

British family heart study: its design and method, and prevalence of cardiovascular risk factors

FAMILY HEART STUDY GROUP

SUMMARY

Aim. The aim of this paper is to describe the prevalence of cardiovascular risk factors in families screened systematically by nurses in British general practice, and in sub-groups with reported hypertension, hypercholesterolaemia, diabetes and coronary heart disease.

Method. Twenty six general practices (13 intervention and 13 control practices) in 13 towns in England, Wales and Scotland were involved in a randomized control trial. Randomly ordered invitations were sent for a family health check to 4158 households (men aged 40–59 years and their partners) registered with the 13 intervention practices.

Results. One or more adult members from 2373 households (57%) were screened; in 1477 visits the selected man and his female partner attended of whom 98% were married. In all, 3850 individuals were screened (2246 men and 1604 women); 15% of men and women were in the pre-defined top quintile of the British family heart study risk score. Twenty four per cent of men and 22% of women smoked cigarettes and 62% of men and 44% of women were overweight (body mass index 25+). One third of men and one sixth of women with no known history of high blood pressure had a diastolic blood pressure of 90+ mmHg. Among the 491 individuals with previously reported high blood pressure 64% were not adequately controlled, having a diastolic blood pressure of 90+ mmHg, while 26% had diastolic blood pressure of 100+ mmHg. Eighteen per cent of men and women with no known history of a high cholesterol level had a random cholesterol level of 6.5+ mmol l⁻¹. In the 173 people with a previously reported high cholesterol level and who had their level measured over half had a cholesterol level of 6.5+ mmol l⁻¹ and in 7% this level was 8.0+ mmol l⁻¹. One per cent of men and 0.3% of women were newly identified as diabetic (random glucose level of 10.0+ mmol l⁻¹). In the 52 with previously diagnosed diabetes unsatisfactory control was found in 52% (random level of 10.0+ mmol l⁻¹). A total of 3034 men and women overall (79%) qualified for follow up for one or more risk factor; 1909 men (85%) and 1125 women (70%). Among the 139 with pre-existing coronary heart disease 119 (86%) had modifiable risk factors: 27% were cigar-

ette smokers, 68% had a body mass index of 25+, 40% had diastolic hypertension, 29% had hypercholesterolaemia and 19% had hyperglycaemia. Five per cent of men and women were taking antihypertensive drugs, 0.3% cholesterol lowering drugs and 0.7% drugs for diabetes.

Conclusion. There is considerable scope for primary and secondary prevention among families registered with general practices, but whether nursing and medical intervention can reduce the risk factors related to cardiovascular disease in this setting remains unknown.

Keywords: coronary risk factors; familial diseases; cardiovascular diseases; screening; clinical trials in general practice.

Introduction

CARDIOVASCULAR disease is still the major cause of premature death in the United Kingdom and the prevention of coronary heart disease and stroke is a priority area for the government in its *Health of the nation* strategy.¹ Targets have now been set for the major cardiovascular risk factors — smoking and diet in relation to obesity and blood pressure — and a voluntary health promotion package for primary care aimed at modifying these factors is being put in place.² There is already ample evidence that trained practice nurses can successfully identify cardiovascular risk factors in general practice using a low technology³ or more intensive approach,⁴ and some evidence that intervention in this setting can reduce risk in relation to smoking and blood pressure.^{5–9} However, there is no evidence that multifactorial screening and health promotion in general practice will reduce total cardiovascular risk.¹⁰

The British family heart study is a randomized control trial of nurse-led cardiovascular risk factor screening and lifestyle intervention in men and their partners in 26 general practices in 13 towns in England, Wales and Scotland which is quantifying the extent of cardiovascular risk factor reduction that may be obtained in one year by such a practice based strategy. This paper describes the prevalence of cardiovascular risk factors in men and women from the baseline screening results in the 13 intervention practices.

Method

Study towns

Fifteen towns were selected, 11 in England, two in Wales and two in Scotland which met the following criteria: population of between 50 000 and 100 000 at the 1981 census; separate from major conurbations; no recent large housing development; elderly population no greater than the national average; comparable in employment type, social class distribution and ethnic structure; and with at least one district general hospital. A pilot study was conducted in Portsmouth which has a larger population. In Wales and Scotland only towns with smaller populations were available. Thirteen towns were eventually used in the study: Bridgend, Burton upon Trent, Bury, Carlisle, Darlington, Dunfermline, Gloucester, Huddersfield, Ipswich, Lincoln, Newport, Poole and Portsmouth.

