Variation in coronary risk factors by social status: results from the Scottish heart health study

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SUMMARY. The relationship between social status and coronary heart disease in the United Kingdom is well established with the more socially disadvantaged being at higher risk. There is also evidence that the levels of most of the known coronary risk factors vary with social status in a way consistent with their relationship to coronary heart disease. Using data from the Scottish heart health study the aim of this study was to quantify, for men and women, the variation in four of the main coronary heart disease risk factors — smoking, serum total cholesterol level, blood pressure and obesity — according to a number of social factors — occupational social class, housing tenure, level of education and employment status. The analyses used both mean risk factor levels as well as the percentages above suggested cut off levels, in order to provide estimates of the percentage of people at risk. All the risk factors, apart from total cholesterol level in men, showed fairly consistent variation across social groups with the more socially disadvantaged being at higher risk. Similar social variation was found for the percentages above the cut off levels, and these indicate that nearly 60% of the Scottish population aged 40–59 years, have one or more risk factors for coronary heart disease.

These results suggest that some targeting of health education and management is appropriate, and this is especially relevant as the reforms to the National Health Service set health targets for health authorities and encourage general practitioners to provide health promotion services. The socioeconomic profile of an area will clearly have to be an important consideration in deciding how best to allocate the resources necessary to implement these reforms.

Keywords: coronary risk factors; social class; socioeconomic factors; inequalities in health.

Introduction

A NUMBER of studies have established a strong relationship between occupational social class and coronary heart disease,[1-3] with manual workers being at higher risk than non-manual workers. There is also strong evidence for a similar relationship with coronary heart disease for other social factors such as housing tenure, income and education, in that the most socially disadvantaged groups are at higher risk.[4-7] The unemployed have also been found to have higher rates of coronary heart disease than the employed.[8] Smoking and fibrinogen levels vary according to social status, so variation in coronary heart disease by social status may be due to effects of smoking and fibrinogen levels,[9-11] but some effect of social status appears to remain even after adjustment for these and other risk factors.[1,4,5,9] However, regardless of the true explanation for the social variation in coronary heart disease it is of interest, from the point of view of health management and health education, to examine the variation of the main risk factors across social groups and to make some attempt at quantifying what percentage of people in particular social groups would require management of these risk factors. A knowledge of the socioeconomic profile of a region or district could then be used to estimate the workload in terms of risk factor management and may also indicate where health education programmes should be targeted.

This paper used data from the Scottish heart health study to look at four risk factors for coronary heart disease — smoking, raised serum total cholesterol level, raised blood pressure and obesity — by four social factors — occupational social class, housing tenure, level of education and employment status. Cut off points, suggested in the literature, were used to estimate the percentage of people requiring treatment for each risk factor within the categories of each social factor. Finally the percentage of people requiring treatment for one, two, three or all four of these risk factors was calculated to indicate the overall treatment workload for each social group.

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Method

The Scottish heart health study was a random population survey conducted in 22 districts in Scotland in 1984–86. The study subjects were men and women aged 40–59 years who were sampled in two stages. First, a sample of general practitioners was selected from the list of general practitioners for each district, and then a sample of patients registered with each of these general practitioners was chosen. Full details of the study design are given elsewhere.[12-14]

The subjects completed a questionnaire, which included questions on their socioeconomic characteristics and smoking behaviour. They were also invited to attend a local clinic for examination where their height, weight and blood pressure were measured and a blood sample was taken for biochemical analysis, including the measurement of serum total cholesterol level. A total of 10 359 subjects (5123 men and 5236 women) responded to the questionnaire and attended for examination. This represents a response rate of 74%, excluding those questionnaires returned by the post office.

