Prevalence of risk factors for heart disease in OXCHECK trial: implications for screening in primary care

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BMJ 1991;302:1057-60

Abstract

***Objective*—To describe the outcome of offering health checks systematically to a general practice adult population, in terms of age and sex specific prevalence of risk factors, follow up workload, and selective screening of cholesterol concentration.**

***Design*—Descriptive analysis of data obtained by postal questionnaire and by personal interview and clinical examination by a trained nurse.**

***Subjects*—2205 patients aged 35-64 who attended for a health check in 1989-90 from an invited random sample of 2777 patients from five urban general practices in Bedfordshire.**

***Results*—Overall, almost three quarters of patients (78% of men, 68% of women) needed specific advice or follow up. Smoking, a high fat diet, and being overweight (body mass index ≥25 kg/m²) were common characteristics exhibited by 35%, 31%, and 55% respectively of men and 24%, 18%, and 48% of women. The total cholesterol concentration was ≥6·5 mmol/l in 37% of patients and ≥8 mmol/l in 8%. In terms of workload 13% needed dietary advice only, 15% needed only follow up of hyperlipidaemia or hypertension, and 9% needed advice on smoking only. A further 35% needed follow up for a combination of risk factors. The proportion of patients in whom cholesterol concentration would be measured if a selective screening policy were adopted would vary from 29% to 71%, according to different criteria, but (particularly in men) no combination would be much better than random testing as a means to detect patients with a total cholesterol concentration ≥8 mmol/l.**

***Conclusions*—If the entire adult population of a practice is offered health checks systematically the acceptance rate is lower and the follow up workload higher than previously understood. The resource implications depend on the age and sex of patients screened and the selective criteria adopted for cholesterol measurement. Health checks are only the beginning of a successful preventive programme—the challenge is to provide effective intervention and follow up.**

Introduction

The provision of health checks for the entire adult population was promoted to general practitioners as a "low cost, low technology" exercise.[1] This is true in terms of the marginal cost to the practice of the initial screening but is otherwise misleading. Effective intervention can seldom be provided within the health check itself and requires follow up—patients with hypertension or hypercholesterolaemia (total cholesterol concentration ≥6·5 mmol/l) require further clinical measurements[2]; advice on how to stop smoking given by nurses on a single occasion is probably ineffective[3]; and change of diet depends on sustained encouragement and advice over time.[4] Although these observations may seem obvious, the evidence suggests that they have not been well understood by those planning or undertaking health checks. In practice, follow up has been incomplete,[5] surprise has been expressed at the work involved,[6] practice staff are ill prepared to deal with patients identified as at risk,[7] and the marked differences in morbidity and risk of disease between men and women and between people in different age groups are often ignored.[8]

One reason for this lack of understanding may be the lack of accessible published information on the outcome of screening, particularly on the age specific prevalence of risk that is likely to be found in a systematically screened general practice population. The major British cohort studies have been restricted to middle aged men, and although data on both men and women are available from the initial screening phase of the Medical Research Council mild hypertension trial,[9] this took place more than 10 years ago. Several general practice based studies have been reported but most are unhelpful because the methodology was inadequate, or the recruitment was not population based, or the results published were incomplete.[10-13] Two general practice based studies which provide reliable data on prevalence of risk factors are the national lipid screening study[14] and the Scottish MONICA/heart health projects.[15] However, recruitment to the national lipid screening study was in part opportunistic, participation in the Scottish projects was not high, and age specific data on prevalence in Scotland of risk factors other than cholesterol concentration are difficult to find. The latest Office of Population Censuses and Surveys dietary and nutrition survey also provides data on cholesterol concentration, diet, body mass, blood pressure, and smoking but used a household based sampling frame (response rate 70-76%).[16]

The OXCHECK (Oxford and collaborators health check) randomised controlled trial was begun in 1989 to assess whether health checks by nurses[17] are effective in helping patients to reduce their risk of heart disease, cancer, and stroke. The study population comprises the entire middle aged (35-64 years) population of each of five practices. Each patient randomised has been or will be offered a health check during one of four randomly allocated 12 month periods between 1989 and 1993. We report age and sex specific prevalence for various factors that are important for formulating screening policy and for assessing workload for the 2205 patients who received health checks during the first year of the study. As a major resource implication for the NHS arises from the measurement of cholesterol concentration and the policy recommendations on measuring cholesterol are varied and contentious,[18] the implications of various selective criteria for cholesterol screening are also described.