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Selection and randomization of practices

With the assistance of the family health services authorities and Fife Health Board in Scotland, general practices with four to seven full-time partners (or whole time equivalents) were surveyed. Practices expressing an interest in the study were visited by the medical and nurse coordinators (G D and J Y) and a pair of general practices was selected which met the following criteria: practice teams willing to be randomized to the intervention or comparison groups in the study; space for the screening clinics; similar list sizes and structures, including level of deprivation according to the Jarman index,¹¹ and proportion of male/female and elderly patients; and where the level of screening currently being undertaken was similar. Each practice pair that agreed to participate was then randomly allocated to either intervention or control and enrolled in the study. Fourteen pairs of general practices were recruited and randomized, of which 13 pairs were able to meet the protocol requirements.

Nurse recruitment and training

In consultation with each practice team research nurses were recruited locally and trained at the National Heart and Lung Institute, London in conducting questionnaire interviews using a laptop computer, in risk factor measurements and their quality assurance and follow up, and client centred lifestyle counselling.

Selection of men and their families

All men aged 40–59 years in each intervention and comparison practice were randomly ordered at the same time within five year age groups, and within each age group their households were approached in order. Within each intervention practice, the list of men was randomly divided into two groups: intervention and an internal comparison group.

Family health check

The health checks were carried out at the practice. The nurse made an appointment for a family by telephone and confirmed it in writing. When an appointment was not kept, one further appointment was offered. Families not contacted by telephone received up to two postal invitations addressed to the man. If a man and his partner declined to be screened they were not approached again.

The first appointment with the nurse, for the man and his partner, was for one and a half hours. The interview was conducted using a programmed questionnaire on a portable personal computer to record demographic details, past medical history, family history and smoking habit. Lifetime exposure to cigarette smoking was quantified as the number of pack-years' experience, calculated by multiplying together the reported number of years smoking cigarettes and the reported number of cigarettes per day, divided by 20. Knowledge of risk factors and perceived health were also recorded but are not reported here. The following measurements were made: height and weight (Seca digital model 707[®] with telescopic measuring rod) from which body mass index (weight (kg)/height (m)²) was calculated, waist and hip using a standard measuring tape, with the subject lightly clothed (in order to calculate waist/hip ratio), breath carbon monoxide (Smokerlyzer[®]), blood pressure (Takeda UA731[®] automatic digital sphygmomanometer), and random total blood cholesterol and glucose levels on a capillary blood sample (Reflotron[®], Boehringer Mannheim UK). In six practices cholesterol level was only measured on a random three quarters of families, as a sub-study to evaluate the impact of cholesterol level testing.

A coronary risk score was calculated¹² using a modification of a score from the British regional heart study¹³ and the man or woman was given his or her decile of risk of coronary heart dis-

ease relative to other men or women of the same age. Those who reported a history of coronary heart disease (angina, myocardial infarction or previous coronary artery surgery) were placed in the top decile of risk. The frequency of follow-up care was determined by coronary risk score and individual risk factors: current cigarette smokers, body mass index 25+, diastolic blood pressure 90+ mmHg, cholesterol level 6.5+ mmol l⁻¹ and random glucose level 7.0+ mmol l⁻¹. Follow-up care will be reported elsewhere.

Quality of data was assured by a series of routine checks of nurse records by J Y, by a weekly review of computer discs (Y K), and by routine data monitoring (S P). For cholesterol and glucose measurements quality assurance was organized by the Wolfson Research Laboratories (C Le G and R C). Internal quality assurance was checked by the distribution of four specimens of human serum (with values assigned by a reference method) which were measured by the nurses on the Reflotron at weekly intervals. Duplicate measurements of blood samples taken from subjects were used to assess duplicate precision. These processes revealed that one intervention practice nurse from one of the 14 towns originally included in the study had departed from a number of protocol requirements. Data in this report are thus based on 13 intervention practices.