Subjects were classified as current regular cigarette smokers (one or more cigarettes per day) or non-smokers according to their self-reported declaration. The number of years a subject had smoked cigarettes was computed for ex-smokers and current regular smokers. A cut off point of 7.8 mmol l^{-1} or above was used to indicate hypercholesterolaemia, as suggested by the European Atherosclerosis Society.[15] The body mass index was calculated (weight (kg)/height^2 (m)) and patients classified as obese if their body mass index was 30.0 or above for men or 28.6 or above for women, as suggestd by the Royal College of Physicians.[16] Finally, subjects were considered to be hypertensive if their diastolic blood pressure was 105 mmHg or above, or if they were receiving drug treatment for high blood pressure.[17]

Occupational social class was determined from the Office of Population Censuses and Surveys occupational classification,[18] with married women being assigned to their husband's social class. Those patients in social classes 1 to 3N were considered to be in non-manual occupations and those in classes 3M to 5 to be in manual occupations.

Raw means and percentages are presented here, but significance tests were carried out after first adjusting for age differences across the social groups. Significant differences between social groups were sought and each group was compared with a base group which is the first group shown on the tables. A t-test derived from an analysis of covariance model was used for mean figures, but when comparing percentages, a t-test derived from a logistic regression model was used.

Results

There were substantial differences in the two measures of smoking across all social measures with manual workers, those in rented accommodation, the less well educated and the unemployed all smoking more than those in the more socially advantaged groups (Table 1). The variation across social groups was similar for men and women for the two measures of smoking used. Men tended to have been smoking longer than women, although the percentage of current smokers was similar for the two sexes.

Less consistent results were found for total cholesterol levels (Table 2). Among men only social class reveals any significant difference, with the manual group having the lowest mean cholesterol value and smallest percentage who had hypercholesterolaemia. The opposite was found for women, with the more socially disadvantaged groups generally having higher cholesterol levels. The two measures of cholesterol were higher among the unemployed than the employed for both men and women although the difference did not achieve significance.

The mean body mass index and the percentage of subjects who were classified as obese are shown in Table 3. There are clear differences across most social groups, particularly for women, with the more socially disadvantaged groups having a higher mean body mass index and a higher percentage who were obese. No significant differences were found between the unemployed seeking work and the employed but women in the sick, disabled or retired group had a higher mean body mass index and a higher percentage were obese than employed women.

In general the more socially disadvantaged groups were found to have higher blood pressure and higher rates of hypertension than the socially advantaged groups (Table 4). For women there were significant differences for manual class, housing tenure and education level, whereas for men significant differences were found for housing tenure and employment status, with the men who were unemployed and seeking work having the highest mean blood pressure and the highest percentage of hypertensive subjects being found among men who were sick, disabled or retired.

Table 5 shows the percentages of men and women with one, two, three or four risk factors by each social factor. A patient was judged to have a risk factor if they were a current smoker, had hypercholesterolaemia, were obese or had hypertension. Clear social differences are apparent, and for men the group with most risk factors were those who were unemployed and seeking work, of whom 20.6% had two or more risk factors. Among women the sick, disabled or retired group had most risk factors (34.2% had two or more risk factors) followed by local authority and housing association tenants (27.9% had two or more risk factors).

Discussion

The raised mortality among the socially disadvantaged has been well documented, for a variety of diseases.[19] The approach used in this study allows some of the reasons for this inequality, in terms of risk factors for coronary heart disease, to be examined more closely.

Significant variation across social groups was found for each

Table 1. Cigarette smoking, by sex and social status.

