Social class and cause of death

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Background: Previous studies have shown that causes of death differ in their relationship to social class, but we lack a more comprehensive description of this variation. The present study provides a detailed and extensive list of social class differences for a large number of specific causes of death.

Methods: All deaths between 1991 and 2003 in Sweden were linked with information on household social class from 1990. Relative death risks and excess mortality in groups of causes according to the European shortlist were estimated separately for men and women in eight classes using Cox Regression.

Results: A clear mortality gradient among employees was found for the majority of causes, from low-relative death risks among higher managerial and professional occupations to relatively high risks for the unskilled working class. There is considerable variation in the strength of the association, from causes such as malignant melanoma, breast cancer and transport accidents among women, where no clear class differences were found. At the other extreme, mental and behavioural disorders, endocrine, nutritional and metabolic diseases and diseases of the respiratory system all show steep slopes for both men and women. Circulatory diseases and cancer together account for 15–20% of excess mortality.

Conclusions: Exceptions to the general pattern—causes of death in which higher social classes are exposed to greater death risks or in which there is no mortality gradient—are practically non-existent. There is nevertheless significant variation in the strength of the class differences in specific causes.

Keywords: cause of death, excess mortality, mortality, social class, socio-economic differences

Introduction

It is well known that mortality rates differ between social classes and along other dimensions of social position. Moreover, the association between socio-economic position and mortality risk varies by cause of death. Previous studies on socio-economic differences in cause-specific mortality generally focus on major cause groups or most common specific causes, or on specific causes within a certain cause group. Research articles presenting socio-economic differences in a larger number of specific causes with some exceptions use a simple division between manual and non-manual occupations, or, alternatively, an area-based index of socio-economic position. We here present class disparity in death risk for an unusually large number of causes, and we also use a detailed class division to obtain a comprehensive description of the variation.

Data and methods

The results presented here refer to the Swedish population in 1990 aged 30–59 years. Social class is obtained from the census of 1990, while time and cause of death are collected from the Cause of Death Register. All deaths between 1991 and 2003 are included. Information from the registers is linked by a unique personal identification number.

In the census, social class is classified according to the official Swedish classification, which closely resembles the British National Statistics Socio-economic Classification and the newly developed draft of a European Socioeconomic Classification. Eight social classes are distinguished in the analyses as shown in table 1.
professionals are assigned to Class IVab.

The correlation between the slopes for common causes for men and women is only moderately high: 0.67. Most of the cause groups have steeper slopes than total mortality, and this is the case for women as well as for men. The obvious reason for this pattern is the relatively slight slope for neoplasms, which amount to close to 60% of deaths among women and around 35% among men in this age group.

For men, most of the cancers have a low association with social class compared to that for total mortality, while neoplasms of the oesophagus (9) and oral cavity (8) have relative slopes >1, i.e. they show greater class differences than do overall death risks. Most cancers have low-relative rates among women as well, but among them there are more instances of tumours with relatively steep gradients: kidney (22), cervix uteri (18), lung (15), oral cavity (8) and bladder (23). Thus, among both men and women, class differences in cancer mortality vary considerably depending on the site.

Together with cancer, the most common cause of death in this age range is diseases of the circulatory system (33), a cause group that generally shows rather steep gradients on social class. However, cerebrovascular diseases (36) among men have a gradient close to one, which means that the class differences are similar to those for total mortality. Cardiovascular disease is a relatively less common cause of death among women in this age range, while the gradients are comparatively steep, with an overall relative gradient of 1.8 for the major group (33) and 2.1 for ischaemic heart diseases (34).

Malignant melanoma has previously been reported to show greater incidence in the higher social classes or in groups with higher education,24–26 and it is the only cause that shows a negative slope for both men and women, although non-significant. While none of the other seven classes differ significantly from Class I, all the hazard ratios are <1 for men and 4/7 for women. Thus, it seems as if there is an increased risk of dying of skin cancer in the salariat, at least among men.

