereas mortality differences by occupational class were smaller in the United States than in northern Europe, differences by educational level were about equally large.

Several studies have compared industrialized countries with respect to socioeconomic differences in all-cause mortality.<sup>15–17,29–32</sup> A recent series of studies for the 1980s observed that these differences were about equally large in most western European countries but were larger in Finland and, especially, France.<sup>19–21,29</sup> Thus, all-cause mortality differences between socioeconomic strata in France were great despite relatively small differences in ischemic heart disease mortality. The significant all-cause mortality differences in France are attributable to exceptionally large differences in mortality from alcohol-related diseases.<sup>29</sup> Frequent alcohol consumption among lower socioeconomic groups probably partly explains the fact that all-cause mortality differences in Mediterranean countries are not

small even though differences in ischemic heart disease mortality are negligible.<sup>29</sup> The socioeconomic differences in the United States were close to the European average not only for ischemic heart disease mortality but also for all-cause mortality. A recent study observed that in the 1980s all-cause mortality differences by educational level or occupational class in the United States appeared to be as large as those in England and Wales and in Sweden.<sup>29</sup>

#### Explanations

It is interesting that with regard to ischemic heart disease mortality, the United States occupies an intermediate position between northern and southern Europe. This may reflect the more heterogeneous nature of the US population, because of which the experience of some subpopulations with larger inequalities may be averaged out in analyses of this kind. Unfortunately, we were not able to analyze the US data by country of descent, so we could not compare inequalities among citizens of northern European descent with those among citizens of southern European descent. Comparisons could be made, however, between different ethnic groups—Hispanics, other Whites, Blacks, and other ethnic groups. We found no consistent evidence that socioeconomic differences in ischemic heart disease mortality were larger in some ethnic groups than in others (results not shown).

Intriguing are the absence of class differences in ischemic heart disease mortality in most of southern Europe and the positive gradient in Portugal. In these countries, ischemic heart disease mortality rates are traditionally low.<sup>27,33,34</sup> Specific factors have protected men in southern European countries against ischemic heart disease (e.g., moderate alcohol consumption and traditional diets that are rich in fresh vegetables, fruits, fish, and vegetable oil).<sup>35–37</sup> If these factors traditionally protected men from lower social classes as much as men from higher classes, they would have contributed to the small class differences in ischemic heart disease mortality in southern countries. There are indications that dietary habits do not differ between classes in southern European countries to the same extent as in northern European countries; socioeconomic differences in the consumption of fresh fruit and vegetables exist in northern European countries but not in southern European countries.<sup>20,38</sup> In Spain, total fat intake was higher in upper socioeconomic groups until the 1980s.<sup>39</sup>

The situation in southern Europe reminds us of the situation that existed in the United States and northern Europe some

**TABLE 3—Ischemic Heart Disease (IHD) Mortality Rate Ratios Comparing Manual Classes With the Class of Professionals, Employers, Administrators, and Managers Among Men Aged 30–44, 45–59, and 60–64 Years at Death**

Country	30–44 Years Rate Ratio (95% CI)	45–59 Years Rate Ratio (95% CI)	60–64 Years Rate Ratio (95% CI)
Finland	2.44 (2.15, 2.78)	1.66 (1.57, 1.74)	1.34 (1.26, 1.44)
Sweden	2.49 (2.00, 3.11)	1.58 (1.50, 1.65)	... <sup>a</sup>
Norway	1.90 (1.63, 2.21)	1.51 (1.42, 1.61)	1.39 (1.30, 1.49)
England/Wales	2.08 (1.30, 3.32)	1.72 (1.46, 2.01)	1.39 (1.17, 1.64)
France	1.33 (1.19, 1.49)	1.03 (0.99, 1.08)	... <sup>a</sup>
Switzerland	1.02 (0.81, 1.29)	0.97 (0.89, 1.06)	1.06 (0.96, 1.18)
Italy (Turin)	1.21 (0.81, 1.79)	1.17 (1.00, 1.37)	0.90 (0.71, 1.17)
United States	1.39 (0.91, 2.13)	1.38 (1.18, 1.62)	1.36 (1.10, 1.67)

Note. Analysis based on data from longitudinal and cross-sectional studies using national population censuses of 1981. Follow-up for most of the longitudinal studies covered the period of 1980 to 1989. CI = confidence interval.