Social factor	Mean no. of years of cigarette smoking[a] (SE): Men		Women		% of subjects who were current smokers (SE): Men		Women	
Social class								
Non-manual (n=2151/2286)	16.5	(0.3)	12.8	(0.3)	*27.4*	*(1.0)*	*28.3*	*(0.9)*
Manual (n=2826/2537)	22.7	(0.3)***	17.4	(0.3)***	*47.8*	*(0.9)****	*46.3*	*(1.0)****
Housing tenure								
Owner occupier (n=2722/2645)	16.7	(0.3)	11.9	(0.3)	*28.1*	*(0.9)*	*26.5*	*(0.9)*
Private rental (n=311/270)	21.0	(0.9)***	15.0	(0.9)**	*41.5*	*(2.8)****	*36.0*	*(2.9)****
LA/HA (n=1978/2172)	24.6	(0.3)***	19.4	(0.3)***	*54.2*	*(1.1)****	*52.4*	*(1.1)****
Level of education								
Degree (387/170)	10.6	(0.7)	7.5	(0.9)	*14.6*	*(1.8)*	*12.1*	*(2.5)*
Professional qualification/diploma (n=1183/1036)	17.3	(0.4)***	12.0	(0.4)***	*29.5*	*(1.3)****	*26.1*	*(1.4)****
Secondary/primary (n=3449/3885)	22.1	(0.3)***	16.5	(0.2)***	*45.3*	*(0.8)****	*42.4*	*(0.8)****
Employment status								
Employed (n=4150/3251)	18.8	(0.2)	14.7	(0.3)	*35.7*	*(0.7)*	*37.7*	*(0.8)*
Unemployed seeking work (n=471/131)	26.0	(0.7)***	20.5	(1.3)***	*63.0*	*(2.2)****	*51.1*	*(4.3)***
Sick/disabled/retired (n=387/266)	27.2	(0.8)***	21.3	(1.0)***	*49.1*	*(2.5)****	*48.5*	*(3.0)****
Housewife (n=–/1422)	–	(–)	15.2	(0.4)*	–	*(–)*	*35.8*	*(1.3)*
All (n=5026/5101)	20.1	(0.2)	15.3	(0.2)	*39.2*	*(0.7)*	*38.1*	*(0.7)*

[a]All subjects included; non-smokers coded as 0 years. *P<0.05; ** P<0.01; *** P<0.001. SE = standard error. n = total no. of men/women in group. LA/HA = local authority/housing association.

Table 2. Total cholesterol level, by sex and social status.

Social factor	Mean total cholesterol level (SE)				% of subjects who had hypercholesterolaemia[a] (SE)			
	Men		Women		Men		Women	
Social class								
Non-manual (n = 2031/2064)	6.44	(0.03)	6.52	(0.03)	*12.6*	*(0.7)*	*16.1*	*(0.8)*
Manual (n = 2634/2236)	6.32	(0.02)***	6.64	(0.03)**	*10.1*	*(0.6)***	*18.3*	*(0.8)**
Housing tenure								
Owner occupier (n = 2579/2392)	6.38	(0.03)	6.50	(0.03)	*11.2*	*(0.6)*	*15.3*	*(0.7)*
Private rental (n = 292/244)	6.38	(0.07)	6.65	(0.09)	*13.0*	*(2.0)*	*19.3*	*(2.5)*
LA/HA (n = 1826/1900)	6.35	(0.03)	6.69	(0.03)**	*10.8*	*(0.7)*	*20.0*	*(0.9)***
Level of education								
Degree (n = 363/148)	6.38	(0.06)	6.26	(0.10)	*9.4*	*(1.5)*	*12.8*	*(2.8)*
Professional qualification/diploma (n = 1122/943)	6.37	(0.04)	6.44	(0.04)	*11.1*	*(0.9)*	*14.8*	*(1.2)*
Secondary/primary (n = 3220/3447)	6.37	(0.02)	6.64	(0.02)**	*11.4*	*(0.6)*	*18.3*	*(0.7)*
Employment status								
Employed (n = 3915/2913)	6.36	(0.02)	6.49	(0.02)	*11.0*	*(0.5)*	*15.1*	*(0.7)*
Unemployed seeking work (n = 424/113)	6.47	(0.06)	6.69	(0.13)	*13.0*	*(1.6)*	*20.4*	*(3.8)*
Sick/disabled/retired (n = 355/230)	6.36	(0.07)	7.01	(0.09)	*12.1*	*(1.7)*	*27.0*	*(2.9)*
Housewife (n = –/1449)	–	(–)	6.72	(0.04)*	–	*(–)*	*20.8*	*(1.1)**
All (n = 5076/5205)	6.37	(0.02)	6.59	(0.02)	*11.2*	*(0.5)*	*17.4*	*(0.6)*

[a] Cholesterol level of 7.8 mmol l^{-1} or above. *P<0.05; ** P<0.01; *** P<0.001. SE = standard error. n = total no. of men/women in group. LA/HA = local authority/housing association.