### Results

The results for all deaths among men and women by household social class are shown in the rows for total mortality in tables 2 and 3. There is a clear mortality gradient among the six employee classes, increasing from a low-relative death risk for the higher professional and managerial class to a high-relative risk among unskilled manual workers. The gradients are steeper for men than for women. Farmers have relatively low-death rates, while other self-employed persons have intermediate death rates, neither exceptionally high nor exceptionally low.

In tables 2 and 3, we furthermore report hazard ratios from Cox regressions for specific causes of death. A few causes in which there were no deaths, e.g. sudden infant death syndrome, are deleted from the list as well as causes with fewer than 100 deaths among men or women.

The causes are sorted according to the slopes reported in tables 2 and 3. These slopes are OLS regression coefficients of the logged parameter values on the six classes of employees; for these analyses, we have excluded the two classes of self-employed as they cannot be placed within a clear hierarchical order. The classes are scaled by the parameter estimates for total mortality, causing the slope for total mortality to become exactly equal to 1. Thus, causes with a slope >1 have a steeper gradient than all causes together and, correspondingly, a slope <1 indicates a flatter gradient. The significance of the slopes at the 5% level, as indicated by boldface figures, are based on rank order tests of the hypothesis of a monotonous increase in the hazard ratios from Class I to VII (not including self-employed), as opposed to a null hypothesis of no association.22 In this way, the tests are not based on the presumption of linearity. Slopes for men and women are not directly comparable, because the tests are not based on the presumption of linearity. Slopes for the higher professional and managerial class to a high:relative death risk for the major group that generally shows rather steep gradients on social class. However, cerebrovascular diseases (36) among men have a gradient close to one, which means that the class differences are similar to those for total mortality. Cardiovascular disease is a relatively less common cause of death among women in this age range, while the gradients are comparatively steep, with an overall relative gradient of 1.8 for the major group (33) and 2.1 for ischaemic heart diseases (34).

Mental and behavioural disorders (28), with subgroups concerning drugs (30) and alcohol (29), are the causes with the steepest gradients among men and show steep gradients for women as well. In these cases, one must assume that the diseases to some extent determine class position. Total alcohol consumption was previously greater in the higher classes, but by 1990, the patterns were equalised or even reversed, and the distribution was more skewed in the working class than among non-manuals.23 These results suggest that it is a high level of consumption rather than the average rate that affects mortality. Other causes with steep gradients among both men and women are chronic liver disease (44), accidental poisoning (62), ulcers (43), endocrine diseases (26), homicide (64) and chronic respiratory diseases (40).

### Table 1 Number of women and men (age: 30–59 years) in each social class in 1990

<table>
<thead>
<tr>
<th>Social class</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (%)</td>
<td>Number (%)</td>
<td></td>
</tr>
<tr>
<td>I Higher managerial and professional occupations</td>
<td>261 393 (16.0)</td>
<td>273 396 (16.2)</td>
</tr>
<tr>
<td>II Lower managerial and professional occupations</td>
<td>334 031 (20.5)</td>
<td>321 080 (19.1)</td>
</tr>
<tr>
<td>III Intermediate occupations</td>
<td>160 105 (9.8)</td>
<td>128 275 (7.6)</td>
</tr>
<tr>
<td>IVc Lower supervisory and skilled manual occupations</td>
<td>211 387 (13.0)</td>
<td>286 615 (17.0)</td>
</tr>
<tr>
<td>V Unskilled manual occupations</td>
<td>77 835 (4.8)</td>
<td>44 626 (2.7)</td>
</tr>
<tr>
<td>VI Seemly employed and own account workers in agriculture</td>
<td>280 589 (17.2)</td>
<td>269 674 (16.0)</td>
</tr>
<tr>
<td>VII Employers and own account workers not in agriculture</td>
<td>27 879 (1.7)</td>
<td>34 036 (2.0)</td>
</tr>
<tr>
<td>Unclassified</td>
<td>97 372 (6.0)</td>
<td>116 324 (6.9)</td>
</tr>
<tr>
<td>Missing</td>
<td>45 672 (2.8)</td>
<td>62 719 (3.7)</td>
</tr>
<tr>
<td>Total</td>
<td>1 629 709 (100.0)</td>
<td>1 682 869 (100.0)</td>
</tr>
<tr>
<td>Cases in analysis</td>
<td>1 450 591</td>
<td>1 474 026</td>
</tr>
</tbody>
</table>
The magnitude of the class differences in specific causes of death, indicated by the slopes, do not necessarily reflect the number of deaths that could be considered as excess mortality. In Table 4, slopes and the proportion of excess mortality are shown for the various ICD chapters, where these are ordered due to excess mortality from any of these two major cause groups.

