Coronary heart disease (CHD) is regarded as a disease that largely afflicts men but even a casual glance at mortality rates belies this. There is obvious concern about the lack of studies of CHD in women and there are suggestions of a sex bias in the way women are investigated and treated.

It is true that the main thrust of the primary prevention trials was to reduce the incidence of CHD in men, particularly by reducing blood cholesterol. In the age groups studied in the primary prevention trials the rate of CHD events in women is much lower than that seen in men. Thus any clinical trials in women would require even greater numbers to achieve the same results. Yet the conclusions from these studies in men, which were some of the largest clinical trials performed, have caused continuing controversy. They have polarised views within the profession and have caused confusion about the value of lowering cholesterol.

An analysis of 34 000 deaths of women in the United States showed a virtually flat relation between blood cholesterol and mortality and led to the proposal that only high risk patients needed treatment to reduce high serum cholesterol. The joint Medical Research Council/British Heart Foundation Heart Protection Study, which has been designed to see whether this proposal is valid, will include women. Such a study is long overdue. We contend that in the interim it is reasonable to extrapolate from men to women when the risk of CHD is high, as it is in familial hypercholesterolaemia, or when the protective female benefit has gone, such as after myocardial infarction, in women with diabetes mellitus, or in the elderly.

Manolio and Harlan neatly summarised the political dilemma facing the health services in the United States in dealing with CHD in the elderly—as a problem affecting women more than men. CHD is the major cause of death in postmenopausal women and has been calculated to cost the United States health service more than CHD in men. Most of the cost of treatment for the over 65s in the United States comes from public funds. Thus the scientific imperative is to evaluate the treatment of CHD in the elderly. Are the strategies and studies of coronary bypass surgery undertaken in the 1970s, which seemed to emphasise survival, applicable to an aging population in the 1990s?

It has been alleged that doctors underinvestigate and undertreat women with CHD. This criticism has been countered by claims that in the United States the level of revascularisation in women is more appropriate than it is in men. In the United Kingdom we might believe intuitively that this is correct because by our standards the rate of revascularisation in American men seems excessive. Perhaps part of the problem is that in published studies we are not able to determine the basis of evaluation, referral, investigation and treatment in men and women. Conclusions of sex bias drawn from crude comparisons of rates of investigation and treatment assume that we are dealing with the same clinical problem in men and women. This is not so. The presentation of CHD differs in men and women. In the Scottish Heart Study women were three times less likely to have a history of myocardial infarction than men. Women answering the Rose questionnaire were less likely to report previous angina but more likely to report current angina than men. Thus women tend to present with angina and their clinical course seems to be more benign, until myocardial infarction occurs.

The death rate from CHD in the Greater Glasgow Health Board (ages 35–64) was about 3 times higher in men (12.4/1000) than in women (4.0/1000) and the corresponding rates for coronary angiography were about twice as high (8.9 v 4.7 for 1986/87 combined). Thus if the need for coronary angiography were based on mortality from CHD these data would suggest over-investigation of women rather than under-investigation. If, however, the need for coronary angiography were based on the incidence of current angina reported in the Scottish Heart Study the results would suggest under-investigation of women by coronary angiography.

Detailed analysis of the 1989/90 discharge diagnosis for CHD (ICD code 9) for 7743 Greater Glasgow Health Board cases aged 35 to 64 (5336 in men and 2407 in women) showed myocardial infarction in 37%, angina pectoris in 26%, and other forms of chronic ischaemic heart disease in 35%. Annual coronary angiography rates at that time were 4.3/1000 and 1.9/1000 respectively. This difference was not statistically significant but more importantly the ratios between the discharge and coronary angiography rates were similar in men and women. Thus there was no evidence of sex bias in the investigation of these patients when hospital discharge was used as the basis of need.

The annual rate of coronary bypass surgery (CABG) was significantly higher in men (1.39/1000) than in women (0.32/1000). One interpretation is that women are undertreated but because the proportion of normal coronary angiograms in men and women is not known we cannot conclude that fewer women with coronary heart disease are referred for revascularisation. If the...
proportion of normal angiograms were similar an explanation would have to be found to explain the markedly different rates of subsequent CABG in men and women. But many middle aged women referred for cardiological investigation have normal epicardial coronary arteries. Almost half of women reported in the CASS (Coronary Artery Surgery Study) registry in 1982 had normal epicardial coronary arteries compared with only 17% of men.11 Pettigrew et al reviewed 23 000 hospital discharges and concluded that there was a systematic difference in the treatment received by men and women.12 They reported that more men than women underwent revascularisation, the ratio was about 1:5 to 1. Among the explanations for this discrepancy was the differing rates of obstructive epicardial coronary disease at angiography in men and women. We believe that this may be an adequate explanation for much of the lower incidence of subsequent coronary bypass surgery in women. A revascularisation bias could be proved only by analysis of the numbers of men and women with angiographically confirmed coronary disease who subsequently have bypass surgery.