Table 3. Body mass index, by sex and social status.

Social factor	Mean body mass index (SE)				% of patients who were obese[a] (SE)			
	Men		Women		Men		Women	
Social class								
Non-manual (n = 2176/2324)	25.9	(0.1)	24.9	(0.1)	*10.2*	*(0.6)*	*15.8*	*(0.8)*
Manual (n = 2848/2588)	26.2	(0.1)**	26.2	(0.1)***	*13.0*	*(0.6)***	*24.5*	*(0.8)****
Housing tenure								
Owner occupier (n = 2751/2692)	25.9	(0.1)	25.0	(0.1)	*9.6*	*(0.6)*	*16.2*	*(0.7)*
Private rental (n = 317/279)	26.2	(0.2)	26.0	(0.3)***	*12.3*	*(1.8)*	*24.4*	*(2.6)****
LA/HA (n = 1990/2211)	26.2	(0.1)*	26.4	(0.1)***	*14.4*	*(0.8)****	*26.2*	*(0.9)****
Level of education								
Degree (n = 387/175)	25.2	(0.2)	23.8	(0.3)	*6.2*	*(1.2)*	*10.9*	*(2.4)*
Professional qualification/diploma (n = 1199/1057)	26.0	(0.1)***	24.7	(0.1)*	*10.2*	*(0.9)**	*14.6*	*(1.1)*
Secondary/primary (n = 3480/3983)	26.2	(0.1)***	26.0	(0.1)***	*12.9*	*(0.6)****	*23.0*	*(0.7)****
Employment status								
Employed (n = 4191/3310)	26.1	(0.1)	25.5	(0.1)	*11.3*	*(0.5)*	*19.3*	*(0.7)*
Unemployed seeking work (n = 476/135)	25.9	(0.2)	25.6	(0.4)	*13.4*	*(1.6)*	*24.4*	*(3.7)*
Sick/disabled/retired (n = 388/273)	26.1	(0.2)	26.6	(0.3)*	*14.7*	*(1.8)*	*27.1*	*(2.7)**
Housewife (n = –/1449)	–	(–)	25.8	(0.1)	–	*(–)*	*22.6*	*(1.1)**
All (n = 5076/5205)	26.1	(0.1)	25.7	(0.1)	*11.7*	*(0.5)*	*20.9*	*(0.6)*

[a] Body mass index 30.0 or above for men; 28.6 or above for women. *P<0.05; ** P<0.01; *** P<0.001. SE = standard error. n = total no. of men/women in group. LA/HA = local authority/housing association.

of the risk factors considered, both in terms of mean levels and the percentage of patients at risk. Apart from the total cholesterol level in men, the pattern is consistent with the more socially disadvantaged groups being at higher risk. These findings are in broad agreement with results reported elsewhere. For example, the differences between social groups are most striking for smoking, a finding consistent with a number of other studies.[6,9,11,20,21]

The question of possible bias as a result of missing data is considered elsewhere.[22] Missing data seem to cause no important biases for men, but tend to lead to underestimation of risk factor levels in women. This appears to be due to difficulties in obtaining blood samples from obese women. In the social context, missing data are associated with living in rented accommodation. Consequently, the risk factor levels for women in rented accommodation presented here are probably underestimates, thus, widening the social differential already noted.

The higher levels of total cholesterol level found in men with non-manual occupations has also been reported in other studies of British men[9,11] but the small difference found according to level of education does not match findings from the Tromsö study[20] or from a study of male Irish industrial employees,[6] both suggesting that the mean cholesterol level is lower in the better educated. This inconsistency between different social factors demonstrates the importance of looking at several measures of social status in order to obtain an overall picture of the social pattern in risk factor levels.

Body mass index showed fairly consistent results between the sexes and across the social groups, apart from employment status. Similar results have been reported elsewhere for education[6,20,21] and the weak effect for men by occupational social class was also found in the British regional heart study.[9]

Table 4. Blood pressure, by sex and social status.