Methods

Recruitment—The trial is based in five general practices in Luton and Dunstable, Bedfordshire. In late 1988 a computerised list of the names and addresses of all registered patients from these practices aged 35-64 on 1 January 1989 was obtained from the family practitioner committee. A questionnaire was sent to all 17 965 registered patients to ascertain their residence at the given address and to document various baseline characteristics such as social class and smoking habits. A small number (338) were subsequently excluded because they were not considered eligible for a health check. After three mailings 11 090 patients had responded and 2327 were known to have moved or died, giving a response rate of 72·5% (531 patients refused to complete a questionnaire). Of the 3679 non-responders, 3501 lived within the boundaries of the Luton and Dunstable electoral district and were sought on the electoral roll. The address to which the questionnaire had been sent was identified in 98·7% of cases, but the patient to whom the questionnaire had been sent was not listed as an occupant in 1483 cases. When these patients are excluded from the denominator the estimated response rate is 80·3%. All 11 090 patients returning the questionnaire were randomised (by household) to be offered a health check at some time during the four year study period. In all, 2776 patients were randomised to the first year; 91 of these had moved away and 11 had died. Of the remaining 2674 patients, 2205 (82%) accepted the invitation. The likelihood of a patient accepting the invitation was related to several variables recorded in the initial questionnaire, including social class and smoking habit, and these relations will be presented in detail in a future publication.

Questionnaire—The questionnaire covered various aspects of lifestyle (including smoking habits and diet), social status, and attitudes to health. It also contained the World Health Organisation chest pain questionnaire, which is designed to record symptoms suggestive of ischaemic heart disease and intermittent claudication.[19]

Health check—At the health check details of personal and family history of ischaemic heart disease, stroke, hypertension, diabetes, and cancer were recorded and a history of smoking habits was taken. Dietary intake was measured by using a food frequency chart which covered the major sources of fat and fibre in the British diet and was completed by the nurse during the health check. A score based on the frequency of consumption of foods in 11 food groups (which contribute 75% of the total fat in the average British diet according to the National Food Survey) was used to assign people to low, medium, or high total fat consumption categories.[20] A high fat score corresponded to an estimated intake of >110 g/day. A polyunsaturated fat score based on the type of spread, frying fat, and cooking or baking fat used was also derived to provide an index of the quality of the fat consumed. Measurement of height and weight (with Seca scales calibrated every three months) and blood pressure (with a Hawksley random zero sphygmomanometer) was according to standard protocols, and body mass index (kg/m^2) was calculated. Cholesterol concentration was measured in serum samples by using the cholesterol oxidase/peroxidase-aminopyrine method with an Olympus AU5000 autoanalyser at the Luton and Dunstable Hospital, which subscribes to the Wellcome quality control scheme and the United Kingdom External Quality Assurance Scheme.

Analysis—Data were manipulated by using the dBASE III Plus software and analysed by the statistical package for the social sciences (SPSS-X) on the university's VAX computer cluster. Confidence intervals are based on the standard error of a proportion. The linear trend with age for the prevalence of each risk factor (see table I) was tested by using the χ^2 test for linear trend.

Results

Table I gives the prevalence of the main indicators of cardiovascular risk. The picture is depressing for preventive medicine. In all, 35% of men were current smokers, 31% had a high fat diet, and 55% were overweight or obese. The corresponding figures for women were 24%, 18%, and 48%. More than a third of patients (37%) had a total cholesterol concentration ≥6·5 mmol/l, and 8% had a concentration of ≥8 mmol/l. More than a quarter of patients (27%) in the 55-64 age group already had a diagnosis of ischaemic heart disease, hypertension, or diabetes, and 12% reported chest pain suggestive of angina or previous infarct.