Kee et al13 did not come to the same conclusions as we did. They found that women had only half the rate of investigation for chest pain and morbidity. The crude rates of investigation were more than four times higher in men than women—a much greater difference than what we found. They used the same basis for need (hospital discharge), which reinforces our view that the question of sex bias cannot be answered until a true measure of need is obtained.

It is difficult to manage chest pain in middle aged women. They often go through a year or so of medical therapy, which usually gives little benefit; then they undergo treadmill exercise tests, which are frequently unhelpful; and finally, after myocardial imaging, coronary angiography shows a normal epicardial coronary tree. This high incidence of normal epicardial coronary arteries in women with angina probably explains the relatively benign prognosis of chest pain in middle aged women.

We and others have reported a higher in hospital mortality and morbidity from myocardial infarction in women than in men even after taking into account known adverse factors and correcting for age.14-16 The results in these relatively small study populations accord with mortality in Scotland 1983-89 after inpatient admission for heart disease. Over this period 74 649 men and 53 322 women were admitted to hospital. The 4 day, 30 day, and 1 year mortality for men v women (%) was 9-4 v 12-2, 16-4 v 21-4, and 25-2 v 32-3. Data from the MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) project (personal communication, Dr Caroline Morrison, Glasgow MONICA project centre), specifically those on myocardial infarction, suggest that men are more likely than women to die before they reach hospital but women are more likely to die after reaching hospital. Thus resultant 28 day mortality is the same. This excess in hospital mortality and morbidity in women after correction for age and comorbidity seen in the United Kingdom and United States suggest that they are. Pettigrew et al found that men were 2-3 times more likely to undergo revascularisation.13 This was based on data on only 1-9 and 0-8% of male and female patients discharged with myocardial infarction. American data point strongly to this result being due to a difference in the investigation rate. In a retrospective analysis of 130 000 hospital discharges of cases with CHD18 men were significantly more likely to undergo coronary angiography, even after myocardial infarction, but the proportions of men and women who subsequently had revascularisation were similar. In contrast, investigators from Alabama found no difference in the investigation rates and subsequent revascularisation rates in men and women in a prospective study of 1000 patients admitted with myocardial infarction.19 They did confirm an unexplained excess mortality in women.

Whatever the case, there is no justification for treating men and women differently after coronary heart disease is diagnosed.20 Women with CHD do not do well.21 Early concerns about the poorer results of CABG and higher mortality in women were not confirmed in later studies.22-24 Further research is required in the United Kingdom, but American findings that women seem to be referred for revascularisation later in the course of their disease with more symptoms and greater adverse features.22-26

In conclusion, we have examined those areas that seemed most relevant to the management of CHD in women and, where appropriate, have tried to give them a local perspective. Our local perspective may differ from others as discussed and perhaps what we should be addressing is the striking regional variations in the investigation and treatment of CHD.2728 Curiously, we have been asked to answer the question “Are women with CHD underinvestigated?” If the determining factor is the incidence of chest pain the answer probably is “yes” (though it could easily be argued that women are overinvestigated if the normal coronary angiography rates reported by the CASS study are representative of practice in the United Kingdom.) Perhaps women are underinvestigated because a diagnosis of CHD in a woman is more likely to be doubted. This may lead to coronary angiography being performed only in women with severe symptoms. There is no doubt that myocardial imaging is less useful in assessing women, and perhaps our lack of confidence in the diagnostic and prognostic capability of stress testing in women makes their investigation more subjective.26

For subsequent revascularisation the picture seems clearer. In our practice, and we are confident that this is not dissimilar to that in most centres in the United Kingdom, most patients (men or women) undergoing investigation have chest pain that is not controlled by medical therapy and if they are shown to have coronary disease they are offered CABG. Thus we believe that it is reasonable to assume that there is little sex bias in the referral of patients with symptoms for revascularisation.

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