Analysis

For the purposes of reporting history prior to screening, the following groups were separated: all those with pre-existing coronary heart disease; all those without a history of coronary heart disease but with reported high blood pressure, high blood cholesterol level or diabetes; and all those without a history of coronary heart disease, reported high blood pressure, reported high blood cholesterol level or reported diabetes. Tests for trends of continuously measured cardiovascular risk factors according to age were by regression analysis. The distribution of blood glucose levels was skewed and so medians rather than means are reported. Cholesterol level measurements were not available for 414 individuals randomly allocated to receive no advice or measurement of cholesterol level at screening. In addition, there were three missing cholesterol values and six missing glucose values owing to temporary equipment failure.

Results

Of the 4158 families invited, 2373 (57.1%) were represented at the screening visit by one or more members; 868 were represented by one family member, 1480 by two members and 25 by more than two members. In all, 3850 individuals were recruited for screening and intervention (2246 men and 1604 women). The distribution of ages is shown in Table 1. In 1477 of the represented families (62.2%) both the selected man and his female partner attended and 1443 (97.7%) of these couples were married. Of the remainder, 769 families were represented by the selected man without a female partner while 127 were represented by a female partner without the selected man. A small

Table 1. Age and sex distribution of the individuals screened.

Age (years)	Number of	
	Men	Women
<40	0	174
40–44	487	376
45–49	574	407
50–54	582	361
55–59	582	241
60+	21	45
Total	2246	1604

number of families were also joined by other family members, usually children. These children were not included in the study. Among the 2174 households containing at least two people, the proportion represented by two or more individuals at the screening was 69.2%. In the 2054 cases where the family contained a male and female partner, the proportion represented by both partners was 71.9%.

The distribution of coronary heart disease risk by predetermined quintiles in men and women is shown in Table 2, excluding the 140 men and 45 women with pre-existing coronary heart disease or reported chest pain on exercise. Approximately similar proportions of men and women fell into each quintile.

The prevalence of cardiovascular risk factors in healthy men and women, in those with coronary heart disease, and those without coronary heart disease but with reported high blood pressure, reported high blood cholesterol level or reported diabetes are shown in Table 3. The risk factor distribution in all men and all women is shown in Table 4.

Smoking status

Overall 66.9% of the 2246 men and 45.7% of the 1604 women reported smoking at some time in their lives, although the proportion of current cigarette smokers was similar among men and women (24.3% and 22.2%, respectively). The proportion of women in each of the categories of smoking changed little with age. In men, however, the proportion of ex-smokers increased from 30.5% among the 1061 40–49 year olds to 35.6% among the 1185 50–59 year olds. Lifetime exposure to cigarette smoking was greater among men than women. Among current cigarette smokers, mean exposure among the 285 men aged 50 years

Table 2. Distribution of British family heart study risk scores in men and women without previously diagnosed coronary heart disease or self-reported chest pain on exercise.^a

Quintile	% of	
	Men (n = 1869)	Women (n = 1379)
1	16.8	21.6
2	21.6	23.5
3	23.8	24.0
4	21.9	16.3
5	15.9	14.6

n = number of patients in group. 1 = low risk quintile, 5 = high risk quintile. ^aData not available for 417 individuals.

and over was 33.4 (standard deviation (SD) 21.1) pack-years while among the 146 women of the same age mean exposure was 23.7 (SD 14.8) pack-years. The corresponding figures for ex-cigarette smokers aged 50 years and over was 23.2 (SD 20.7) pack-years for the 422 men and 16.4 (SD 21.5) pack-years for the 153 women. Reported smoking habit was verified by breath carbon monoxide measurement. Carbon monoxide was 10 parts per million or more in nine of the 1614 reported life-long non-smokers (0.6%) and 23 of the 1121 reported ex-cigarette smokers (2.1%) compared with 722 of the 901 current cigarette smokers (80.1%).

Anthropometry

Mean body mass index in men was significantly greater than in

Table 3. Risk factor distributions in men and women with no disease and with coronary heart disease, and in men and women without coronary heart disease but with reported high blood pressure, with reported high blood cholesterol level and with reported diabetes.