As expected, prevalence was strongly related to age and gender: the outcome of screening in men and

TABLE I—*Percentage prevalence (number of patients) of risk factors for cardiovascular disease in 2205 patients attending for health check in 1989-1990, according to gender and age group*

	Men						Women					
	35-44 (n=320)	45-54 (n=332)	55-64 (n=335)	p Value*	Mean prevalence	95% Confidence interval	35-44 (n=414)	45-54 (n=424)	55-64 (n=380)	p Value*	Mean prevalence	95% Confidence interval
Personal history:												
Hypertension, diabetes, or ischaemic heart disease	3 (11)	12 (39)	25 (85)	0·00	14	11 to 17	6 (24)	11 (47)	29 (111)	0·00	15	13 to 17
Current smoker	37 (119)	34 (114)	32 (108)	0·18	35	32 to 38	28 (114)	23 (98)	20 (76)	0·01	24	21 to 26
Chest pain†	8 (25)	8 (25)	14 (47)	0·01	10	8 to 12	5 (21)	9 (36)	10 (38)	0·01	8	6 to 9
Family history:												
Ischaemic heart disease in first degree relative aged <50	8 (27)	6 (21)	4 (12)	0·01	6	5 to 7	11 (45)	8 (33)	6 (21)	0·01	8	7 to 10
Ischaemic heart disease in first degree relative aged 50-59	12 (37)	11 (36)	10 (33)	0·48	11	9 to 13	9 (37)	10 (41)	12 (45)	0·18	10	8 to 12
Dietary fat:												
Low polyunsaturated fat	11 (35)	12 (39)	17 (56)	0·03	13	11 to 15	8 (35)	11 (46)	16 (62)	0·00	12	10 to 13
High total fat	31 (100)	30 (98)	33 (109)	0·71	31	28 to 34	19 (80)	15 (62)	21 (81)	0·51	18	16 to 20
Clinical measurements:												
Total cholesterol (mmol/l)‡												
≥8·0	5 (17)	6 (21)	12 (38)	0·00	8	6 to 10	2 (7)	5 (21)	16 (61)	0·00	8	6 to 9
6·5-7·9	28 (87)	30 (99)	33 (107)	0·17	30	27 to 32	12 (50)	28 (116)	46 (173)	0·00	29	26 to 31
Diastolic blood pressure (mm Hg)‡												
≥100	1 (4)	3 (9)	4 (13)	0·04	3	2 to 4	<1 (1)	3 (12)	3 (11)	0·01	2	1 to 3
90-99	7 (21)	15 (50)	12 (39)	0·04	11	9 to 13	4 (18)	7 (31)	10 (38)	0·00	7	6 to 8
Body mass index (kg/m^2)‡												
≥30	8 (26)	9 (31)	13 (41)	0·06	10	8 to 12	11 (46)	16 (68)	21 (78)	0·00	16	14 to 18
25-29·9	39 (127)	49 (161)	47 (159)	0·05	45	42 to 48	24 (101)	35 (147)	37 (143)	0·00	32	29 to 35

*χ^2 test for linear trend, df=1. †WHO questionnaire response indicating angina or infarction. ‡Cholesterol concentration not available for 46 patients, blood pressure missing for two patients, body mass index missing for three patients.

TABLE II—*Percentage (number) of patients requiring follow up or advice for specific identified risk factors, according to gender and age group*

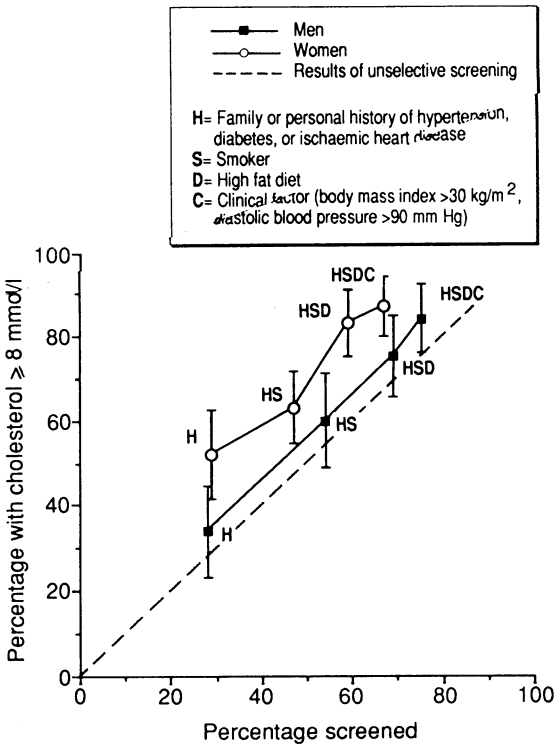
	Men					Women				
	35-44 (n=320)	45-54 (n=332)	55-64 (n=335)	Mean % of patients	95% Confidence interval	35-44 (n=414)	45-54 (n=424)	55-64 (n=380)	Mean % of patients	95% Confidence interval
Smoking advice only	12·8 (41)	11·4 (38)	6·3 (21)	10·1	8·2 to 12·0	11·6 (48)	10·1 (43)	2·6 (10)	8·3	6·8 to 9·8
Dietary advice only*	16·6 (53)	11·4 (38)	11·6 (39)	13·2	12·0 to 14·4	16·2 (67)	16·3 (69)	8·4 (32)	13·8	11·9 to 15·7
Management of hypertension only†	0·6 (2)	5·1 (17)	5·1 (17)	3·6	2·4 to 4·8	1·9 (8)	3·5 (15)	2·9 (11)	2·8	1·8 to 3·8
Management of hyperlipidaemia only‡	10·0 (31)	11·7 (39)	12·8 (43)	11·6	9·6 to 13·6	4·8 (20)	13·4 (57)	21·1 (80)	12·9	11·1 to 14·7
More than one of above	33·8 (109)	39·1 (130)	46·6 (156)	39·9	36·8 to 43·0	20·8 (86)	25·2 (107)	46·8 (178)	30·5	27·9 to 33·1
More than two of above	9·4 (30)	12·0 (40)	15·2 (51)	12·3	10·3 to 14·3	2·9 (12)	6·1 (26)	14·5 (55)	7·6	6·1 to 9·1

