

A coronary screening programme in general practice

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SUMMARY. All male patients between the ages of 37 and 43 were selected from an age-sex register and invited to attend the surgery for coronary screening, which included medical history, family history, occupation, smoking habits, blood pressure, examination of the urine, measurement of weight and height, the taking of an electrocardiogram and chest x-ray, plus fasting blood levels of cholesterol, sugar, triglycerides, lipid electrophoresis, urea, and full blood picture. Sixty-four per cent responded to the invitation and of those, avoidable risk factors were found in 52 per cent.

Forty per cent of those reporting had not previously had their blood pressure recorded. Fifty-eight per cent had not had their urine examined, and 71 per cent had never had a chest x-ray.

Twenty per cent were found to have atypical electrocardiograms (mainly T-wave changes and ectopics) and 20 per cent had sufficiently elevated plasma lipids to justify further electrophoresis. Forty-four per cent of patients admitted to smoking more than 10 cigarettes daily.

Follow-up of the smokers one year later showed that 27 per cent had stopped smoking completely, 12 per cent had reduced their smoking by more than half, 54 per cent had not changed their smoking habits at all, five per cent had given up smoking but started again, and two per cent had either moved away or could not be traced.

I believe such a programme can readily be undertaken in the average general practice and can yield much useful information, such that it is possible to influence patients' smoking habits by advice.

Introduction

IN the UK, coronary heart disease is now the major cause of death in middle and old age, and as a result each year more than 150,000 people die, representing more than 25 per cent of all deaths.

In men between the ages of 45 and 54, 52 per cent of all deaths are due to cardiovascular disease, and more than three quarters of these deaths are due to coronary heart disease, whilst half of the remaining deaths are due to strokes (Office of Population Censuses and Surveys, 1975). It has been estimated that on average each week 4,000 new cases of coronary heart disease occur, resulting in 1,300 patients being admitted to hospital (Julian, 1976). Furthermore, it is generally agreed that 40 per cent of all heart attacks end fatally, and 40 per cent of the deaths occur during the first hour following the attack. These are very depressing figures, and even with coronary care ambulances, intensive care units, and modern methods of resuscitation, the prognosis is still far from good; which emphasises the importance of trying to prevent the acute attack. Various risk factors have been identified over the years, the most generally accepted being family history, hypertension, diabetes, raised serum lipids, obesity, cigarette smoking, and stress. Most of these can be measured and where they are abnormal, steps can be taken to correct them.

The annual death rate from coronary heart disease from 1950 to 1975 is shown in Figure 1. The International Classification of Diseases (ICD) 6th and 7th Revisions classified it in categories 420-422, and these are used for the dates 1950 to 1967. From 1968, the 8th Revision reclassified coronary heart disease under categories 410-414.

The role of dietary fats in the aetiology of coronary heart disease has been debated for many years. Carlson and Bottiger (1972) showed a definite association between coronary heart disease and fasting values of triglycerides and cholesterol; Stamler and Epstein (1972)

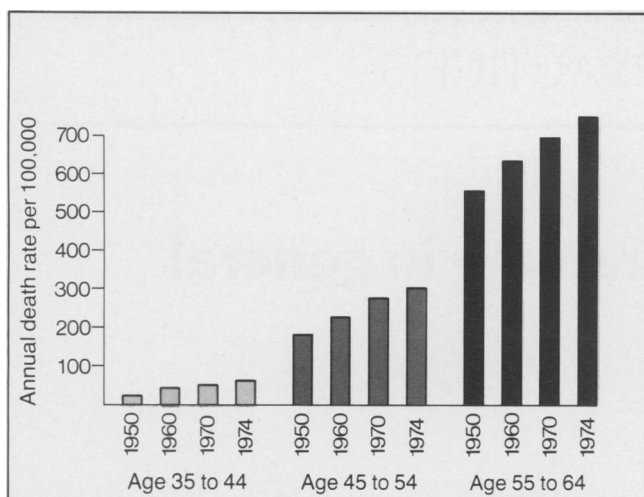


Figure 1. Annual death rate from coronary heart disease (ICD 410-414) for men aged 35 to 64 in 1950, 1960, 1970, and 1974 in England and Wales (rates per 100,000).