### Discussion

The risk of dying in any cause is more than twice as high for men in the unskilled working class compared to the risk for men in the salariat, the consequence being that around half of the deaths among these men can be regarded as excess mortality. The corresponding relative risk among women is only about 0.5–1.5% of all deaths are due to excess mortality from any of these two major cause groups.

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**Table 2** Hazard ratios from Cox regressions of death risks in separate causes of death by household social class for men aged 30–59 years in 1990. Hazard ratios significantly different from those for Class I (reference category, ratio = 1) in boldface. Slopes in boldface are significant at 5% level according to rank correlation tests.

<table>
<thead>
<tr>
<th>Number</th>
<th>Cause of death</th>
<th>Number of deaths</th>
<th>II</th>
<th>IIIa</th>
<th>Iib</th>
<th>VI</th>
<th>VII</th>
<th>Slope IVa</th>
<th>IVcd</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Malignant melanoma of skin</td>
<td>941</td>
<td>0.96</td>
<td>0.99</td>
<td>0.88</td>
<td>0.89</td>
<td>0.95</td>
<td>-0.13</td>
<td>0.83</td>
</tr>
<tr>
<td>25</td>
<td>Diseases of the blood-forming organs, immunological disorders</td>
<td>419</td>
<td>1.08</td>
<td>1.36</td>
<td>0.96</td>
<td>1.08</td>
<td>1.19</td>
<td>0.09</td>
<td>0.79</td>
</tr>
<tr>
<td>11</td>
<td>Malignant neoplasm of colon</td>
<td>2029</td>
<td>1.02</td>
<td>1.07</td>
<td>1.08</td>
<td>1.29</td>
<td>1.15</td>
<td>0.25</td>
<td>1.17</td>
</tr>
<tr>
<td>21</td>
<td>Malignant neoplasm of prostate</td>
<td>2351</td>
<td>0.84</td>
<td>1.07</td>
<td>1.06</td>
<td>1.21</td>
<td>1.05</td>
<td>0.25</td>
<td>1.01</td>
</tr>
<tr>
<td>24</td>
<td>Malignant neoplasm of lymphohaematopoietic tissue</td>
<td>3014</td>
<td>1.01</td>
<td>1.14</td>
<td>1.16</td>
<td>1.20</td>
<td>1.18</td>
<td>0.26</td>
<td>1.17</td>
</tr>
<tr>
<td>23</td>
<td>Malignant neoplasm of bladder</td>
<td>1211</td>
<td>1.06</td>
<td>1.13</td>
