Scottish Needs Assessment Programme

CORONARY HEART DISEASE

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CORONARY HEART DISEASE

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PART 1: COMMENTARY ON CURRENT CHD ISSUES

PART 2: EPIDEMIOLOGY AND TRENDS

This document is in two parts:

Part 1 offers a commentary on current issues relating to the prevention and treatment of CHD.

Part 2 deals with epidemiology and trends and offers a more classical approach to needs assessment.

EXECUTIVE SUMMARY

SNAP's analysis is that, if coronary heart disease (CHD) is to be combated, the people of Scotland need:

- Social and economic circumstances conducive to accelerating the decline in CHD.
- Social policies to facilitate health related behaviours that reduce the risk of CHD.
- Interventions at the level of the whole population to reduce the population risk of CHD
- Interventions in those with established risk factors to reduce their risk of developing symptomatic CHD.
- Appropriate management of CHD at the primary, secondary and tertiary levels of care.
- Appropriate 'surgical' interventions for individuals with symptomatic disease not responding to medications.
- Effective rehabilitation and secondary prevention for patients with established disease.
- Monitoring, audit and outcome measurement of all relevant activities.
- A co-ordinated research and evaluation strategy.

Conclusions

A. LIFE CIRCUMSTANCES

1. Scotland, like most industrialised countries, has experienced a twentieth century epidemic of CHD. Although the classical risk factors for CHD (smoking, cholesterol, hypertension) explain some of this phenomenon, much remains unexplained.

2. The complex relationship between poverty and CHD is being recognised as increasingly important.

3. The single most important strategy for reducing heart disease in Scotland will be an integrated national and local initiative to confront relative deprivation (life circumstances).

4. Health boards, professional bodies and concerned individuals should combine in advocacy for social and economic circumstances conducive to an accelerating decline in CHD.

5. Health boards should take the lead in creating (or further developing) healthy alliances so that they genuinely confront the local determinants of health.

B. LIFESTYLE

6. A variety of policy initiatives at national and local level should be initiated to reduce smoking, promote healthy eating , promote physical exercise and facilitate the development of 'life skills' amongst the young.

7. Setting based health promotion should form part of a wider population based strategy for CHD in, for example, schools, hospitals, workplaces and housing schemes.

8. Community based CHD programmes of the style developed in the 1970s and 1980s may have a place but only if they apply the principles and theories learned from evaluation. (In particular, the vital role of community ownership and participation).

C. HEALTH SERVICES

9. The evidence is strong for personalised health education to confront smoking and raised blood pressure in the primary care setting (i.e. primary prevention).

10. The West of Scotland Coronary Prevention Study established that men with moderately elevated cholesterol could benefit from the new 'statin' class of cholesterol lowering drugs but at a cost of £29,375 per year of life saved (if costs are discounted). Patients at higher risk have lower costs per year of life saved, so patient selection through local protocols seems wise.

11. There is an estimated half a million Scots with CHD, with around 180,000 being treated for symptomatic disease. Most patients with symptomatic CHD are treated in a primary care setting.
12. General practice, therefore, faces a formidable task in implementing all of the tested interventions in daily practice. A practice of 10,000 will have between 300 and 500 individuals with established CHD and over 5,000 with one or more reversible risk factors - the CHD iceberg of disease.

13. For patients with CHD, changes in lifestyle can improve symptoms and prognosis - stopping smoking, improving diet and taking more exercise.

14. Changes in lifestyle for this group can be supplemented by pharmacological interventions including antiplatelet therapy and beta blockade for the majority, angiotensin converting enzyme inhibitors and lipid lowering drugs for selected patients.

15. The 4S and the CARE studies of patients with a history of myocardial infarction or angina support the use of lipid lowering agents in secondary prevention. However, dietary interventions should be tried first.

16. The evaluation of formal cardiac rehabilitation programmes has been difficult because of variability in components and protocols. However, there is convincing evidence of effectiveness. Nonetheless, the effectiveness of all rehabilitation as currently practised in Scotland is not known and much more evidence of local outcomes is required.

17. The current clinical consensus within Scotland is that all patients suspected of having an acute myocardial infarction should be considered for admission to a Coronary Care Unit.