	% of men					% of women				
	No disease (n = 1716)	CHD (n = 114)	High BP (n = 280)	High cholesterol (n = 150)	Diabetes (n = 40)	No disease (n = 1321)	CHD (n = 25)	High BP (n = 211)	High cholesterol (n = 53)	Diabetes (n = 12)
Smoking status										
Never smoked	35.0	15.8	31.4	31.3	15.0	54.5	52.0	56.9	45.3	50.0
Current smoker ^a	25.1	28.1	21.1	22.7	7.5	22.0	20.0	21.3	32.1	8.3
Ex-smoker ^a	30.9	50.0	35.4	36.7	60.0	23.3	28.0	21.8	22.6	41.7
Other ^b	9.0	6.1	12.1	9.3	17.5	0.2	0	0	0	0
Body mass index										
<20	2.8	0.9	0.4	0.7	0	5.1	0	2.4	1.9	0
20–24	37.6	31.6	25.0	28.7	27.5	53.6	28.0	37.9	50.9	66.7
25–29	48.5	48.2	53.2	57.3	45.0	30.5	40.0	32.7	30.2	8.3
30–34	10.2	15.8	16.8	10.7	10.0	8.4	24.0	20.9	9.4	16.7
35+	0.9	3.5	4.6	2.7	17.5	2.4	8.0	6.2	7.5	8.3
Diastolic blood pressure (mmHg)										
<90	66.6	61.4	30.7	58.7	65.0	82.5	56.0	43.1	77.4	83.3
90–99	22.8	27.2	38.9	27.3	12.5	13.4	28.0	35.5	13.2	16.7
100+	10.6	11.4	30.4	14.0	22.5	4.1	16.0	21.3	9.4	0
Cholesterol level (mmol l⁻¹)^f										
<5.20	37.4	21.4	34.1	9.5	47.2	46.2	29.4	29.3	10.6	36.4
5.20–6.49	43.3	48.5	39.2	34.9	27.8	38.2	47.1	42.6	38.3	36.4
6.50–7.99	16.4	26.2	23.1	49.2	22.2	13.9	23.5	22.3	42.6	27.3
8.0+	3.0	3.9	3.5	6.3	2.8	1.7	0	5.9	8.5	0
Glucose level (mmol l⁻¹)^d										
<7.0	89.8	79.8	84.3	93.3	32.5	94.8	84.0	92.4	90.6	33.3
7.0–9.99	9.6	12.3	9.3	5.3	15.0	5.0	16.0	7.1	7.5	16.7
10.0+	0.6	7.9	6.4	1.3	52.5	0.2	0	0.5	1.9	50.0

n = number of patients in group. CHD = coronary heart disease. BP = blood pressure. ^aOf cigarettes. ^bCurrent or ex-smoker of other tobacco products. ^cData available for 1534 men (1176 women) with no disease, 103 (17) with coronary heart disease, 255 (188) with reported high blood pressure, 126 (47) with reported high cholesterol level and 36 (11) with reported diabetes. ^dData available for 1712 men and 1319 women with no disease.

Table 4. Risk factor distributions in all men and all women.

	% of	
	Men (n = 2246)	Women (n = 1604)
<i>Smoking status</i>		
Never smoked	33.1	54.3
Current smoker ^a	24.3	22.2
Ex-smoker ^a	33.2	23.4
Other ^b	9.4	0.1
<i>Body mass index</i>		
<20	2.3	4.6
20–24	35.5	51.3
25–29	49.4	30.8
30–34	11.2	10.2
35+	1.7	3.2
<i>Diastolic blood pressure (mmHg)</i>		
<90	62.1	77.2
90–99	24.8	16.4
100+	13.2	6.4
<i>Cholesterol level (mmol l⁻¹)^c</i>		
<5.20	34.8	42.7
5.20–6.49	42.9	39.0
6.50–7.99	19.0	15.9
8.0+	3.3	2.3
<i>Glucose level (mmol l⁻¹)^d</i>		
<7.0	88.1	93.8
7.0–9.99	9.6	5.6
10.0+	2.3	0.6

n = number of patients in group. ^aof cigarettes. ^bCurrent or ex-smoker of other tobacco products. ^cData available for 2009 men and 1424 women. ^dData available for 2242 men and 1602 women.

women and there was a positive trend with age. Overall, mean body mass index was 25.7 in men aged 40–44 years and 26.6 in men aged 55–59 years. The corresponding means in women were 24.6 and 25.9, respectively.

It was found that 62.2% of men and 44.1% of women were overweight (body mass index 25+). A higher proportion of men (49.4%) than women (30.8%) had a body mass index of between 25 and 29 and conversely, a higher proportion of women (51.3%) than men (35.5%) had a body mass index of between 20 and 24. Over 80% of men and women had a body mass index between 20 and 29.