<td>1.15</td>
<td>1.24</td>
<td>1.38</td>
<td>0.40</td>
<td>1.10</td>
</tr>
<tr>
<td>6</td>
<td>Neoplasms</td>
<td>27912</td>
<td>1.11</td>
<td>1.25</td>
<td>1.37</td>
<td>1.47</td>
<td>0.53</td>
<td>1.30</td>
<td>0.93</td>
</tr>
<tr>
<td>7</td>
<td>Malignant neoplasms</td>
<td>27563</td>
<td>1.11</td>
<td>1.24</td>
<td>1.37</td>
<td>1.47</td>
<td>0.53</td>
<td>1.31</td>
<td>0.93</td>
</tr>
<tr>
<td>22</td>
<td>Malignant neoplasm of kidney</td>
<td>1144</td>
<td>1.33</td>
<td>1.15</td>
<td>1.68</td>
<td>1.33</td>
<td>1.59</td>
<td>0.55</td>
<td>1.29</td>
</tr>
<tr>
<td>14</td>
<td>Malignant neoplasm of pancreas</td>
<td>2071</td>
<td>1.06</td>
<td>1.26</td>
<td>1.25</td>
<td>1.48</td>
<td>1.53</td>
<td>0.58</td>
<td>1.31</td>
</tr>
<tr>
<td>15</td>
<td>Malignant neoplasm of liver and intrahepatic bile ducts</td>
<td>795</td>
<td>1.08</td>
<td>1.34</td>
<td>1.51</td>
<td>1.41</td>
<td>1.82</td>
<td>0.76</td>
<td>1.52</td>
</tr>
<tr>
<td>49</td>
<td>Diseases of kidney and ureter</td>
<td>257</td>
<td>1.39</td>
<td>1.27</td>
<td>1.36</td>
<td>1.77</td>
<td>2.33</td>
<td>0.92</td>
<td>1.40</td>
</tr>
<tr>
<td>10</td>
<td>Malignant neoplasm of stomach</td>
<td>1430</td>
<td>1.35</td>
<td>1.46</td>
<td>1.93</td>
<td>1.70</td>
<td>2.12</td>
<td>0.93</td>
<td>1.69</td>
</tr>
<tr>
<td>1.29</td>
<td>Symptoms, signs, abnormal findings, ill-defined causes</td>
<td>1015</td>
<td>0.99</td>
<td>1.22</td>
<td>1.54</td>
<td>1.25</td>
<td>2.20</td>
<td>0.94</td>
<td>1.29</td>
</tr>
<tr>
<td>36</td>
<td>Cerebrovascular diseases</td>
<td>4134</td>
<td>1.24</td>
<td>1.54</td>
<td>1.82</td>
<td>1.62</td>
<td>2.17</td>
<td>0.95</td>
<td>1.65</td>
</tr>
<tr>
<td>15</td>
<td>Malignant neoplasm of larynx and trachea/bronchus/lung</td>
<td>5724</td>
<td>1.23</td>
<td>1.56</td>
<td>1.90</td>
<td>1.80</td>
<td>2.06</td>
<td>0.97</td>
<td>1.66</td>
</tr>
<tr>
<td>57</td>
<td>Unknown and unspecified causes</td>
<td>990</td>
<td>1.00</td>
<td>1.23</td>
<td>1.58</td>
<td>1.30</td>
<td>2.25</td>
<td>0.98</td>
<td>1.31</td>
</tr>
</tbody>
</table>

