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Background. Many European countries have in recent decades reported growing socioeconomic differentials in mortality. While these trends have usually paralleled high unemployment and increasing income disparities, Sweden had low unemployment and narrowing income differences. This study describes trends, 1961–1990, in total and cardiovascular mortality among men, 45–69 years of age, in major occupational classes in Sweden.

Methods. From census data four cohorts were created from those enumerated in 1960, 1970, 1980 and 1985. Through record linkage with the Swedish cause of death registry the mortality in each cohort was followed for 5–10 years. Age-standardized mortality trends 1961–1990 were calculated for occupational groups, categorized according to sector of the economy.

Results. The increase in mortality among middle-aged men in Sweden 1965–1980 was mainly a result of increasing cardiovascular mortality among industrial workers and farmers. In the 1980s the trend for these groups changed into a fast decrease in mortality similar to that for non-manual occupations for the whole period. Consequently the rate ratio for industrial workers in comparison with men having a professional/managerial type of occupation increased from 0.98 to 1.43. The slowest decrease is now found among unqualified occupations in services and transportation.

Conclusions. While Sweden, during the period studied, had narrowing income differentials and low unemployment this result points to the importance of working conditions in understanding trends and distribution of male adult mortality.

Keywords: mortality, cardiovascular disease, occupation, inequality

The British report by the Working Group on Inequalities in Health (‘The Black Report’) in 1982 drew attention to the Nordic countries as examples of nations that had succeeded in reducing social inequalities in mortality through welfare policies. It was later shown that all of them now actually have considerable inequalities in health but that Sweden in the early 1960s did indeed have very small social inequalities in adult mortality. It has further been shown that the social differentials, at least up to the early 1980s, have been widening among men but not among women, although they still may be smaller than in England. A number of other European countries and the US have reported substantial, and from the 1960s onwards, often increasing socioeconomic differentials in mortality. Increasing differentials in male cardiovascular and injury mortality seem to play a major role. The mechanisms behind this development are largely unknown but increasing class differences in smoking are probably an important element. Wilkinson, Davey Smith and others have, on the structural level, emphasized the role of income distribution, poverty and unemployment while Marmot and Theorell have focused on the possible role of the working conditions. In some respects Swedish society has had a somewhat different development with comparatively small and decreasing income differentials, and until recently much lower unemployment rates and high levels of work safety regulation. There are, however, indications that the increasing mortality rate from 1965 to 1979 among Swedish men aged 40–59 was mainly due to a rise in cardiovascular (CVD) mortality among industrial workers. The purpose of this study is to describe the long-term trends in total and CVD mortality in different occupational classes in Swedish society.

MATERIAL AND METHODS

From Swedish census data four cohorts were created from those enumerated in 1960, 1970, 1980 and 1985. Through record linkage with the Swedish cause of

The standardized mortality rates (SR) are based on death rates (deaths per number of person years), standardized for age with the direct method using the employed population in 1970 as the standard population. The study includes all deaths which can be considered as a sample in time. Confidence intervals have however, for simplicity, not been set out for all figures. For the last period with the lowest death rates the absolute number of deaths is however shown in Table 1. The approximate relative size of the 95% confidence intervals will be ±4% for groups with approximately 2000 deaths and ±2% for the larger aggregates with 8000 deaths. As a measure of the overall public health significance of the occupational inequalities the population attributable risk has been calculated, using the occupational group with the lowest mortality rate in each period as the reference group for all the other groups. Mortality from all causes and from CVD is reported. Cardiovascular deaths are not only a major cause of death among middle-aged men, but also play the dominant role in the changes over time. Cardiovascular deaths are defined as codes 390–458 in the 8th edition of the International Classification of Diseases (ICD). In the first cohort the causes of death were classified according to the 7th edition of ICD. Therefore, in this cohort cerebrovascular accidents were included with the group of CVD to make the classifications comparable.