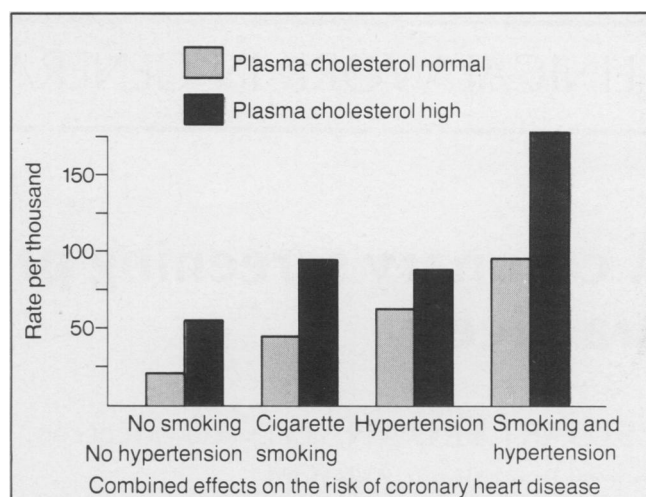


Figure 2. Combined effects of plasma cholesterol, cigarette smoking, and hypertension on the risk of coronary heart disease: 10-year rates are per 1,000 for the first major coronary heart disease events in men aged 30 to 59 (Stamler and Epstein, 1972).

showed a definite association between high levels of cholesterol and coronary heart disease, whilst Miettinen and colleagues (1972) reported the beneficial effects of a cholesterol-lowering diet on the mortality from coronary heart disease.

More recently, the Framingham Study (Gordon *et al.*, 1977) showed that whereas the total serum cholesterol still remains a good predictor for people under 50 years old, it fails to predict the risk for older people. In these, high density lipoproteins or alpha-cholesterol levels can be used to assess risk factors, and in these, the levels bear an inverse ratio; the higher the levels of high density lipoproteins the lower the risk of coronary heart disease; for once, a high level of something is good! Similar findings were also reported in the Tromsø Heart Study (Miller *et al.*, 1977).

This topic has been reviewed in detail by 18 national committees set up by governments or professional bodies in 10 different countries, and each has recommended a reduction in the consumption of saturated fats, particularly in those patients found on screening to be at high risk. Nearly all advised a partial substitution of saturated by polyunsaturated fats, and a reduction in the dietary cholesterol (Ball, 1978).

A still more convincing relation can be shown when one considers cigarette smoking and coronary heart disease (Ball and Turner, 1974). In an analysis of the smoking habits of 20,540 doctors followed up for 20 years, Doll and Peto (1977) showed that general practitioners smoked 37 per cent more cigarettes than their hospital colleagues: and their total death rate was 25 per cent higher, whilst their death rate from smoking-related diseases was greater by 38 per cent.

This shows such a clear association that it has been

standard advice to all patients in this screening programme to stop smoking completely and rate cigarette smoking as a high-risk factor.

When the combined effects of several risk factors are examined, the same pattern emerges (Stamler and Epstein, 1972). Figure 2 shows the combined effects of plasma cholesterol, cigarette smoking, and hypertension on the risk of coronary heart disease.

Screening programmes in general practice, particularly for hypertension, have been in use for many years (Hart, 1970 and 1971; Coope, 1974; Sinclair, 1975). The taking of cervical smears is now an accepted procedure in many practices, as is screening for diabetes, anaemia, phenylketonuria, deafness, rubella status, glaucoma, tuberculosis, and breast cancer. Various private organizations such as the BUPA Medical Centre have offered a comprehensive multiphasic screening programme for many years, including electrocardiography, blood pressure, biochemistry, and radiological examination.

Unfortunately, it is often *after* the patient has suffered a myocardial infarction that the avoidable factors such as smoking, obesity, and plasma lipids are looked at, in an attempt to prevent a second attack. To look for these factors *before* the patient suffers his first infarct seems more sensible, and the results of this programme suggest that it is well worth the time and effort.

Many patients are already anxious about coronary heart disease: the media regularly inform them about 'heart attacks', lipoproteins, and so on, and many welcome the chance to have an electrocardiogram; and some screening tests, which in the majority will be normal, will provide reassurance and record base-line values, which can be useful for future reference.