18. There is evidence to support the effectiveness of surgical interventions for the treatment of severe angina. Coronary Artery Bypass Grafting (CABG) does substantially improve symptoms and modestly improves survival rates for up to 10 years after surgery.

19. In the light of uncertainty, health service planners will have to resolve the issue of inequity in the provision of CABG and angioplasty. Some boards with high levels of need may have to increase the number of their procedures.

20. Primary prevention is generally cheap and effective over time particularly in populations but less so in primary care. Secondary prevention is also effective for a more limited time but at a cost. Interventions in tertiary care hospitals for established disease are generally expensive with least benefit. However, all are required. The points of contention surround relative priority and expenditure.

Action points

Health Boards should:

1. Advocate and support policies that reduce the gradient of wealth, opportunity and hope within Scottish society.

2. Advocate for national policies and create local policies that 'make the healthy choices the easy choices'.

3. Create or further develop 'healthy alliances' that influence the physical and social environment of the local area.

4. Create or further develop comprehensive programmes of health promotion (including CHD prevention) based on 'settings' that promote 'life skills' in the young and help adults towards healthier lifestyles.

5. Support primary care in its contribution to primary prevention (mostly opportunistic advice on smoking, diet and exercise and the identification and treatment of hypertension) and secondary prevention for those with established disease (including smoking, diet, exercise and medications).

6. Assess and address issues of inequity in the provision of CABG and angioplasty.

7. Continue to commission current rates of CABG and angioplasty while funding research into the appropriate threshold for CABG and angioplasty based on symptoms, pathology and outcomes.

8. Consider increasing rates of CABG and angioplasty if this is required to address inequity.

9. Ensure high quality rehabilitation for all who require it.

Primary Care Trusts, GPs and the primary care team should:

1. Support policies, 'healthy alliances' and other local interventions that will decrease CHD.

2. Avoid unnecessary expenditure on multiphasic screening for CHD risk factors.

3. Further develop systems of primary prevention through opportunistic advice on smoking, diet and exercise and the identification and treatment of hypertension.

4. Agree and implement programmes of secondary prevention among those with established disease.

5. Ensure high quality rehabilitation for all who require it.

PART 1

INTRODUCTION

1.1 Background

The Green Paper on Public Health[1] has reaffirmed Coronary Heart Disease (CHD) as a major priority. However, this report by the Scottish Needs Assessment Programme (SNAP) should be seen in context. It seeks to build upon the Public Health Policy Unit (PHPU) report 'Coronary Heart Disease in Scotland'[2] which provoked much discussion and prompted an intercollegiate review by the Royal Colleges of Edinburgh and Glasgow[3].

1.2 Speaking from a distinct perspective

SNAP has decided to issue a CHD review, written for the non-expert, to provide health services planners with an unbiased public health perspective on this difficult and complex subject. The purpose of this report is to offer a commentary on the strategic options that arise from the current debate over CHD. One of the fundamental messages of this document is that there is considerable uncertainty surrounding several areas of CHD strategy and it is better to recognise ambiguity and deal with it rather than impose a false certainty.

1.3 SNAP's analysis

SNAP's analysis is that, if CHD is to be combated, the people of Scotland need:

- Social and economic circumstances conducive to an accelerating decline in CHD.
- Social policies to facilitate health related behaviours that reduce the risk of CHD.
- Interventions at the level of the whole population to reduce the population risk of CHD.
- Interventions in those with established risk factors to reduce their risk of developing symptomatic CHD.
- Appropriate management of CHD at the primary, secondary and tertiary levels of care.
- Appropriate 'surgical' interventions for individuals with established disease.
- Effective rehabilitation and secondary prevention for patients with established disease.
- Monitoring, audit and outcome measurement of all relevant activities.
- Research and evaluation.

All of the above is required. The difficulty arises in allocating relative priority to each element of the strategy and deciding which specific interventions will best deliver the desired outcomes. Nonetheless, it is an important first step to establish that all the above are necessary to combat CHD.