<sup>a</sup>No data were available for these age groups.

decades ago. Until about 1950, US studies on ischemic heart disease mortality and incidence among men at working age observed no, or even positive, associations with income, educational level, or occupational status.<sup>40–42</sup> The first studies that reported inverse gradients referred to the 1950s.<sup>43–46</sup> Inverse gradients in northern Europe were first reported for the 1960s.<sup>7,10,47–50</sup> More recently, studies from France and Spain suggest that inverse gradients emerged there in the 1980s.<sup>11,12</sup> This evidence suggests that the situation in southern Europe can be understood in part as a delay in the transitions that occurred first in the United States and somewhat later in northern Europe.

This hypothesis of delayed transition implies that the situation in southern Europe can be explained in part by the same risk factors as those that were responsible for the transition from positive to inverse mortality gradients that occurred previously in the United States and northern Europe. This transition was probably related in part to the fact that higher socioeconomic groups were first to pursue a “modern” lifestyle, which implies tobacco consumption, high animal fat intake, and physical inactivity. Tobacco consumption is a well-documented example.<sup>2,5,7,51–53</sup> In the 1950s, there were no clear social gradients, not even positive gradients, in tobacco consumption in the United States and in northern Europe. Inverse gradients emerged in the late 1950s or in the 1960s, when higher socioeconomic groups stopped smoking on a massive scale.<sup>2,5,7,51–53</sup> This situation seems to have persisted longer in southern Europe. In most southern European countries, inverse gradients in smoking prevalence emerged only during the 1980s.<sup>20,38,54–56</sup> Inverse class gradients in smoking existed in Switzerland by the early 1980s but at that time were weaker than in northern Europe.<sup>57</sup> In Portugal, inverse gra-

dients had still not emerged by the late 1980s.<sup>20,38</sup>

Given this delayed transition in social gradients in both ischemic heart disease mortality and smoking, the southern European situation in the 1980s may provide some new insights into the ways in which the wider social context determined the transition from positive to inverse social gradients in ischemic heart disease mortality and its associated risk factors. The wider social context may have been relevant in 3 respects.

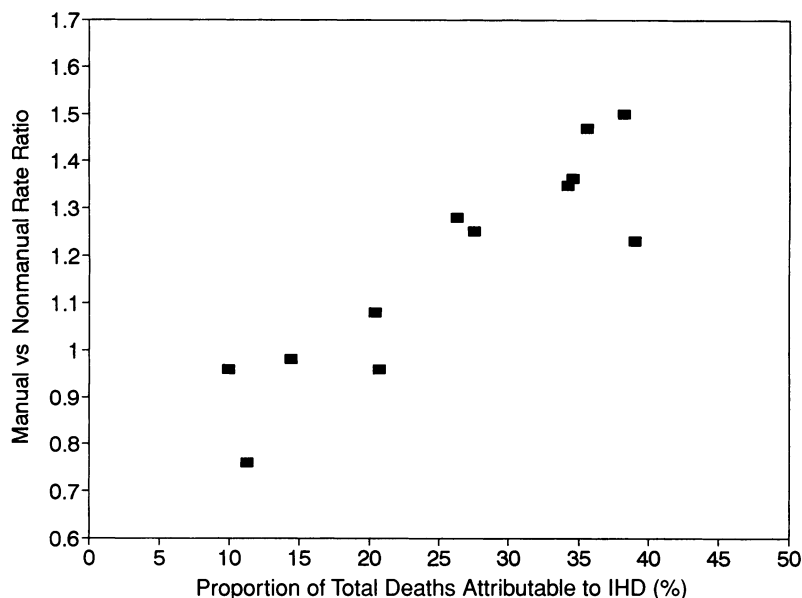
1. *Low living standards.* Positive gradients in ischemic heart disease mortality might have existed in the United States until the 1950s because members of lower socioeconomic groups were too poor to afford high levels of tobacco consumption and animal fat intake or to lead a sedentary way of life. This mechanism may help to explain why Portugal was the only country where ischemic heart disease mortality was still higher in nonmanual occupational classes in the 1980s. Of all countries included in this study, Portugal has the lowest national income and one of the largest income inequalities.<sup>58,59</sup> The positive gradient in ischemic heart disease mortality in Portugal resembles those observed in studies from low-income countries elsewhere in the world.<sup>60–62</sup> Inconsistent with this type of explanation, however, is that positive or no social gradients in ischemic heart disease mortality were also observed in affluent countries like France and Switzerland and not in a poor country like Ireland.<sup>59</sup>