*For obesity (body mass index ≥30 kg/m^2) or high total fat, or low polyunsaturated fat diet; body mass index missing for three patients.
†Diastolic blood pressure ≥90 mm Hg or systolic blood pressure ≥160 mm Hg; missing for two patients.
‡Total cholesterol ≥6·5 mmol/l; cholesterol concentration not available for 46 patients.

women and in different age groups was considerably different. Older patients were more likely to report a diagnosis of diabetes, hypertension, or ischaemic heart disease and to have a positive result on the chest pain questionnaire. A total cholesterol concentration of ≥8 mmol/l, a low polyunsaturated fat score, and a high total fat score were also more common in the older age groups. The reported prevalence of smoking was lower in women and declined slightly with age in both men and women. The higher total fat score in men does not mean necessarily that a higher proportion of their energy intake is derived from fat than in women—the food frequency chart used covered only fibre and fat, so no estimate of total energy intake was available. Although more men than women were overweight (body mass index ≥25 kg/m^2), frank obesity (≥30 kg/m^2) was more common in women and occurred in more than a fifth of older women.

Table II shows the proportion of patients screened in each age and sex band who needed some intervention or follow up as a result of identified risk. Overall, 72·8% of those screened needed specific advice or follow up for one or more risk factors (78·4% of men, 68·2% of women). More than a third of patients (39·9% of men, 30·5% of women) needed follow up for two or more risk factors, and about a tenth of patients required follow up for more than two risk factors. Where only one factor was present diet (mainly because of obesity) was the most common problem (13·5%), followed by hyperlipidaemia (12·6%), smoking (9·1%), and high blood pressure (3·2%).

The figure shows the proportion of the population screened and the proportion of patients with appreciable hypercholesterolaemia (total cholesterol concentration ≥8 mmol/l) detected by four selective strategies. Measuring cholesterol concentration only in those with a family history of premature ischaemic heart disease (age <60 years) in a first degree relative or with a personal history of ischaemic heart disease, diabetes, or hypertension would require 29% of the population to be screened and will detect 44% of those with a total cholesterol concentration ≥8 mmol/l, whereas if all available indices of risk are used the figures increase to 71% and 86%. Selective screening would be more effective in women than in men, but overall the benefit of any combination of selective criteria over random testing is small.



Percentage of patients with various risk factors eligible for screening and percentage with total cholesterol concentration ≥8·0 mmol/l that would be detected using different criteria for screening

Discussion

An important strength of the information on prevalence reported here is that we have screened a predefined group aged 35-64 years in each practice. One previous attempt to screen an entire practice was reported from Swansea,[15] where an acceptance rate of 62% was achieved. The acceptance rate in the first year of the OXCHECK study was much higher (82%), but only patients who responded to the initial questionnaire were randomised to be invited. It is likely that the acceptance rates of health checks among the non-responders would have been lower and their health poorer than that of the responders.[21] Hence the data presented here may overestimate the acceptance rate of health checks but may also underestimate the workload generated by them. Nevertheless, this estimate of the workload generated by systematically screening a middle aged general practice population is arguably the best available to date.