Each census contains information on individual job titles and these are classified into occupational groups as defined by the International Labour Organization (ILO) in the International Classification of Occupations. Professional, managerial and commercial work, service, clerical and transportation, industry, and agriculture are occupational categories that reflect different sectors of the economy. They have no clear inherent socioeconomic hierarchy. However, in the 1980 census the percentage of non-manual employees among middle-aged men with professional, managerial or commercial work is 96%, including 79% as high- or medium level employees. Among industrial workers, 92% are manual workers and among occupations in service, transportation or in clerical work, 72% are manual workers and another 15% low-level non-manual occupations. These figures are essentially unchanged during the study period.

In the analysis of occupational differences the study base is restricted to men gainfully employed at the time of the census, i.e. employed at least 20 h during the census week and not unemployed or absent from work for health (or other) reasons for a longer period than the previous four months. There is no information regarding job titles for those not employed. Those not employed are mainly early retired pensioners, but the category also includes some long-term ill or unemployed and (in this age group) very few students. To restrict the analysis to employed men introduces, especially in societies with high rates of early retirement, a ‘healthy worker’

### Table 1: Direct age-standardized mortality rates 1961–1990 for employed Swedish men aged 45–69 in different occupational groups. Deaths from all causes per 100 000 person years and number of deaths 1986–1990

<table>
<thead>
<tr>
<th>Year</th>
<th>Professional</th>
<th>Managerial</th>
<th>Commercial</th>
<th>Service</th>
<th>Clerical</th>
<th>Transportation</th>
<th>Industry</th>
<th>Agriculture</th>
<th>All employed</th>
<th>Not employed</th>
<th>All men 45–69</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961–1965</td>
<td>1095</td>
<td>1206</td>
<td>1328</td>
<td>1269</td>
<td>1244</td>
<td>1164</td>
<td>1028</td>
<td>821</td>
<td>1036</td>
<td>2940</td>
<td>1194</td>
</tr>
<tr>
<td>1966–1970</td>
<td>1079</td>
<td>1132</td>
<td>1349</td>
<td>1310</td>
<td>1252</td>
<td>1238</td>
<td>1140</td>
<td>899</td>
<td>1114</td>
<td>2622</td>
<td>1182</td>
</tr>
<tr>
<td>1971–1975</td>
<td>905</td>
<td>914</td>
<td>1045</td>
<td>1067</td>
<td>1083</td>
<td>1062</td>
<td>1008</td>
<td>794</td>
<td>971</td>
<td>2918</td>
<td>1199</td>
</tr>
<tr>
<td>1976–1980</td>
<td>924</td>
<td>958</td>
<td>1085</td>
<td>1210</td>
<td>1112</td>
<td>1170</td>
<td>1178</td>
<td>878</td>
<td>1081</td>
<td>2794</td>
<td>1201</td>
</tr>
<tr>
<td>1981–1986</td>
<td>743</td>
<td>706</td>
<td>850</td>
<td>958</td>
<td>903</td>
<td>932</td>
<td>943</td>
<td>731</td>
<td>859</td>
<td>2484</td>
<td>1139</td>
</tr>
<tr>
<td>1986–1990</td>
<td>626</td>
<td>592</td>
<td>652</td>
<td>1029</td>
<td>785</td>
<td>835</td>
<td>824</td>
<td>675</td>
<td>752</td>
<td>2065</td>
<td>1008</td>
</tr>
<tr>
<td>No. of deaths</td>
<td>4980</td>
<td>907</td>
<td>1917</td>
<td>2636</td>
<td>1212</td>
<td>2268</td>
<td>9464</td>
<td>2060</td>
<td>25444</td>
<td>20902</td>
<td>46346</td>
</tr>
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</table>
selection. The incidence of early retirement among middle-aged men in Sweden has gradually been rising since 1960 and was in the 1980s approximately 2.5% per year, with major occupational differences. The risk of early retirement for industrial workers is increased threefold compared to professionals. As this differs among occupations it introduces a bias in the estimate of occupational differences. If the increasing mortality in certain occupations is a result of an increasing morbidity this may tend to raise the risk of early retirement from these occupations. Accordingly, the estimate of increased mortality over time will be lower than the true value. In addition the bias is more pronounced in the first compared to the second 5-year period of the first two cohorts. The healthy worker effect wears off during the years of follow-up and the occupational patterns come out more clearly.\(^5\)

