Socioeconomic status and ischaemic heart disease mortality in middle-aged men: importance of the duration of follow-up. The Copenhagen Male Study

Poul Suadicani, Hans Ole Hein and Finn Gyntelberg

Objectives The predictive value of some risk factors may diminish with increasing duration of follow-up. This study was performed to elucidate the role of socioeconomic status as a risk factor for ischaemic heart disease (IHD) mortality in middle-aged men, testing the hypothesis that the role of mediators of the association of socioeconomic status with risk of IHD would diminish with increasing length of follow-up.

Methods A cohort of 5249 men aged 40–59 was established in 1971. Baseline data on social class and other confounder variables were collected, and the cohort was followed through registers for 8, 15, and 22 years. In all, 5028 without a history of myocardial infarction or angina pectoris were included in the follow-up. Four factors associated with either occupation or lifestyle were strong mediators of the association found between social class and risk of fatal IHD, and were more common in the lower social classes (classes IV and V): occasional demand for vigorous activity at work, low leisure time physical activity level, high alcohol consumption, and smoking.

Results After the first 8 years, 78 men had died due to IHD, after 15 years: 222, and after 22 years: 411. Compared with social classes I, II, and III, the age-adjusted relative risk (RR) with 95% CI for classes IV and V was 1.69, \( P < 0.05 \) after the first 8 years; adjusted for the above potential risk factors the RR dropped to 1.09, \( P = \text{NS} \). Corresponding RR after 15 years were 1.67, \( P < 0.001 \) and 1.33, \( P = \text{NS} \); and after 22 years, 1.59, \( P < 0.001 \) and 1.36, \( P < 0.05 \).

Conclusions Risk factors with an uneven social distribution related to occupation and lifestyle were strong mediators of the association of socioeconomic status with risk of IHD. A quite strong explanatory potential persisted but diminished with length of follow-up.

Keywords Myocardial ischaemia, social class, epidemiology, confounding factors, work, risk factors

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During the preceding three to four decades the association of socioeconomic status with risk of ischaemic heart disease (IHD) has changed in Western, industrialized countries; from being a disease more common among affluent people, IHD has become a disease of the poor. Several studies have attempted to disclose relevant confounders, i.e. mediators, responsible for these differences in risk. Typically, it has been possible to explain less than 50% of the inequalities through an uneven social distribution of cardiovascular risk factors.\(^1\)\(^-\)\(^8\)

In the Copenhagen Male Study we have previously shown that among men with a mean age of 63 years (range 54–75), low socioeconomic status was associated with a significantly increased risk of contracting a first IHD event; in a 6-year follow-up study using a baseline established in 1985–1986, men in social classes IV and V (basically unskilled and semiskilled
workers) had a 44% increased risk compared to men in social classes I, II and III (men with an intermediate or high educational level). Approximately 70% of the excess risk could be attributed to an uneven social distribution of risk factors, in particular factors associated with lifestyle and physical work environment. Social differences in fasting serum lipids, blood pressure, and body mass index (weight in kg/height in m²) contributed only little to the explanation. The predictive value of some risk factors may diminish with increasing duration of follow-up, a suggestion supported in a recent study by Wannamethee et al. A number of explanations for this may exist, e.g. measurements, either of the risk factor studied or of the mediating factors, become outdated because they were taken a long time ago. Accordingly, the length of follow-up may in itself be an important potential bias or effect modifier in studies attempting to identify relevant mediators of socioeconomic differentials in risk.

In addition to including different risk factors, the above cited studies also had different lengths of follow-up which may also explain in part differences between the studies. This study was performed to elucidate the role of socioeconomic status as a risk factor for IHD mortality in middle-aged men. It uses the initial study baseline in the Copenhagen Male Study which was established in 1970–1971 and tests the hypothesis that the role of mediators of the association of socioeconomic status with risk of IHD would diminish with increasing length of follow-up.

Material and Methods

The 1970–1971 baseline

The Copenhagen Male Study was established in 1970–1971. At 14 companies in Copenhagen, covering the railway, public road construction, military, post, telephone, customs, national bank, and the medical industry, all men aged 40–59 years were invited to take part in a study of fitness and risk of cardiovascular disease; 5249 men, 87% of potential participants, agreed to participate. The examination consisted of a questionnaire, a short interview, and a clinical examination with measurement of systolic and diastolic blood pressure, and height and weight. From the questionnaire information was obtained about working conditions, lifestyle and general health factors. For diagnosis of angina pectoris and myocardial infarction the Rose Questionnaire was used. The information given in the questionnaire was clarified with each subject in the ensuing interview. Details on the questionnaire have already been published. A number of these factors are elaborated in more detail below.