1.4 What caused the epidemic of heart disease?

All industrialised countries have experienced an epidemic of CHD. The word epidemic is used advisedly because there has been a clear increase, peak and decline of CHD in countries like the UK, USA and Australia. The time sequence has varied but the pattern has been similar[4]. A country's CHD prevalence principally reflects levels of smoking, dietary fat intake and blood pressure[5 6]. Trends in CHD prevalence are thus generally predictable: uncommon in less developed countries like Zaire and Bangladesh, increasing in parallel with a "westernised lifestyle" (for instance Poland and the Philippines), and then falling again as smoking declines and diet and health care improve (USA, UK). Although this analysis seems beguilingly straight forward it has not been established for certain what caused the CHD epidemic.

1. 5 Risk factors

Some risk factors are 'fixed' (e.g. age, male gender, family history of CHD). These factors are important for the targeting of interventions, but they provide no scope for risk reduction in the context of preventive programmes. Other important risk factors are potentially reducible (e.g. smoking, diet, blood pressure, exercise). Although many other factors have been implicated (e.g. diabetes, obesity, genetic makeup and water hardness), it is more important to focus on the major ones. However, if this simple risk factor model provided the complete answer, the strategy for the prevention of CHD would be simple: change the risk factors in individuals and prevent the disease. In practice, this has proved to be difficult. Large, community based, risk factor intervention trials have in some cases been very disappointing as most have failed to reduce all cause mortality in the intervention groups[7 8 9].

1.6 The complex relationship between poverty, class and CHD

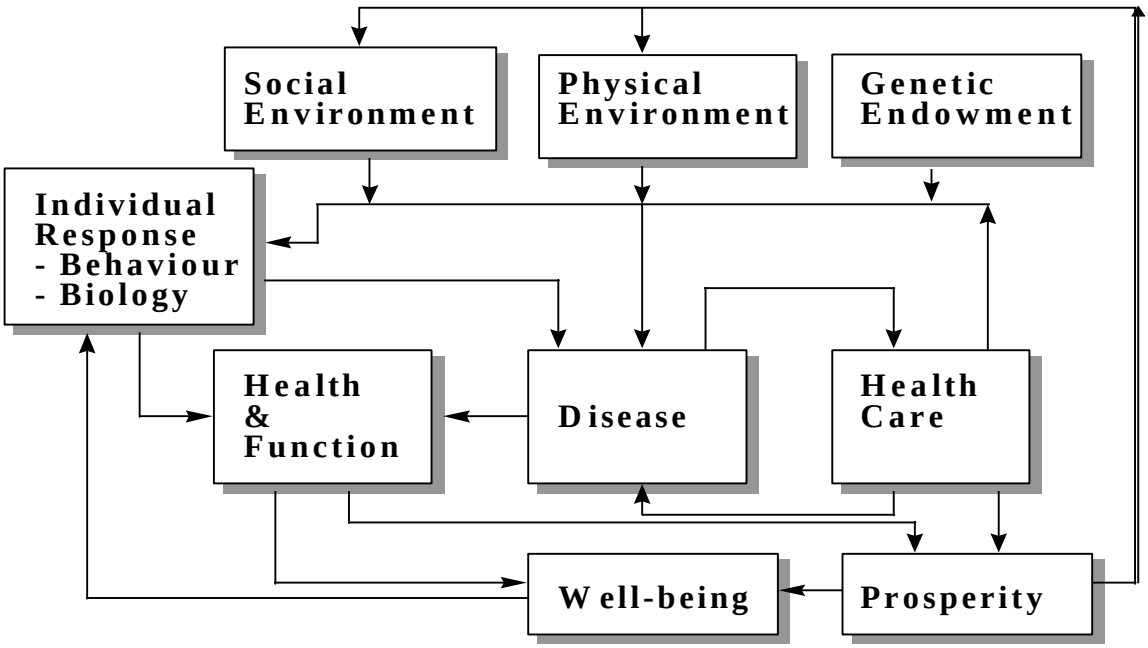
In very poor countries post mortem examinations of individuals in their sixties reveal little or no evidence of atheroma[10] (the pathological process responsible for CHD). As countries become wealthier, the more affluent develop CHD first. However, once CHD is established (for example, in affluent industrialised societies), rates fall more rapidly in the higher social classes. Consequently, there are now marked inequalities in heart health amongst the Scottish people[11]. Some, but by no means all of this, can be explained in terms of the conventional risk markers (principally smoking, cholesterol and blood pressure). There is no doubt that smoking rates, diet, exercise and a variety of other risk factors are 'worse' in our housing estates than in the affluent suburbs. Nonetheless, some of the inequalities in CHD seem to be due to a more direct effect of relative deprivation. This has led some to argue that the main thrust of strategy should be directed towards combating deprivation (because confronting deprivation could directly influence heart disease rates while indirectly changing lifestyles).