**Total mortality**

| 80400 | Total mortality                                      | 1.18 | 1.41 | 1.69 | 1.80 | 2.13 | 1.00 | 1.45 | 1.12 |

**Diseases of the circulatory system** (33) this figure is exceeded, with 8% for women and 13% for men. The class differences in death rates are large in mental and behavioural disorders (28) and endocrine, nutritional and metabolic diseases (26) for both men and women, while only about 0.5–1.5% of all deaths are due to excess mortality from any of these two major cause groups.

**Discussion**

The risk of dying in any cause is more than twice as high for men in the unskilled working class compared to the risk for men in the salariat, the consequence being that around half of the deaths among these men can be regarded as excess mortality. The corresponding relative risk among women is about 1.7, leading to excess mortality of around 40% among...
women in unskilled occupations. However, there is substantial variability in the degree to which death in different causes varies by social class, from a few causes for which there are no significant differences between social classes to those for which the relative risk for men in the unskilled working class is more than six times higher than the risk for men in the salariat. The class schema is not assumed to form a complete hierarchy, as is generally higher risks than women and men in Class VI (skilled working class).

Naturally, the fact that we find consistent gradients on social class is not an indication that class is the crucial dimension of 'socio-economic position'. Education, income or status may from social class in their relation to mortality and should other socio-economic dimensions can be assumed to differ between social class and risk of death insignificant. That is, no clear cases, although preferably be studied in their own right. Yet, we have previously been reported for a few causes, among them breast cancer, malignant melanoma of the skin and flight accidents. We do not find any clear cases, although

Instances of a reversed association between some indicators of socio-economic position and mortality/morbidity have been previously reported for a few causes, among them breast cancer, malignant melanoma of the skin and flight accidents. We do not find any clear cases, although
death due to malignant melanoma seems to be more common in the higher managerial and professional occupations, at least among men. For women, the hazard ratio for breast cancer in the skilled working class (VI) is significantly <1. There is no gradient for transport accidents among women, while there is a weak association among men, presumably related to the fact that most professional drivers are men. The observed gender difference, with male inequality and female equality in transportation mortality, is in line with previous research using education instead of social class. 31

Some of the causes showing a strong association with social class seem to be related to consumption patterns or/and behavioural disorders, such as drug dependence and alcohol abuse as well as malignant neoplasms connected to smoking. Other causes, such as accidental poisoning, accidental falls and homicide assaults, may generally be related to more dangerous lifestyles or more exposed conditions in the working class.

For some causes, such as mental disorders and congenital malformations, the causal order may be inverted in the sense that the health problem, which eventually leads to the person’s death, may have been the major cause of his or her relatively low-social class position. Thus, a selection hypothesis could be plausible for a few diseases with an early onset. The rather weak association between social class and congenital malformations among men could be due to the assignment of class positions according to the dominance principle, by which many of these men may be classified according to their partner’s occupation. However, this does not seem to be relevant for women or for people with mental disorders, given the steep gradients in these cases.

The different causes of death analysed here may share risk factors. For example, smoking is a risk factor for a range of cancer types, but also for cardiovascular and respiratory diseases. Furthermore, there are multiple risk factors for every cause, for example, hypertension, smoking, total cholesterol level, body mass index and excess alcohol use are a few of the many cardiovascular risk factors. 32 Thus, examining every possible pathway between social class and mortality for every possible cause of death is a major task. The variation per se could give a suggestion of where to look. One approach to this is to compare the association between socio-economic position and ‘preventable’ causes of death (both in terms of medical treatment and preventability) with causes that are considered less preventable. 33 Preventable causes are generally more class-related, partly because individuals with greater resources may be better able to adjust their behaviour in line with new knowledge about risk and prevention factors. Therefore, relative risks in different causes of death may change as new knowledge becomes available and with the diffusion process as this knowledge spreads in the population. Thus, the ranking of class differences in specific causes of death will certainly change over time.

That we find no clear case of a reversed association between social class and risk of death, while nearly all causes are related to a greater risk for the working class compared to the salariat, can be seen as supporting Cassel’s idea of the general susceptibility of individuals of lower status. 34 Hallqvist 35 formulated the hypothesis that general susceptibility depends on several interacting factors, where the risk of falling ill if exposed to one of these factors will depend upon whether the person is exposed to the other factors as well. Workers and poorly educated people will then be more susceptible than others if some very general risk factors—general in the sense that they are included in the risk set for a large number of diseases—are relatively common among them, as they will run other risk factors. The distributions of these latter factors are not necessarily different among the social classes. Smoking is one important example of a general risk factor; almost half of the male mortality in the lowest social strata can be attributed to smoking. 36 The hypothesis of general susceptibility indicates the importance of searching for a common general risk set that underlies class gradients. In current research on health inequality, more general hypotheses refer to the life course, 37 status 38 and intelligence. 39 However, searching for and testing such broad explanations of health differences do not mean that we can overlook the disparate pattern of specific causes of death.

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Conflicts of interest: None declared.

Key points
- We know from previous research that the association between social class and mortality varies by cause of death, but here we present a ranking of social class differences for an unusually large number of causes of death. Moreover, the class differences are described in detail for every cause.
- We find no clear reversed class gradient.
- Routine non-manual workers generally have higher death risks than do skilled manual workers. Thus, the common manual/non-manual division in previous research tends to underestimate class differences in mortality.
- Cancer, for which the differences between social classes in death risk are relatively small, nevertheless contributes to a large number of deaths that can be considered as excess mortality.

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