Smoking

The men were asked if they smoked currently, previously or had never smoked. In addition, smokers gave information on the number of cigarettes, cheroots, cigars and number of pipes smoked a day. An estimated weekly amount of tobacco smoked was calculated. One cigarette was regarded as equivalent to 1 g of tobacco, one cheroot to 3 g of tobacco, one cigar to 4 g and a pipe to 2 g of tobacco.

Alcohol

Participants reported their daily alcohol consumption as the number of alcoholic beverages consumed per day. An estimated weekly amount consumed was calculated. One beverage corresponded to 10–12 g of ethanol, and most of the alcohol consumed came from beer.

Physical activity in leisure time

The men classified themselves into one of four different groups of leisure time physical activity as: predominantly sedentary, slightly active, fairly active or very active. For analytical purposes answers were dichotomized into the least active (predominantly sedentary) versus the rest.

Physical activity at work

Physical activity at work was assessed from the questionnaire. To a question phrased ‘Do you do heavy physical work?’, 4.9% of subjects answered ‘often’, 27.2% ‘occasionally’ and 67.9% ‘rarely or never’.

Social class

The men were divided into five social classes according to a system originally elaborated by Svalastoga, later adjusted by Hansen. This system of classification is based on education level, and job position in terms of number of subordinates. Typical jobs in the study cohort were, in social class I: officer, civil engineer, office executive, head of department; social class II: head clerk, engineer, unqualified architect; social class III: engine driver, train guard; social class IV: machine fitter in a telephone company; social class V: unskilled labourer, mechanic, driver. For the analyses, study participants were divided into two classes, social classes IV and V (basically unskilled and semi-skilled workers), and social classes I, II and III, i.e. men with an intermediate or high educational level. This dichotomy made it possible to compare the present results with those from previous work in the Copenhagen Male Study.

Exclusion criteria

Men with a history of angina pectoris or myocardial infarction were excluded for this prospective study together with eight men with missing job title. A total of 5028 men were included for study.

End-points

In 1995 a register follow-up on mortality between 1971 and 1993 was carried out. All men who had taken part in the study were traced by means of the Danish Central Population Register. Death certificate diagnoses within the follow-up period were obtained from the National Health Service register and from the Danish Institute of Clinical Epidemiology. Both registers used International Classification of Diseases, 8th Revision, and IHD diagnoses used were codes 410–12. To test the importance of duration of follow-up, the association of socioeconomic status with risk of IHD mortality was tested in three different time periods: 8, 15, and 22 years.

Statistical analyses

All analyses were performed using the SPSS statistical software for Windows. Student’s t-test and χ² analyses were used for comparing unadjusted characteristics of men who died due to IHD during the first 8 years of follow-up with men who did not, and for comparing men in lower social classes with men in higher social classes (Tables 1 and 2). Also in Tables 1 and 2
age-adjusted odds ratios with 95% CI are given based on the results of multiple logistic regression analyses using maximum likelihood estimation and backward elimination of variables.

To estimate the explanatory potential, i.e. their role as mediators, of the above identified potential confounders, they were included in three different analyses using 8, 15, and 22 years of follow-up. Relative risk (RR) comparing social classes IV and V with classes I, II and III, and RR of risk factors significant after adjustment in a backward elimination model were estimated by taking the natural log e raised to the hazard coefficient for the variable of interest in Cox proportional hazards regression models using the maximum likelihood ratio method 17 and backward elimination of variables (Table 3). The RR associated with low social class was calculated from the hazards regression coefficient and the standard error of the dichotomous social class variable at the time of its removal from the stepwise model. The explanatory role of each factor in the final model was analysed by calculating how large a proportion of the ‘explained’ excess risk in social classes IV and V could be attributed to each factor. Variables with P-values <0.10 were allowed to remain in the final multivariable models (Tables 3 to 5).

For all analyses a two-sided probability-value of P<0.05 was taken as statistically significant.

Ethics
The study was approved by The Ethics Committee for Medical Research in the County of Copenhagen.