1.7 Early life influences

Variability of CHD and other chronic diseases of adult life result from geographical and social class differences in foetal and child development. Small babies, particularly those who are small in relation to placental size, have increased rates of CHD in adulthood. There is also increasing awareness of the importance of childhood influences on adult health. Poor growth and development, not only in the foetus but also in infancy, is predictive of CHD in adulthood[12].

1. 8 A more holistic model of causation

What these arguments suggests is that, although health-damaging behaviours and identifiable pathology are the visible expressions of risk, these reflect a wide range of social, economic and environmental factors that affect individual behavioural and biological responses (*see Figure 1*)[13]. These factors (e.g. physical environment, social environment, behavioural responses) explain the patterns of disease across social groups and communities, and need to be addressed for effective health promotion. If such a model is accepted as the basis for a CHD prevention strategy, simultaneous efforts will be necessary to improve the physical environment, social environment, prosperity, health care and 'personal response' (behavioural and biological) of whole populations and not just those at obviously high risk of CHD. Of course, such a strategy, if successful, would have far reaching health benefit beyond its impact on CHD.



1.9 Strategies for combating CHD

Figure 2 shows a simple representation of the natural history of disease experienced by all too many victims of CHD. In the diagram,* the horizontal axis represents advancing age from left to right while the vertical axis represents progression of disease. The symptom threshold for pathology is marked with a horizontal line. For many, early pathological changes of atheroma begin in childhood, progress as asymptomatic disease in young adulthood to become manifest as symptomatic CHD in middle life. Thereafter, the individual experiences a variable period of morbidity, characterised by increasing symptoms, that ends in premature death.