In order to make the cohorts and study periods more comparable and to adjust the mortality rates roughly for these errors we have included an analysis (Table 3 and Figure 1) where the deaths among the not employed have been included under each occupational group in proportion to the group’s share of early retirement. This means that the group of not employed men are attributed a previous occupation in relation to the knowledge we have about the recruitment to this group from different occupations. The assumptions have thus been that the relative risk of retirement for each occupational group has been constant and that mortality rates for the not employed are the same whatever the previous occupation was. This may not be correct but the bias introduced is probably smaller than the influence of the selective outflow of workers in varying rates from different occupations.

RESULTS

We found that the mortality rates (all causes) among those employed in professional, managerial and commercial work decreased strongly (>40%) during the whole period while there were small changes in 1961–1980 (albeit on different levels) in agriculture and industry, followed by a decrease in 1981–1990 (Table 1). A third cluster of occupations with clerical, transport and service work decreased only about 20% from a rather high level. The effect of health-related mobility out of the work force is illustrated by the lower mortality rates among the employed in the first compared to the second 5-year period of the first two cohorts. Accordingly mortality among the not employed is higher in the first compared to the second period. This effect tends to be stronger among those employed in the manual occupations since the risk of health-related early retirement is higher in those occupations.\(^5\)

Based on their mortality patterns we have aggregated the occupations into four major clusters (Table 2). We find here a reversal in total mortality of the rate ratio (RR) between industry and professional/managerial from 0.86 in 1961–1965 to 1.33 in 1986–1990. For CVD the reversal is slightly more pronounced: from 0.77 to 1.32. Correcting for the selective, health-related outflow from the workforce does not change the main trends but the RR between these two groups rises to 1.43 (Table 3 and Figure 1). The correction makes all six periods more comparable and an absolute increase in mortality is shown among industrial workers in 1966–1980 especially in CVD. This was followed by a decrease during the 1980s equal to that among professional and managerial groups. At the same time clerical/transport/service occupations with a slower decrease emerge as the high risk group. A high level of job strain and job insecurity characterizes these often unqualified jobs. Since in professional and managerial occupations more than 95% belong to non-manual classes but manufacturing workers almost exclusively belong to manual classes the figures also indicate reversed and then increasing
social class differentials in overall and cardiovascular mortality among middle-aged Swedish men.

The relative proportions of the different occupational groups have changed considerably during the period. The cluster of professional/managerial groups has increased from 21% to 36% while industrial work has decreased its share from 44% to 34% and agriculture from 21% to 8%. The proportion in the last group working in clerical occupations etc. has thus increased from 14% to 22%.

In a population where the proportion of several different occupational groups changes, the public health problem related to occupational inequalities is better reflected by measures like population attributable risk (PAR) compared to an RR between two contrasting groups. But if, at the same time, the overall mortality decreases the PAR is a proportion of a diminishing problem.

A more adequate estimate of the size of the public health problem as a mortality rate may be achieved by multiplying the PAR with the average mortality rate for all employed. With the occupation with the lowest rate in each decennium as the reference group (i.e. agriculture 1961–1980 and professional/managerial 1981–1990) the all-cause mortality rate attributable to occupational differences seems to be somewhat lower in the 1970s (166 per 100 000) compared to the 1960s (209) and the 1980s (193). However, if we exclude the agricultural group from the calculations and use the professional/managerial group as the reference in all periods the mortality rate attributable to occupational differences increases from 11 in the 1960s to 183 in the 1980s, reflecting increasing differentials between the professional/managerial groups and the rest.
DISCUSSION
There is little reason to believe that changes in disease classification from ICD-7 in the 1960s to ICD-8 in the following years (adjusted for the shift in cerebrovascular disease) have influenced the observed trends in cardiovascular mortality. The fact that mortality from all causes follows a similar trend supports the notion that changing diagnostic criteria cannot be a relevant explanation.