2. *Absence of scientific information on ischemic heart disease risk factors.* Until the 1950s, higher socioeconomic groups may have adhered to adverse lifestyles because the health hazards of tobacco consumption, high animal fat intake, obesity, and physical inactivity had yet to be discovered. When

information on the risk involved with these factors became available, higher socioeconomic groups were probably first to be informed and to modify their lifestyles and living conditions accordingly. It is difficult to explain along these lines, however, the fact that differences in ischemic heart disease mortality emerged about 30 years earlier in the United States than in southern Europe. In the United States, inverse ischemic heart disease gradients started to appear in the 1950s, that is, when the evidence on the health hazards of smoking and other habits was just beginning to accumulate. In southern Europe, inverse ischemic heart disease gradients emerged in the 1980s, that is, when higher socioeconomic groups already must have been aware of the risk factors for ischemic heart disease for many years. It is likely that other conditions had to be fulfilled before these groups were to change their lifestyles accordingly.

3. *Values, tastes, and social norms.* During the 1950s, higher socioeconomic groups in the United States and northern Europe may have adhered to a “modern” lifestyle because this lifestyle was positively valued. An example is the values and social norms related to overweight.<sup>63</sup> As long as malnutrition was a major cause of disease and ill health, overweight must have been viewed as beneficial to health. In addition, it may have been a status symbol: the rich were fat and the poor were thin. Later, when rising living standards eliminated malnutrition and enabled the poor to be fat, overweight gradually lost these positive connotations and became a physical state to be avoided. And, as is usual,<sup>64</sup> higher socioeconomic groups were first to avoid it. Parallel changes may have occurred with values attached to other “modern” risk factors for ischemic heart disease, such as tobacco consumption, animal fat consumption, and physical inactivity. The available evidence suggests that the changes in values that started in the United States have diffused to France and more southern European countries.

One can only speculate why these values persisted longer in southern Europe. Perhaps there is an association with the occurrence of the epidemic of ischemic heart disease and other “diseases of affluence” in the United States and northern Europe. In these countries, ischemic heart disease mortality increased dramatically during this century and is still responsible for a large number of premature deaths among men.<sup>33,34</sup> This modern epidemic and the necessity to halt it may have contributed to changing attitudes toward tobacco consumption and other



Note. Data derived from Tables 1 and 2.

**FIGURE 1—The association between manual vs nonmanual mortality rate ratios and the proportion of total deaths attributable to ischemic heart disease (IHD) among men aged 45 to 59 years at death.**

behaviors that were found to increase the risk of ischemic heart disease and other “diseases of affluence.” And, as is documented for tobacco consumption,<sup>2,5,7,51–53</sup> higher socioeconomic groups were first to adjust their lifestyles effectively. In southern Europe, on the other hand, ischemic heart disease has never become a major killer and remained less important than, for example, deaths related to alcohol abuse. Under these circumstances, positive connotations of tobacco consumption might have persisted until more recently.

### Implications

This study confirms the impression of trend studies that socioeconomic differences in ischemic heart disease mortality are highly variable. This variability offers some hope: what has increased in the past can decrease in the future.

Both trend studies and cross-national comparisons show that ischemic heart disease mortality gradients are strongly responsive to social gradients in behavioral risk factors like smoking and diet. This suggests that socioeconomic differences in ischemic heart disease mortality could be reduced substantially if interventions or policies were to succeed in helping socioeconomically disadvantaged people to quit smoking and improve their diets.

The wider national context appears to determine the magnitude of socioeconomic

differences in ischemic heart disease mortality in complex ways. Both variations across countries and variations over time suggest that the role of cultural factors should not be overlooked. A better understanding of the cultural as well as economic determinants may be essential to predict the future course of ischemic heart disease mortality differentials and to estimate the extent to which alternative policy measures can change their course. □

### Contributors

A. E. Kunst, F. Groenhouf, and J. P. Mackenbach wrote the paper and carried out the analyses. The other coauthors participated in developing the study design, collecting the data, and interpreting the results of the analyses. All of the authors read the preliminary versions of the manuscript, most gave comments, and all approved the final version.

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