Waist: hip ratio (a measure of central adiposity) increased with age. Mean waist: hip ratio in men aged 40–44 years was 0.89 and in men aged 55–59 years was 0.92, while in women aged 40–44 years the mean was 0.77 increasing to 0.79 for women aged 55–59 years. The middle third of the distribution of waist: hip ratio in men was in the range 0.89 to 0.93 while for women the corresponding range was 0.75 to 0.79. Waist: hip ratio was strongly correlated with body mass index ($r = 0.58$ for men; $r = 0.42$ for women): 86.3% of 51 men with a body mass index of less than 20 were in the bottom tertile of the waist: hip distribution, while 92.1% of 38 men with a body mass index of 35+ were in the top tertile. In women, the corresponding figures were 54.8% of 73 and 76.5% of 51, respectively.

Blood pressure

Mean diastolic blood pressure was higher in men than women and increased with age in both men and women. Mean diastolic blood pressure was 85.2 mmHg in men aged 40–44 years and

88.1 mmHg in men aged 55–59 years; the corresponding figures for women were 80.3 mmHg and 83.8 mmHg, respectively.

Diastolic hypertension (90+ mmHg), as measured on recruitment, was found in 37.9% of men and 22.8% of women. Twice as many men (13.2%) as women (6.4%) had a diastolic blood pressure of 100 mmHg or more. The proportion with diastolic blood pressure of 90 mmHg or more was correspondingly higher among those aged 50 years and over (41.1% in men, 30.9% in women) than those aged 40–49 years (34.4% in men, 18.1% in women).

Systolic hypertension (160+ mmHg) was found in 314 men (14.0%) and 132 women (8.2%), and of these, 50 men (15.9%) and 26 women (19.7%) had a diastolic blood pressure of 90+ mmHg. Conversely, among those with diastolic hypertension, 588 men (69.0%) and 260 women (71.0%) had a systolic blood pressure of less than 160 mmHg. Of the 1398 men and 708 women who had a body mass index of 25+, 43.1% of men and 31.9% of women also had diastolic hypertension. In all, 103 men (4.6%) and 90 women (5.6%) were using antihypertensive drugs.

Blood cholesterol level

Among men, mean cholesterol level increased slightly with age from 5.5 mmol l⁻¹ in those aged 40–44 years to 5.8 mmol l⁻¹ in those aged 55–59 years. Among women, a positive trend with age was observed, with mean values of 5.0 mmol l⁻¹ among those aged 40–44 years and 6.1 mmol l⁻¹ among those aged 55–59 years.

The proportion of men with hypercholesterolaemia (cholesterol 6.5+ mmol l⁻¹) was 22.3% while in women the proportion was 18.3%; 3.3% of men and 2.3% of women had a cholesterol level of 8.0 mmol l⁻¹ or higher. A total of 128 men (28.6%) and 81 women (31.2%) with a cholesterol level of 6.5+ mmol l⁻¹ had a family history of coronary heart disease in a first degree relative aged less than 65 years. Of the 1246 men and 620 women who had their cholesterol level measured and who also had a body mass index of 25+, 330 men (26.5%) and 152 women (24.5%) also had a cholesterol level of 6.5+ mmol l⁻¹. Eight men (0.4%) and four women (0.2%) were using cholesterol lowering drugs.

Blood glucose level

Median glucose levels were slightly higher in men than in women, and increased with age. Among men, the median glucose level was 5.3 mmol l⁻¹ in those aged 40–44 years and 5.5 mmol l⁻¹ in those aged 55–59 years. In women aged 40–44 years, the median was 5.3 mmol l⁻¹ while in those aged 55–59 years the median was 5.4 mmol l⁻¹.

The proportion with hyperglycaemia (glucose level of 7.0+ mmol l⁻¹) was greater in men (11.9%) than women (6.2%). Among all subjects without previously diagnosed diabetes and with their glucose level measured, four out of 1565 women (0.3%) and 21 out of 2088 men (1.0%) had a random glucose level of 10.0+ mmol l⁻¹. Among those with diagnosed diabetes, but without pre-existing coronary heart disease, 21 men (52.5%) and six women (50.0%) had a glucose level of 10.0+ mmol l⁻¹. Of the 1396 men and 708 women who had their glucose level measured and who had a body mass index of 25+ 192 men (13.8%) and 38 women (5.4%) also had a glucose level of 7.0+ mmol l⁻¹. Nineteen men (0.8%) and nine women (0.6%) were using diabetic drugs (oral diabetic drugs or insulin).