Social factor	Mean diastolic blood pressure (SE) Men		Women		% of subjects who were hypertensive[a] (SE) Men		Women	
Social class								
Non-manual (*n* = 2186/2327)	84.2	(0.3)	80.2	(0.2)	*10.9*	*(0.7)*	*7.8*	*(0.6)*
Manual (*n* = 2856/2589)	84.6	(0.2)	81.7	(0.2)***	*11.1*	*(0.6)*	*11.3*	*(0.6)****
Housing tenure								
Owner occupier (*n* = 2765/2696)	83.7	(0.2)	79.8	(0.2)	*10.2*	*(0.6)*	*7.0*	*(0.5)*
Private rental (*n* = 317/278)	84.8	(0.6)	81.2	(0.7)	*10.7*	*(1.7)*	*13.7*	*(2.1)****
LA/HA (*n* = 1996/2212)	85.3	(0.3)***	82.6	(0.3)***	*12.2*	*(0.7)*	*12.9*	*(0.7)***
Level of education								
Degree (390/175)	83.5	(0.6)	78.0	(0.9)	*10.0*	*(1.5)*	*4.6*	*(1.6)*
Professional qualification/diploma (*n* = 1202/1056)	83.8	(0.4)	79.0	(0.3)	*9.6*	*(0.8)*	*6.7*	*(0.8)*
Secondary/primary (*n* = 3494/3958)	84.7	(0.2)	81.8	(0.2)***	*11.7*	*(0.5)*	*11.0*	*(0.5)**
Employment status								
Employed (*n* = 4210/3316)	84.1	(0.2)	80.7	(0.2)	*9.6*	*(0.5)*	*8.9*	*(0.5)*
Unemployed seeking work (*n* = 475/132)	85.8	(0.6)**	81.2	(1.0)	*13.5*	*(1.6)**	*9.1*	*(2.5)*
Sick/disabled/retired (*n* = 390/273)	85.7	(0.6)	83.1	(0.7)	*24.0*	*(2.2)****	*17.0*	*(2.3)**
Housewife (*n* = –/1450)	–	(–)	81.6	(0.3)	–	*(–)*	*10.9*	*(0.8)*
All (*n* = 5096/5209)	84.4	(0.2)	81.1	(0.2)	*11.0*	*(0.4)*	*9.9*	*(0.4)*

[a]Diastolic blood pressure 105 mmHg or above, or receiving drug treatment for high blood pressure. *$P<0.05$; ** $P<0.01$; *** $P<0.001$. SE = standard error. *n* = total no. of men/women in group. LA/HA = local authority/housing association.

Table 5. Percentage of patients, by number of risk factors, sex and social status.

Social factor	% of men by no. of risk factors 1	2	3	4	% of women by no. of risk factors 1	2	3	4
Social class								
Non-manual (*n* = 2000/2038)	*36.3*	*10.3*	*1.2*	*0.1*	*36.1*	*11.5*	*2.4*	*0.1*
Manual (*n* = 2606/2202)	*50.5*	*12.2*	*2.0*	*0.1*	*44.3*	*20.6*	*4.2*	*0.5*
Housing tenure								
Owner occupier (*n* = 2541/2359)	*37.7*	*9.2*	*0.9*	*0.1*	*34.8*	*11.8*	*1.9*	*0.1*
Private rental (*n* = 288/242)	*45.5*	*11.5*	*2.8*	*0.0*	*39.7*	*18.2*	*4.5*	*0.4*
LA/HA (*n* = 1807/1874)	*54.1*	*14.4*	*2.4*	*0.1*	*48.1*	*22.1*	*5.2*	*0.6*
Level of education								
Degree (*n* = 358/145)	*26.8*	*6.1*	*1.1*	*0.0*	*24.1*	*7.6*	*0.7*	*0.0*
Professional qualification/diploma (*n* = 1106/934)	*35.4*	*9.9*	*1.3*	*0.0*	*33.6*	*10.8*	*1.8*	*0.0*
Secondary/primary (*n* = 3180/3398)	*49.7*	*12.5*	*1.8*	*0.1*	*43.4*	*18.3*	*4.0*	*0.4*
Employment status								
Employed (*n* = 3362/2873)	*42.3*	*10.4*	*1.3*	*0.1*	*40.8*	*14.9*	*3.0*	*0.3*
Unemployed seeking work (*n* = 421/111)	*57.5*	*17.1*	*3.3*	*0.2*	*46.8*	*18.9*	*6.3*	*0.0*
Sick/disabled/retired (*n* = 350/225)	*54.0*	*16.9*	*3.1*	*0.3*	*41.3*	*27.1*	*6.7*	*0.4*
Housewife (*n* = –/1254)	–	–	–	–	*39.8*	*18.1*	*3.7*	*0.3*
All (*n* = 4650/4485)	*44.6*	*11.4*	*1.6*	*0.1*	*40.7*	*16.5*	*3.5*	*0.3*