Aims

The aim of this coronary screening programme was to find out if it was possible to identify the various risk factors for coronary heart disease in men between the ages of 37 and 43, and to offer advice and treatment in an attempt to reduce the incidence of myocardial infarction.

Method

The programme was discussed with the community nurses attached to the practice: they had already had many years' experience in the taking of electrocardiograms, and also of taking venous blood samples. They were extremely enthusiastic, and the success of the screening programme has been largely due to their skill and enthusiasm throughout.

The consultant pathologists and district laboratory staff were approached and asked if they could undertake the additional biochemical investigations; after discussion it was decided that the most useful tests were: haemoglobin, white count, sugar, urea, cholesterol, triglycerides, and lipid electrophoresis.

The consultant radiologists and radiographers were asked if they could take the additional films at the local hospital. This they did readily, which has been much appreciated.

When the screening programme started it was possible for patients to have a mass miniature chest x-ray; this service was discontinued half-way through the programme, but a better arrangement of open access, no waiting, direct referral for chest x-rays was instituted at the local hospital. This has enabled patients to have a full-plate chest x-ray with the minimum of inconvenience and a reduction in the total amount of irradiation.

Male patients between the ages of 37 and 43 were selected from the age-sex register and sent a letter inviting them to attend for a screening test, by appointment, in the morning, having previously fasted for 14 hours.

A stencilled questionnaire was given to the nurses (Figure 3) which was completed at the time of the screening test. This was cut to the size of the standard FP7 and 8 so that when all the results had been entered, it could be conveniently filed in the patient's notes without folding. Initially the whole test took about one hour, but with increasing confidence and repetition, this was reduced to under half an hour.

The majority of the screening programme was, therefore, undertaken by the attached community nurses: if their general workload was heavy, fewer screenings were done, and conversely, when the general workload was light, more screenings could be offered.

The letters to the patients were delivered to their homes by the doctor, to reduce the cost of postage, since it could be done during the daily visiting round without

SURNAME	JONES	FORENAMES	ALBERT
ADDRESS	25, NORTH STREET		
D. of B.	22-2-1935		
CORONARY SCREENING CHECK PERFORMED 19 77			
Date	1-5-77	Number	67
Age	42	Occupation	MECHANIC
Family History	NIL	Past History	NIL
Weight	110t 5lbs	Height	5' 11"
Smoking Habits	20 / DAY		
B.P.	110/70		
E.C.G.	NORMAL		
Urine	N.A.D.		
CXR	CLEAR		
Hb	14.8 G%		
Sugar	4.6 m.mol		
Urea	4.0 m.mol		
Cholesterol	6.9 m.mol		
Triglycerides	1.2 m.mol		
ADVICE	STOP SMOKING!		

Figure 3. Stencilled questionnaire which can be inserted in the patient's medical record envelope when finally completed.

much inconvenience. The response was good, most patients requesting an appointment within one week of receiving the letter.

As a result of this response, it was found preferable to deliver only about three letters each week to prevent a long waiting time for appointments, and to control the numbers should the general nursing workload unexpectedly increase. Pathology and x-ray forms were completed in advance by the practice secretary, and this saved much of the nurse's time.

Most results were available after one week. Any abnormal biochemical tests were repeated and patients were asked to return after two weeks to discuss the findings. This second consultation usually lasted 10 minutes, when the results could be discussed, and any treatment offered. It was also a good opportunity to check that the patient's tetanus and polio immunizations were up to date, and if not, offer the necessary vaccine.

A marker label "Coronary Screening Check" plus the date was affixed to the outside of the patient's record envelope and on the continuation card inside, and the fact recorded on the age-sex card.

Results

The most gratifying result was the response by the patients, most of whom made an appointment for the screening check within one week of receiving the letter. This contrasts with a poorer original response to letters inviting women at risk to attend for cervical cytology.

When the cervical cytology programme was launched, only 30 per cent of patients invited actually attended; gradually over 10 years the acceptance rate has increased and is now 80 per cent. Most of the men expressed slight surprise that such a screening programme could be offered by their general practitioner.