Coronary heart disease

Overall, 114 men (5.1%) and 25 women (1.6%) reported a previous diagnosis of coronary heart disease. Eighty six men and 22

women reported angina, 75 men and four women reported myocardial infarction and 17 men and two women had had coronary artery bypass grafting.

Of the 139 people with coronary heart disease, 119 (85.6%) had modifiable risk factors. Thirty two men and five women with coronary heart disease were current cigarette smokers; 77 men and 18 women had a body mass index of 25+, 44 men and 11 women had a diastolic blood pressure of 90+ mmHg, 31 men and four women had a cholesterol level of 6.5+ mmol l⁻¹, and 23 men and four women had a glucose level of 7.0+ mmol l⁻¹.

High blood pressure, high cholesterol level and diabetes

A previous report of high blood pressure, high cholesterol level and/or diabetes, without coronary heart disease was made by 416 men (18.5%) and 258 women (16.1%). Among this group, 65.6% had a body mass index of 25+, 53.3% had a diastolic blood pressure of 90+ mmHg, 31.8% (of those with cholesterol measured) had a cholesterol level of 6.5+ mmol l⁻¹, 14.2% had a glucose level of 7.0+ mmol l⁻¹ and 21.2% were current cigarette smokers. Among the 491 men and women who reported high blood pressure 68.2% had a body mass index of 25+, 64.0% had a diastolic blood pressure of 90+ mmHg, 27.3% (of those with cholesterol measured) had a cholesterol level of 6.5+ mmol l⁻¹, 12.2% had a glucose level of 7.0+ mmol l⁻¹ and 21.2% were current cigarette smokers. Among the 203 men and women who reported a high cholesterol level 64.5% had a body mass index of 25+, 36.5% had a diastolic blood pressure of 90+ mmHg, 54.3% (of those with cholesterol measured) had a cholesterol level of 6.5+ mmol l⁻¹, 7.4% had a glucose level of 7.0+ mmol l⁻¹ and 25.1% were current cigarette smokers. Among the 52 men and women with reported diabetes 63.5% had a body mass index of 25+, 30.8% had a diastolic blood pressure of 90+ mmHg, 25.5% (of those with cholesterol measured) had a cholesterol level of 6.5+ mmol l⁻¹, 67.3% had glucose level of 7.0+ mmol l⁻¹ and 7.7% were current cigarette smokers.

In all, 24.4% of those with reported high blood pressure were taking antihypertensive medication, 3.9% of those with a high cholesterol level were taking cholesterol lowering drugs and 50.0% of those with diabetes were taking diabetic drugs at the time of screening. A further 16 men and women with prevalent coronary heart disease were taking antihypertensive drugs, as were 57 patients not previously reported as having high blood pressure. Similarly, cholesterol lowering drugs were being used by a further three men and women with prevalent coronary heart disease and one person not previously reported as having a high cholesterol level. Finally, diabetic drugs were also being used by two people with prevalent coronary heart disease.

Follow up

A total of 1909 men (85.0%) and 1125 women (70.1%) qualified for follow up of one or more risk factors, 78.8% of the sample overall.

Discussion

While the potential for prevention in primary care is widely recognized, and general practitioners now have a contractual requirement to offer preventive services, the impact of this approach on the burden of cardiovascular risk in the population remains unquantified.¹⁴ The British family heart study is addressing this important subject by testing in a randomized control trial the extent to which nurse-led screening, followed by risk related lifestyle intervention in families, and medical treatment by the general practitioner where appropriate, can reduce the risk factors related to cardiovascular disease.

The study uses an intensive nurse-led screening and intervention model⁴ and an innovative approach through screening families, rather than individual patients, because it seems more likely that lifestyle changes in relation to smoking habit, eating and exercise will occur if the whole household is involved. Invitations for a health check were made, wherever possible, by a personal telephone call from the nurse, as the pilot study had found a higher response rate to this method of invitation compared with a letter. The overall household response rate was 57% but this is an underestimate because a proportion of non-respondents are 'ghosts' on the practice lists as a result of death or people moving away. A survey of these non-respondents in selected practices, which is to be reported separately, suggests the true response rate is 73%. The Oxcheck trial of cardiovascular screening in five general practices reported a response rate of 66%; of the 80% who responded to an initial postal questionnaire, 82% attended for screening.¹⁵ The results of the present study show the majority of couples will attend together if invited, and this should increase the chances of family lifestyle changes in these households.