n = total no. of men/women in group. LA/HA = local authority/housing association.

The Caerphilly and Speedwell studies found no relationship between social class and body mass index for men.[11]

For mean diastolic blood pressure strong associations were found with housing tenure and employment status for men, and with occupational social class, housing tenure and level of education for women. However, the more socially disadvantaged groups do have higher mean blood pressure for all measures even though the differences do not always achieve significance. This accords well with some British studies[9,11] which looked at social class. For level of education the results are inconsistent with those of the Framingham study[23] but agree with some others.[6,20]

Most previous studies have only looked at men and have only used one social measure, usually occupational social class or level of education. This study indicates that whereas housing tenure and level of education show fairly consistent effects for the risk factors considered, for the unemployed, only smoking and raised blood pressure in men can be used as possible explanations for their higher risk of coronary heart disease. In addition, the effect of having a manual occupation on total cholesterol levels in men is contrary to that expected from a comparison of levels of coronary heart disease.[2] The findings presented here also suggest that the social variation in risk factor levels is stronger and more consistent across the social measures considered for women than for men. For all four risk factors, women in more socially disadvantaged groups appear to have higher levels of risk factors, but for men there is evidence of a contrary relationship for cholesterol.

Possible reasons for the social variation in levels of coronary heart disease risk factors have been discussed elsewhere.[5] Although there may be direct links between social factors and risk factors, the social factors considered may be strongly related to many of the factors governing healthy behaviour, such as opportunity, knowledge and attitude. Thus, for example, personal habits can be influenced by education, and opportunities for healthy living by income.

The percentages of patients with one or more risk factors should be taken as a rough guide only as the cut off points used are, to some extent, arbitrary. As women tend to have higher cholesterol levels than men in the age group studied here, use of the same cut off for men and women may be misleading, and may explain why a higher percentage of women than men have two or more risk factors. Thus the risk score takes little account of the differential level of risk between the sexes. Nonetheless, the scores do give some indication of the extent of the problem in Scotland, with 13.1% of men and 20.3% of women having two or more risk factors, and of the implications for counselling and therapeutic services.

The strong social variation in the percentages with one or more risk factors does suggest a need to target health education and management, especially as some other suggested risk factors, such as fibrinogen level and alcohol consumption, also appear to be related to social status.[5,10] This is an important consideration since the reforms to the National Health Service encourage general practitioners to offer health promotion/illness prevention services, which would include some risk factor measurements and lifestyle advice.[24] In addition, the government has identified coronary heart disease as a key area where real improvement in health is possible, and targets for reducing mortality have been suggested.[25] Targeting may well be necessary in view of the increased workload that is likely to result from these reforms. This could be achieved using a variety of approaches, including reallocating, or increasing, resources for community and primary care services in socially deprived areas as well as increasing the role of these services in health education and promotion. However, a broad, intersectorial, approach will be needed to increase the opportunities for healthy behaviour.

Undue weight should not be given to disparities with results from studies in other countries, especially given the reverse that appears to have taken place in the relationship between social status and coronary heart disease in the UK over the past 40 years.[26] Rather, the excess of avoidable risk in the socially disadvantaged and the associated causes need to be considered if we are to achieve 'Health for all by the year 2000'[27] in Scotland and the UK as a whole.

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