One hundred and twenty letters were delivered; 77 (64 per cent) of those contacted took advantage of the offer. The highest response came from patients whose occupation put them in social categories 1 to 3, with the poorest response in social classes 4 and 5. This was probably to have been expected, although it may have been due to the fact that patients in groups 4 and 5 would find it harder to take a morning off work, or were just less 'coronary conscious'! Two wives arrived!

Of those screened 31 patients (40 per cent) had not previously had their blood pressure recorded in their medical notes; indeed many of these had scarcely seen their doctor since childhood. Although almost all had a normal blood pressure, in this small sample, nevertheless, the undiagnosed hypertensive would eventually be picked up, and the risks of cerebrovascular disease reduced with earlier treatment.

Forty-five patients (58 per cent) had not previously had a sample of urine tested. Again, although no abnormalities were discovered on this sample, nevertheless, the undiagnosed diabetic or patient with renal disease would eventually be found.

Fifty-five patients (71 per cent) had not previously had a chest x-ray report in their notes. One patient was found to have an unusually large heart and one patient discovered to have a cystic swelling in the mediastinum which was subsequently found to be benign and probably congenital in origin. Otherwise all chest x-rays were reported as normal. In this part of Kent, the chances of finding undiagnosed disease on a chest x-ray are now fairly remote.

Five patients (seven per cent) were considered sufficiently overweight to be advised about some form of dietary control.

Fifteen patients (20 per cent) were found to have ECG abnormalities, the majority being T-wave changes or the presence of ventricular extrasystoles. Most of the T-wave changes were considered to be within the normal range, but could have caused some confusion had the patient been admitted to hospital complaining of chest pains. Where ECG variations were noted, the patient was advised that if any doubt was expressed about his ECG in the future, he should contact his general practitioner who would have kept a base-line ECG for reference. This alone could save a patient several days' anxiety in a coronary unit, waiting for any changes in serial ECGs.

Are patients who have multiple ventricular premature beats more likely to have fatal arrhythmias should they suffer an infarction? Although the Framingham Study showed ventricular ectopics were predictive for sudden death, more recently the general trend is to attribute

ever-diminishing significance to premature beats, even when frequent in the post-infarction phase (Zoob, M; personal communication).

Fifteen patients (20 per cent) had sufficiently elevated cholesterol or triglyceride levels to perform further lipid electrophoresis (cholesterol greater than 6.5 mmol/litre or triglycerides greater than 1.7 mmol/litre) and in these, 79 per cent had only raised pre-beta bands, 11 per cent had only raised beta-bands, and 10 per cent had both raised beta and pre-beta bands. In such cases, the fasting levels were repeated, and if still found to be elevated, or the beta or pre-beta bands on lipid electrophoresis still found to be increased, the patient was given a low-cholesterol or low-saturated fats diet, and levels repeated after six months. None were sufficiently high to commence clofibrate or cholestyramine. Several manufacturers produce leaflets giving dietary advice to reduce lipids, and these were given to such patients (see addendum).

Follow-up of these patients one year later showed an average fall in cholesterol of 0.5 to 1 mmol/litre and triglycerides of 0.5 to 0.8 mmol/litre. The number is, however, too small to be significant, particularly in the light of conflicting evidence on the role of plasma lipids at present.

Thirty-four patients (44 per cent) admitted to smoking more than 10 cigarettes a day, or the equivalent in pipe tobacco. In every case the risks were explained, and the patient strongly urged to stop. The Health Education Council produce many helpful leaflets on the hazards of smoking, and they were given to these patients to reinforce the verbal advice.

Follow-up of these patients one year later showed some very interesting results. Nine patients (27 per cent) had stopped smoking completely; four patients (12 per cent) had reduced their smoking considerably; 18 patients (54 per cent) had not stopped smoking; two patients (five per cent) had stopped smoking, but subsequently started again; and one patient had moved away from the area, and could not be traced. Three patients were found to have slightly elevated fasting blood sugars (upper limit of normal 5 mmol/litre). In these, glucose tolerance tests were performed and found to be within normal limits. They were advised to have repeat fasting tests in one year's time. (Since preparing this, the upper limit of normal has been increased to 6.7 mmol/litre, and had this been applied to the above three patients, all would have been considered within normal limits on fasting levels.)