Results
Baseline characteristics
Table 1 shows characteristics of men who died due to IHD during the first 8 years of follow-up and men who did not. Lifestyle factors, occupational factors, and other factors separated the
two groups. Compared to others, among those who died, a larger proportion belonged to the lower social classes, drank more alcohol, smoked more tobacco, and were less physically active in their leisure time. Conspicuous and highly significant associations were found for the phenomenon ‘occasional demand for vigorous physical activity at work’ and for systolic as well as diastolic blood pressure. Also, those who died due to IHD comprised a larger proportion receiving antihypertensive medication, and even those using sedatives on a regular basis. On average those who died were 3 years older than controls.

Table 2 Characteristics of men in social classes IV and V and of men in social classes I, II, and III. Values presented are mean (SD) or frequency in per cent together with the age-adjusted odds ratio (OR) with 95% CI

<table>
<thead>
<tr>
<th>Lifestyle factors</th>
<th>Social class IV/V (n = 2763)</th>
<th>Social class I, II, III (n = 2265)</th>
<th>Age-adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol beverages/week</td>
<td>13.1 (14.1)</td>
<td>9.0 (10.1)</td>
<td>1.03 (1.02–1.035)**</td>
</tr>
<tr>
<td>Alcohol beverages &gt;35/week</td>
<td>4.5%</td>
<td>1.3%</td>
<td>3.5 (2.4–5.3)**</td>
</tr>
<tr>
<td>Smoking</td>
<td>75.3%</td>
<td>68.0%</td>
<td>1.4 (1.3–1.6)**</td>
</tr>
<tr>
<td>Grams of tobacco smoked/day</td>
<td>12.0 (9.5)</td>
<td>11.0 (9.9)</td>
<td>1.01 (1.00–1.02)**</td>
</tr>
<tr>
<td>Never smoking</td>
<td>7.9%</td>
<td>10.3%</td>
<td>0.7 (0.6–0.9)**</td>
</tr>
<tr>
<td>Low leisure time physical activity</td>
<td>19.4%</td>
<td>14.4%</td>
<td>1.4 (1.2–1.7)**</td>
</tr>
<tr>
<td>Frequently under psychological strain</td>
<td>5.8%</td>
<td>8.0%</td>
<td>0.7 (0.6–0.9)**</td>
</tr>
</tbody>
</table>

Table 3 Relative risk (RR) of ischaemic heart disease (IHD) comparing social classes IV and V with classes I, II, and III using three different lengths of follow-up 8, 15, and 22 years. Relative risk is presented with and without adjustment for confounders

<table>
<thead>
<tr>
<th>predictors in the final model</th>
<th>RR</th>
<th>E.F.</th>
<th>RR</th>
<th>E.F.</th>
<th>RR</th>
<th>E.F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasional demand for heavy physical activity versus not</td>
<td>1.9 (1.1–3.2)</td>
<td>47%</td>
<td>1.4 (1.03–2.0)</td>
<td>34%</td>
<td>1.3 (0.99–1.6)</td>
<td>23%</td>
</tr>
<tr>
<td>Low leisure-time physical activity versus more</td>
<td>1.6 (0.9–2.7)</td>
<td>15%</td>
<td>1.3 (0.96–1.9)</td>
<td>6%</td>
<td>1.4 (1.1–1.9)**</td>
<td>5%</td>
</tr>
<tr>
<td>Alcohol consumption &gt;35 beverages/week versus less</td>
<td>2.9 (1.3–6.5)**</td>
<td>10%</td>
<td>1.4 (0.7–2.7)</td>
<td>2%</td>
<td>1.3 (0.8–2.2)</td>
<td>3.5%</td>
</tr>
<tr>
<td>Age (risk increase associated with a 10-year increase in age)</td>
<td>1.13 (1.8–1.19)*</td>
<td>9%</td>
<td>1.10 (1.07–1.13)**</td>
<td>6%</td>
<td>1.09 (1.07–1.1)**</td>
<td>5.5%</td>
</tr>
<tr>
<td>Current smoking versus not</td>
<td>2.1 (1.1–4.2)*</td>
<td>6%</td>
<td>1.6 (1.1–2.3)**</td>
<td>3%</td>
<td>1.5 (1.2–2.0)**</td>
<td>2%</td>
</tr>
<tr>
<td>Unexplained</td>
<td>13%</td>
<td>49%</td>
<td>61%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* E.F. = explanatory fraction, i.e. the relative proportion in per cent of the ‘explained’ excess risk in social classes IV and V which can be attributed to each factor.
* P < 0.05, ** P < 0.01, *** P < 0.001.
Table 2 illustrates that several of the factors separating those who died due to IHD from those who did not, also significantly separated men in the lower social classes from men in classes I, II, and III, with a clustering of adverse factors in the lower classes: they drank more, they smoked more, they were less active in their leisure time, and demand for physical activity at work was very different between high and low social classes. More than half of the men in the lower classes reported having frequent or occasional demand for vigorous activity at work compared to only 7% among classes I, II and III.