As expected from other studies in general practice, the prevalence of cardiovascular risk factors which could be modified was high in both men and women. The prevalence of cigarette smoking among men (24%) and women (22%) found in this study was similar to that in the Oxcheck trial,¹⁵ and fairly similar to other national household surveys, including the health and lifestyle survey,¹⁶ the dietary and nutritional survey of British adults,¹⁷ and the government's own estimates of 31% and 28%, respectively.¹

Prevalence estimates may be affected by the measurement methods used. In the present study there were between two and three times as many cases of hypertension (diastolic blood pressure 90+ mmHg) as in the Oxcheck study. An automatic digital sphygmomanometer was chosen to eliminate the problem of intra- and inter-observer variability, whereas in the Oxcheck study the random zero sphygmomanometer was used. The latter instrument may underestimate diastolic blood pressure compared with a standard mercury model and this measurement bias could explain the difference in prevalence of hypertension between the two studies.¹⁸ Conversely, compared with Oxcheck the present study found only half the number of cases of hypercholesterolaemia (cholesterol 6.5+ mmol l⁻¹) and even fewer of those with a cholesterol level of 8+ mmol l⁻¹. In the present study dry chemistry was used to estimate cholesterol level, which allowed the nurse to provide all screening results at one visit, whereas in the Oxcheck study, a conventional enzymatic laboratory method was used. The Reflotron will estimate cholesterol levels about 0.3 mmol l⁻¹ lower than wet chemistry and this could explain the difference (Cramb R, personal communication). Risk factor measurement methods and their quality assurance have important implications, not only for estimating prevalence but for the identification and treatment of individuals at high risk.

The prevalence of risk factors among those reporting high blood pressure, high cholesterol level or diabetes was substantial. About one fifth of these high risk patients were currently smoking cigarettes and nearly two thirds had a body mass index of 25+. Control of risk factors in those reported to be at high risk was unsatisfactory in approximately half of these patients and this is consistent with other studies of hypertension and diabetes, all of which demonstrate the difficulties of systematic follow up in primary care. In those for whom a blood pressure measurement is recorded in general practice, follow up and management can be haphazard.^{5,7} In a three year follow up of patients with raised blood pressure identified at health checks in three general practices in Oxfordshire, the proportion of patients with a diastolic blood pressure of 100+ mmHg was only halved.⁹ In a ran-

domized control trial of routine general practice care versus hospital care for non-insulin dependent diabetic patients fewer patients in the group being cared for by their general practitioner were regularly reviewed or had regular estimates of blood glucose concentration.¹⁹ Among those who had developed overt coronary heart disease there were still modifiable risk factors — cigarette smoking, obesity, hypertension, high cholesterol and glucose levels — which are known to increase the chances of a further cardiac event as well as decrease long term survival.²⁰ While it will not be possible to encourage all patients to stop smoking and become lean and fit, as some will simply not wish to change their way of life, there is still considerable potential for improvement among these high risk groups, as well as the population at large.

Women in this study were recruited through their partners and are therefore not a true random population sample, as single women were excluded, but estimates of risk factor prevalence are applicable to the majority of women in the age range studied. While women are at lower risk compared with men, cardiovascular disease is still the commonest cause of premature death among women, and smoking, high blood pressure and high cholesterol levels are the major known modifiable risk factors.²¹ Women have been largely ignored in preventive strategies and, in particular, all the major prevention trials have been carried out among men. Although the potential benefit of lifestyle changes and associated risk factor modification has not been quantified in women it seems appropriate to encourage them to stop smoking and modify their diet in order to lose weight and reduce blood pressure and cholesterol level. The inclusion of women in this family based study is particularly important as women still hold the main responsibility, in most families, for shopping and cooking. They are therefore in a powerful position to influence the dietary habits of the whole family.²²

In describing the prevalence of risk factors in men and women screened in general practice, this study has defined the size of the challenge the government is setting primary care in the prevention of coronary heart disease and stroke through general medical services and health promotion. Whether cardiovascular screening and health promotion in this setting are actually producing any favourable change in risk factors is not known. The British family heart study aims to provide an estimate of the contribution to the health of the nation of a nurse-led screening and intervention programme in general practice.

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