Twenty-five patients (33 per cent) had a strong family history of ischaemic heart disease; this is one of the unavoidable risk factors. However, in such patients, all avoidable risk factors such as smoking or hyperlipidaemia were treated more enthusiastically in an attempt at least to reduce the chances of coronary heart disease.

The three most significant risk factors identified in this survey were:

1. Cigarette smoking (avoidable) 34 patients.
2. Family history of ischaemic heart disease (unavoidable) 25 patients.
3. Hyperlipidaemia (? avoidable) 15 patients.

Of the 34 patients who smoked, half (17 patients) had a family history of ischaemic heart disease; thus they already had two risk factors even before measuring their lipids, whilst about a quarter (eight patients) had, in addition, elevated lipids, representing three risk factors, two of which could be considered avoidable. The distribution of the three main risk factors is shown in Figure 4.

One patient who qualified for the most risk factors had a strong family history of coronary heart disease; both parents had died in their forties from myocardial infarctions, there was a family history of diabetes, he was grossly overweight, hypertensive, smoked more than 50 cigarettes daily, had hyperlipidaemia, and an elevated blood sugar! Married with two young children, he had not seen his doctor since childhood. One year later, he had stopped smoking completely, lost two stones in weight, and had a normal fasting blood sugar, but still had hyperlipidaemia, and is under treatment for his hypertension.

Advantages

1. *Reassurance.* Many men in this age group are 'coronary conscious'; most know of colleagues who have had a coronary thrombosis; many would like to have a screening check, but do not know how or where to obtain one. Thirty-seven patients (48 per cent) in this series were able to be told that all tests were 100 per cent normal. In those with avoidable risk factors, all were reassured that their chances of having a coronary could be reduced.
2. *The blood pressure is recorded.* This provides a valuable base-line, both for the doctor and also life insurance companies.
3. *The urine is examined.* Again, a very useful base-line for the doctor, and when completing life insurance reports.
4. *A base-line electrocardiogram is obtained.* This can be filed in the patient's notes and can be of great help for comparison with doubtful tracings in the future.
5. *Identification of those at risk of ischaemic heart disease.* This is possible and regular surveillance of blood pressure, smoking habits, and biochemistry can be undertaken.
6. *Tetanus and polio immunizations.* One is able to check on the state of tetanus and polio immunizations, and where these are not up to date, offer to give these at the time of the second consultation.

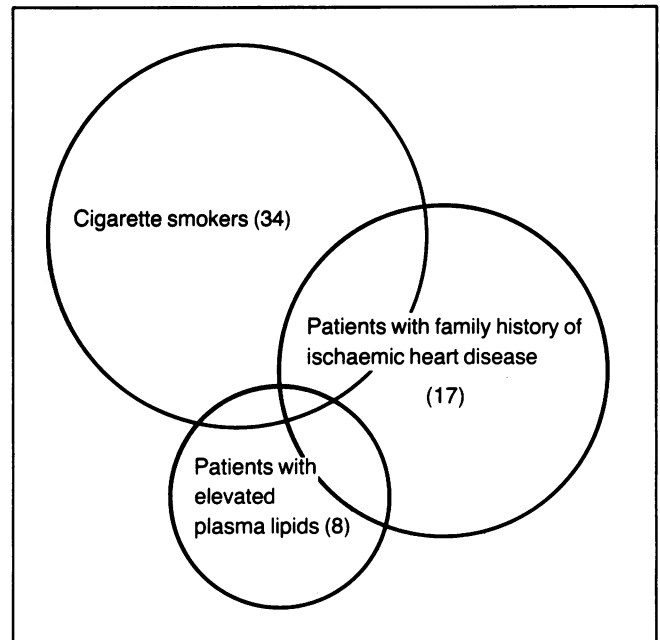


Figure 4. Distribution of the three main risk factors.