Identification of potential mediators of the association of socioeconomic status with risk of fatal IHD

Based on the results presented in Tables 1 and 2 potential confounders or mediators were identified. Four factors were significantly associated with fatal IHD as well as socioeconomic status on the 0.05 level, and were regarded as relevant: low leisure time physical activity, smoking, occasional demand for vigorous physical activity at work, and alcohol consumption. In preliminary analyses we found that there was no association

Table 4 Predictors of fatal ischaemic heart disease (IHD) during the first 10 years of follow-up among men with and without occasional demand for vigorous physical activity on the job. Risk factors are presented according to their relative strength of association with fatal IHD after multivariable adjustment. Relative risk (RR) with 95% CI is estimated from the hazard ratios of Cox proportional hazards regression models

<table>
<thead>
<tr>
<th>Predictor</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasional demand for heavy physical activity (n = 1369)</td>
<td></td>
</tr>
<tr>
<td>Age (risk increase associated with a one-year increase in age)</td>
<td>1.14 (1.07–1.22)**</td>
</tr>
<tr>
<td>Systolic blood pressure (risk increase associated with a 10-mmHg increase)</td>
<td>1.29 (1.16–1.43)***</td>
</tr>
<tr>
<td>Current smoking versus not</td>
<td>6.2 (1.5–26.1)**</td>
</tr>
<tr>
<td>Weight (risk associated with a one-unit change in weight in kg)</td>
<td>0.97 (0.94–0.998)*</td>
</tr>
<tr>
<td>Others (n = 3659)</td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure (risk increase associated with a 10-mmHg increase)</td>
<td>1.21 (1.10–1.31)***</td>
</tr>
<tr>
<td>Age (risk increase associated with a one-year increase in age)</td>
<td>1.09 (1.04–1.14)***</td>
</tr>
<tr>
<td>Alcoholic beverages &gt;35/week versus less</td>
<td>3.8 (1.6–9.3)**</td>
</tr>
<tr>
<td>NIDDMa versus not</td>
<td>5.0 (1.3–19.5)*</td>
</tr>
<tr>
<td>Frequent use of sedatives versus not</td>
<td>2.1 (0.96–4.6)</td>
</tr>
</tbody>
</table>

a Non-insulin dependent diabetes.

Covariates included in both analyses: social class, age, high alcohol consumption, smoking, leisure time physical activity, NIDDM, systolic blood pressure, diastolic blood pressure, weight, height, frequent use of sedatives, car ownership, antihypertensive medication, work-related stress, perceived stress in leisure time.

* P < 0.05, ** P < 0.01, *** P < 0.001.

Table 5 Predictors of fatal ischaemic heart disease (IHD) (n = 119) during the first 10 years of follow-up among all men. Risk factors are presented according to their relative strength of association with fatal IHD after multivariable adjustment. Relative risk (RR) with 95% CI estimated from the hazard ratios of Cox proportional hazards regression models

<table>
<thead>
<tr>
<th>Predictors</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic blood pressure (risk associated with a 10-mmHg increase)</td>
<td>1.24 (1.16–1.32)***</td>
</tr>
<tr>
<td>Age (risk increase associated with a one-year increase in age)</td>
<td>1.11 (1.06–1.15)***</td>
</tr>
<tr>
<td>NIDDMa versus not</td>
<td>3.8 (1.4–10.5)**</td>
</tr>
<tr>
<td>Interaction term: occasional demands of job-related heavy physical activity * smoking</td>
<td>5.7 (1.3–23.9)*</td>
</tr>
<tr>
<td>Alcoholic beverages &gt;35/week versus less</td>
<td>2.4 (1.1–5.1)*</td>
</tr>
<tr>
<td>Interaction term: occasional demand for job-related heavy physical activity * weight (lowest fifth, ≤69 kg, versus rest)</td>
<td>2.0 (1.01–4.1)*</td>
</tr>
<tr>
<td>Frequent use of sedatives versus not</td>
<td>1.8 (0.94–3.5)</td>
</tr>
</tbody>
</table>

a Non-insulin dependent diabetes.