In the OXCHECK study strenuous attempts were made to maximise recruitment by using letters, opportunistic contact, and telephone. The acceptance rate of 82% suggests that early claims of acceptance rates of 90-95% were achieved by selectively inviting compliant patients.[17] This confirms our previous experience that opportunistic invitation does not reach those at greatest need of preventive care and is more difficult to sustain than elective invitation.[22] Whatever method is used the overall acceptance rate of health checks will be substantially lower than 82% when offered electively in most practices.

Three quarters of patients screened needed some form of intervention according to accepted clinical practice. Most of these patients required advice on diet or on how to stop smoking. Unfortunately, these are factors which the evidence for effectiveness of nurse intervention is limited, follow up has been shown to be incomplete, and protocols for follow up are not well established.[5] While there is an obvious need for training, this cannot be provided until an effective and

feasible intervention strategy has been developed. It may also be more appropriate to adopt a population approach to certain problems, such as helping overweight patients (body mass index 25-30 kg/m^2), than to try to provide individual counselling in general practice.

The issue of measuring cholesterol concentration remains contentious. The proportion of patients with a raised total cholesterol concentration was high, with 37% having a concentration ≥6·5 mmol/l (each of whom required a fasting lipid profile and clinical follow up[2]) and 8% a concentration ≥8 mmol/l. The proportion of patients falling into these categories from the other population based studies cited are: national lipid screening study 29% and 3·5% (for patients aged 25-59, for plasma concentration); Scottish studies 35% and 11% (serum concentration >7·8 mmol/l, for patients aged 25-64); and diet and nutrition survey 27% and 9% (serum concentration ≥7·8 mmol/l, for patients aged 18-64). It is difficult to compare directly the different studies, primarily because of the strong age gradient in cholesterol concentrations. In addition, methods of patient selection, differences in laboratory method, and sociodemographic factors must be taken into account. The important point is that the follow up workload generated by cholesterol screening is heavy and may be considerably higher than that suggested by the national lipid screening study, particularly if it is done systematically and effectively in a defined population and includes patients aged over 59. It must be remembered that general practitioners are contractually required to screen a very wide age range (17-74 rather than 35-64) and are implicitly encouraged to rescreen every three years.

The perceived extent of the cholesterol screening workload has fuelled demands for selective screening using other risk factors to determine who should have their cholesterol concentration measured. Many screening strategies have been suggested, but it is clear that no strategy commends itself as very much better than chance in identifying patients with hyperlipidaemia. This means that the argument for selective screening must rest on the principle of synergy (that is, risks are multiplicative and it is more important to identify and treat hyperlipidaemia in patients with other risk factors).

If some form of selective screening is not adopted and the whole population is screened, however, the implication of an 8% prevalence of a total cholesterol concentration of ≥8 mmol/l for the national drug budget is profound. In the Oxford arm of the national lipid screening study 80% of patients with an initial cholesterol concentration ≥8 mmol/l remained at or above this concentration despite dietary advice. If this experience is repeated more than 5% of the screened population will receive drugs for hyperlipidaemia. The drugs most commonly prescribed by general practitioners are likely to be statins because of their effectiveness and their acceptability to patients. Statins are expensive—£240-£810 per year for treatment with simvastatin for each patient. If all general practitioners in the United Kingdom offer health checks to their patients aged 35-64 over the next five years, if half of those invited accept, if cholesterol concentration is measured in all of them, and if dietary advice remains no more effective than at present, then 500 000 patients will be treated for hyperlipidaemia at a cost of up to £400m per year.

The purpose of the OXCHECK trial is to ascertain whether health checks by nurses have any place in a national strategy to prevent premature death from heart disease, stroke, and cancer. The result of the trial will not be known for three years, but it is already obvious that screening is only the first stage in a process of helping people to reduce their risk. The south east London study established more than a decade ago that screening alone cannot be justified on scientific, ethical or economic grounds.[23] The importance of the data presented is to emphasise that the real work in cardiovascular disease prevention is not in screening but in providing and sustaining follow up. The major failing of health checks has been to confuse the process of screening with that of intervention and follow up. It is time that these two processes were separately identified so that it becomes clear to all concerned that identifying risk does not necessarily reduce it.

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(Accepted 4 April 1991)