Disadvantages

1. *Cost.* With the present method of payment for general practice, the doctor will have to pay for such a screening programme out of his own pocket as there is no provision for reimbursement for the cost of electrocardiogram machines (£500), ECG paper and spares, maintenance, and servicing (£100 last year). There is also the cost to the NHS of the chest x-rays, biochemical investigations, and staff.
2. *Time.* Each examination takes half an hour of the nurse's time and 10 minutes of the doctor's time. It was generally felt that the results amply justified this amount of time involved.
3. *A possible risk of cardiac anxiety.* This has not appeared to have been the case, but it is too soon to know what the long-term effects will be. Several patients wanted to know when they could have their "next screening"!
4. *Problems with life insurance policies.* One patient who had a coronary screening check and was found to have an elevated serum cholesterol, subsequently applied for a life insurance policy and had his premiums loaded, despite the fact that he had been on a cholesterol-lowering diet and had had normal readings for two years. From a theoretical consideration, this patient could be considered a better risk for life insurance than were he not to have had the original cholesterol estimated, but repeated requests to the insurance company to reconsider the loadings were ignored.

Fortunately, most patients attending have already taken out their life insurance policies at an earlier age.

Discussion

Are screening programmes helpful in general practice? Is the small pick-up rate with all the effort entailed in organizing such programmes justified with limited resources? Which screening procedures produce the best results? Does it make any difference to the eventual outcome if diseases are picked up earlier in such screening programmes?

Recently a report from the South East London Screening Study Group (1977) has cast doubts on the value of multiphase screening programmes in general practice, finding no difference between those screened five years previously in 1968, and a control group not screened. This is perhaps not too surprising in such a short follow-up, particularly as it was conducted on men aged 40 to 64 when many atherosclerotic changes will have already occurred. Perhaps we should be screening at a much earlier age, for example, 20 to 30, to show significant reductions in morbidity and mortality.

Advocates of screening programmes point to the number of undiagnosed conditions uncovered; cynics point out that the death rate from cervical cancer has not been influenced as a result of the National Cervical Cytology screening programme. Advocates for screening for diabetes point out that treatment can be initiated earlier—although the evidence shows that it seldom affects the vascular complications, particularly in the retina.

Mass radiography was introduced to pick up undiagnosed tuberculosis and carcinoma of the lung; in practice, the majority who used the service were the fit, healthy members of the population; many with a prolonged cough never had a chest x-ray because "they were frightened it might show something". On the other hand, screening for hypertension has been shown to reduce the incidence of stroke, and is now a well recognized and recommended procedure.

In any one year, 60 per cent of registered patients between the ages of 25 and 65 will consult their general practitioner, and within five years most, although not all, will have occasion to see him. The routine taking of blood pressure in this group of patients will reveal undiagnosed hypertension, and enable treatment to be started, thus reducing the incidence of strokes.

A simple coronary screening programme is a logical extension of the hypertension screening in general practice and, with secretarial help, the time taken in identifying and contacting those at risk is minimal. With 44 per cent of this sample still smoking more than 10 cigarettes daily, the opportunity to spell out the known risks face to face made the whole exercise worth while, particularly as 39 per cent of those patients had either stopped smoking completely or reduced their consumption by more than half when followed up one year later.

With the antismoking publicity now gaining momentum, perhaps we are now in a much stronger position to influence people's smoking habits, and this

screening programme has shown quite conclusively that it is perfectly possible to do so.

It is now the intention to extend the screening progressively to younger men in the practice.

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Addendum

The following are useful sources of pamphlets and literature which can be given to patients:

The Health Education Council, 78 New Oxford Street, London WC1A 1AH. Telephone: 01-637 1881.

Pamphlet AS3 *Smoking Can Damage Your Health*.

Flora Information Service, 25 North Row, London W1R 2BY. Telephone: 01-408 2332 and 01-499 0414.

Leaflet F47 *Eating for a Healthy Heart*

Leaflet F57 *Cholesterol and Heart Attacks*

Leaflet F54 *What you should know about Dietary Fats and your Health*

Leaflet F56 *High Blood Pressure*

Leaflet F58 *Coronary Heart Disease and Stress*

Coronary Disease—How to protect your Family

Cholesterol and Saturated Fats Indicator.

Imperial Chemical Industries Ltd., Pharmaceuticals Division, Alderly Park, Macclesfield, Cheshire SK10 4YA.

Hyperlipidaemia Diet Booklets.

All these leaflets can be ordered directly and are free of charge.