Changes in the composition of the occupational aggregates may have had some influence. Sweden is a country with a high rate of intergenerational mobility and we cannot exclude the possibility of increasing mobility of healthy men into the growing number of professional jobs even if empirical studies from Scandinavia seem to indicate that this plays a minor role. \(^2,8\) A number of ‘sick’ workers may have moved from industrial jobs into low level service jobs which may contribute to the increasing mortality in those groups.

The proportion of immigrants has increased in Sweden from 2.5% in 1960 to 5.0% in 1980. In industry and service occupations the proportion of middle-aged men is 10–15%. In the 1960s immigrants came mainly from Finland (with a more than 50% excess CVD mortality) and went into industry. In the 1970s and 1980s the majority of the immigrants came from countries with a slightly lower cardiovascular mortality than that of the Swedish population and they went mainly into service occupations. If a population with an RR of 1.5 increases its share of the total population from 5 to 10% this will increase the mortality by 2.4%. Immigration may thus have contributed to the trend among industrial workers but it is not possible to explain the changes entirely by immigration. Even the trends in the service occupations may be influenced by immigrants, but typically these are groups other than Finnish men, and they would not be expected to have a high CVD mortality.

Since data on occupation stem from census and data on causes of deaths are derived from death certificates we have little reason to believe in differential misclassification of occupation or cases. A possibility is however that a cardiovascular diagnosis may be chosen in a number of unclear cases and certifying doctors may be influenced by their assumptions about the occupational patterns of these diseases. In the 1960s ischaemic heart disease was mainly regarded as a disease of the upper and middle classes and may thus have been underascertained among lower classes. This stereotype may later have disappeared. There is, however, a random misclassification of occupations in the census that at the one-digit level is estimated to at least 6%. \(^13\)

Many authors have emphasized the role of poverty and income distribution on social inequalities in health. \(^9,10\) Income differentials measured as GINI-coefficients (of income after tax) decreased in 1967–1981 from 0.28 to 0.19 but increased in the 1980s to 0.23. This is low compared to countries like the US and most other Western European countries with higher levels increasing to more than 0.35. \(^16\)

As in Britain, smoking seems to play an important role as mediator between occupational conditions and health. The distribution of smoking has changed since the early 1960s. While the prevalence of daily smoking in most occupations has decreased by one-third during the 1970s, it has only decreased slightly among industrial workers. \(^2,18\) Both British and Swedish studies on occupational distribution of coronary heart disease show however that controlling for the effects of known risk factors like smoking etc. reduces the RR between unskilled workers and professionals only partially. \(^11,17\)

Many developed countries had, during the 1950s and 1960s, a period of increasing male mortality from CVD and injuries. In Sweden this period occurred in 1965–1980. Even the Eastern European countries had a change in adult male mortality trends around 1965, but while Sweden joined the other West European countries in a fast decrease in the 1980s, the East European countries continued their increase. Many studies have shown that in most countries these overall trends cover persisting or, more often, increasing social inequalities.

In this study we have decomposed the mortality trends in 1961–1990 into occupational groups employed in different sectors of the economy. It appears that the increase in Sweden in 1965–1980 was concentrated on cardiovascular mortality among industrial workers and farmers. In the 1980s these occupations showed a sharp decrease in mortality, as the non-manual occupations continued their increase. The causes behind this decrease, which is also found in many other Western European countries are not well understood, even if it is clear that decreasing exposure to cardiovascular risk factors plays an important role. The slowest decrease is now found among unqualified occupations in service and transportation. Sweden had during 1961–1985 narrowing income differentials and low unemployment; our results point to the importance of working conditions in understanding trends and distribution of male adult mortality.

ACKNOWLEDGEMENTS
This study was supported by the Swedish Council for Social research (SFR 90-0115) and the National Institute of Public Health.
REFERENCES


(Revised version received October 1996)