Covariates included in the analysis:

Main effects: social class, age, high alcohol consumption, smoking, leisure time physical activity, NIDDM, systolic blood pressure, diastolic blood pressure, weight, height, frequent use of sedatives, car ownership, antihypertensive medication, work-related stress, perceived stress in leisure time, frequent demand for heavy physical activity on the job, occasional demands of heavy physical activity on the job.

Interaction terms:

1. Occasional demand for heavy physical activity on the job * smoking
2. Occasional demand for heavy physical activity on the job * weight
3. Occasional demand for heavy physical activity on the job * NIDDM
4. Occasional demand for heavy physical activity on the job * high alcohol consumption
5. Occasional demand for heavy physical activity on the job * frequent use of sedatives

* P < 0.05, ** P < 0.01, *** P < 0.001.
between alcohol consumption and risk of fatal IHD during the first 8 years of follow-up among men consuming <35 beverages/week; accordingly, the dichotomous variable alcohol consumption ≥35 beverages/week versus less was considered the more relevant and was used for further analyses. The dichotomous variable smoking and smoking in g/day were highly correlated. Which of the two was used had no influence on the results presented. For simplicity of presentation we used the dichotomous variable in the multivariable analyses.

Prospective analyses
Table 3 illustrates the association of social class with risk of fatal IHD in 8, 15 and 22 years of follow-up, including the four factors mentioned above together with age. The joint explanatory potential of these factors was very strong in the 8-year follow-up, reducing the age-adjusted only RR from 1.69 to 1.09. An additional analysis including all factors presented in Table 1 did not further reduce the strength of the association of social class with IHD (not shown).

The relative contribution of each factor included in the final model is depicted in the column denoted E.F. for explanatory fraction. With increasing length of follow-up the role of the factors included in the analyses diminished. However, almost half of the excess risk was ‘explained’ in the 15-year follow-up which included almost three times as many end-points, and almost 40% could be attributed to an uneven social distribution of baseline risk factors in the 22-year follow-up which had more than five times the number of endpoints included in the 8-year incidence study.

Table 4 shows which factors were associated with risk of fatal IHD during 10 years of follow-up among men with and without occasional demand for heavy physical activity at work. Within both groups there was a strong predictive value of blood pressure and age. However, only among men with occasional demand for heavy physical activity was smoking highly significantly associated with IHD mortality, and also a significant inverse association was found between weight and risk of IHD. Among the large group of men without these demands, the association between smoking and risk of fatal IHD was quite weak and far beyond reaching statistical significance (RR = 1.06, P = 0.85), at the time of removal from the multivariable model. In contrast, only among men without occasionally physically demanding work were a high alcohol consumption level, NIDDM, and frequent use of sedatives, significantly associated with risk of fatal IHD.

In order to test the relevance of these differences in predictors between men with and without work-related occasional demand for heavy physical activity, a final analysis was performed including all men. Five multiplicative interaction terms were added to the model together with all main effects included in the analyses presented in Table 4. The association with IHD risk was equally strong whether weight was included as a continuous or a dichotomous variable. To simplify interpretation of the model, for the analysis presented, the variable weight was dichotomized (arbitrarily using the lowest quintile, 69 kg, as cut-off point).

Table 5 shows the result of the final model including only factors significantly associated with fatal IHD after multivariable adjustment. Systolic blood pressure and age were the strongest risk factors, followed by the interaction of occasional demand for heavy physical work and smoking, NIDDM, high alcohol consumption, and the interaction of occasional demand for heavy physical work and weight. In this 10-year follow-up RR associated with low social class was 1.60 before adjustment, and 1.17 after adjustment.

Discussion
Two measures of socioeconomic status were analysed in this study—hierarchical position and a measure of relative material wealth—car ownership. Since car ownership was neither an independent predictor of fatal IHD nor a mediator of the association of social class with risk of fatal IHD, the analyses in this study were mainly based on the hierarchical classification.

The Copenhagen Male Study cohort consists of a majority of men employed in public service. In the Danish public services salary and hierarchical status are closely related, and also the relative status differences remain fairly stable with time.

Irrespective of the length of follow-up, the lower social classes had a clearly increased risk of fatal IHD. The excess RR during the first 8 years of follow-up, 69%, was more than 50% higher than the 44% risk increase reported in our study of the cohort when it had a mean age of 63 years and was followed for 6 years. The results of the present study support the hypothesis that the role of mediators of the association of socioeconomic status with risk of IHD mortality diminish with increasing length of follow-up. The excess RR in the lower classes remained quite high with a 59% excess risk after 22 years of follow-up. This observation may indicate that either the lower classes were less likely to change their lifestyle in a positive direction (e.g. to reduce or quit smoking, and maintain a reasonable degree of leisure time physical activity), or that other risk factors with an uneven socioeconomic distribution were responsible for the excess risk in the later part of the follow-up period.

It is consistent with the observation that the association of socioeconomic status with risk of IHD was reversed in Western, industrialized countries after World War II. From being a disease of affluent people, IHD became a disease more dominant among those economically underprivileged. An increasing
proportion of various forms of labour previously calling for physical activity has been taken over by machines, and regular demand for physically demanding work in the lower, manual classes, has become rarer. Thus, nowadays a relatively larger proportion of men in lower social classes have a low physical training effect from their work. The results indicate that untrained men are at increased risk when they have to carry out physically strenuous work for which they are not properly trained. The observation is consistent with the results of a recent paper on sudden cardiac death. The authors found that ‘undetected cardiac lesions cause unexpected sudden cardiac death during occasional sport activity’. From the register follow-up data available to us it was not possible to obtain information on how many men died suddenly while performing strenuous tasks at work. In parallel with occasional strenuous sporting activity, occasional strenuous work activity may have been triggering a myocardial infarction event or lethal rhythm disturbances with manifest symptoms occurring during, as well as after, work.

The above considerations were supported by a number of further analyses. We analysed the predictive value of the factors included in the present study of risk of fatal IHD in separate analyses of those who reported having occasionally physically demanding work, and among others (Table 4). One observation was particularly noteworthy: only among those with occasional demand for physically strenuous activity at work was smoking significantly, and strongly, associated with risk of fatal IHD. This finding, suggestive of a dangerous interplay of smoking and physical demands, is interesting in the light of a recent in-depth review of the pathology of the coronary arteries in smokers and non-smokers considering the pathophysiological mechanism of smoking. It concluded that ‘both clinical and experimental data strongly support the notion that thrombogenic factors are responsible for the increased occurrence of ischaemic heart disease, and particularly acute coronary syndromes, among chronic smokers.’ Also in support of a possible causal association between occasional demand for heavy physical work and increased risk of fatal IHD was the observation that men with a low weight belonging to the group occasionally exposed to heavy work had an excess risk of fatal IHD. A weight load of a given magnitude no doubt has a larger impact on the body of a man of low weight than on a heavy man.

Low leisure time physical activity level and heavy alcohol consumption were almost equally strong mediating factors; as point estimates explaining 15% and 10% of the excess IHD mortality in classes IV and V. The lower classes had an approximately 30% larger proportion of subjects who were largely sedentary in their leisure time, and as a group they reported consuming between 30% and 40% more alcohol per week. Although the age difference between lower and higher classes was small, differences in age explained 9% of the excess risk, and differences in smoking habits explained 6%.

In previous work from the Whitehall Study, social class differentials expressed as employment grade and car ownership—a marker of income and relative wealth—were independently associated with total mortality and mortality from the major cause groups. Although strongly associated with social class, in the study presented here, car ownership was not associated with risk of fatal IHD. Also height was included and scrutinized in the Whitehall Study. Height differences between the socio-economic groups explained little of the differential mortality, a result in accordance with the results on IHD death presented here.

Summing up, although the risk factors were not identical, in essence the results of this study agree with our previous finding—that a socioeconomic heterogeneity distribution of occupational and lifestyle factors, and to a lesser extent personal clinical features, are strong mediators of social inequalities in risk of IHD. The results of this study also emphasize that the predictive value of risk factors diminishes with increasing length of follow-up, and that waiting for more end-points in follow-up studies may be futile.

**KEY MESSAGES**

- The association of low social class with risk of fatal ischaemic heart disease is strongly mediated by occupational and lifestyle factors in middle-aged men.
- With increasing duration of follow-up occupational and lifestyle factors explain less of the association of low social class with risk of fatal ischaemic heart disease.
- Occasional occupational exposure to vigorous physical activity is strongly associated with risk of fatal IHD in men who smoke and in men with a low weight.

**References**