Figure 2

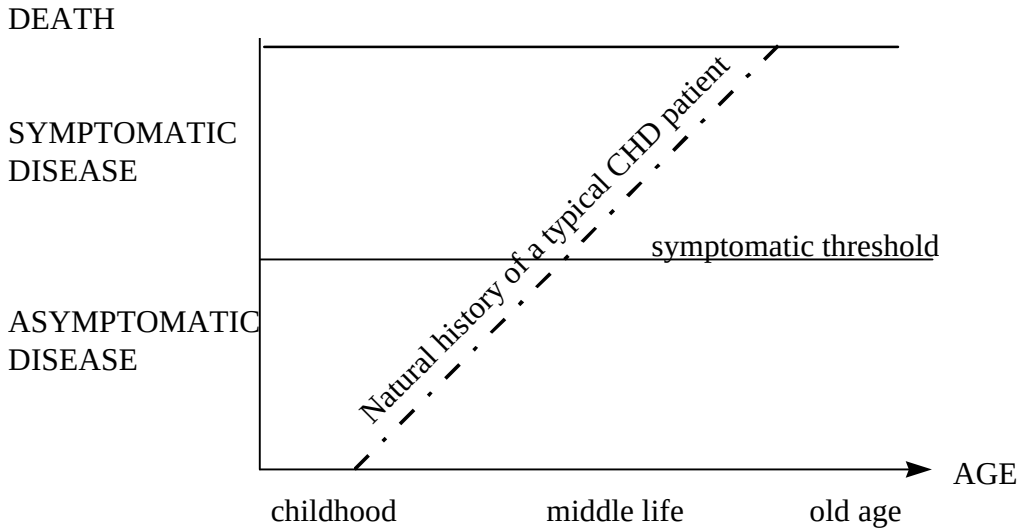


Figure 3

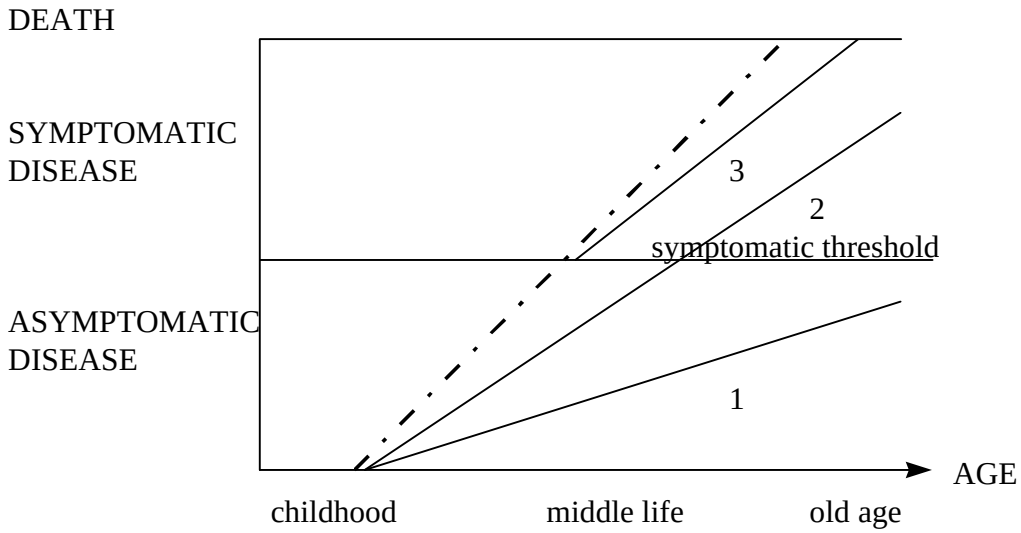


Figure 3 illustrates several options for intervention. The typical pattern of disease progression (introduced in figure 2) is shown again.

* This model is derived from a more generic version that was first presented by Fries and Capro.

- Line 1 demonstrates the ideal prevention outcome from reducing CHD risk over a lifetime. Disease progression occurs at such a slow rate that symptoms never occur, even if some pathological evidence of atheroma exists.

- Line 2 represents a more modest modification of CHD risk over a lifetime. The age of first symptoms is delayed and the rate of progression of symptomatic disease is slowed. Death, although premature, is also delayed.

- Line 3 demonstrates the impact of effective secondary prevention of CHD. Although no action is taken until the onset of symptoms, disease progression is slowed and death postponed (by a combination of secondary prevention and the successful management of acute events).

Obviously, as a strategic outcome, line 1 is preferable to 2, which is better than 3. However, the strategies are not in competition as, currently, all three approaches are required because people at all three stages exist simultaneously. It is clear from this model, that the aims of a CHD programme should be:

Aim 1: to decrease sufficiently the rate of progress of pathology in whole populations so that, for most individuals, the disease never becomes symptomatic

Aim 2: to delay the onset and progression of symptomatic disease in those at higher risk; or, failing that

Aim 3: to intervene after the onset of symptoms to prevent death in the acute phase, slow the progress of pathology, prolong survival and improve the quality of life.

Aim 1 is achieved through creating a population whose susceptibility to heart disease is greatly reduced. Aim 2 involves a strong emphasis on population strategies for primary prevention together with secondary prevention and health care interventions for those with symptomatic disease. Aim 3 requires action only for those individuals and groups with symptoms.

1.10 Judging the evidence

The approaches and interventions required to achieve aims 1 - 3 are radically different.

- Aim 1 will only be achieved through the creation of societal and population changes that simultaneously confront the physical environment, social environment, inequalities in wealth and variations in personal response (see figure 1).
-
- Aim 3 will require the judicious application of a wide variety of medical and surgical interventions combined with individual advice and support on issues of health related behaviour (lifestyle).
-
- Aim 2 combines approaches for both aims 1 and 3 and also involves traditional disease prevention interventions in high risk groups.

The contention of this report is that clinical interventions should be judged on the basis of the well-established rules of evidence based medicine but that social policy and

population based approaches should be judged no less rigorously, but require other types of evidence.

How should we establish an "evidence based health service"? If we adopt a position where interventions are limited to those which have been shown to be efficacious in double blind placebo controlled trials, only those interventions that are easily evaluated by this methodology will be considered. Other approaches that are not easily manipulated into this analytical framework (or have never attracted the funding needed for large scale research) will be excluded. There are reasons to believe that the exclusive application of such a narrow perspective may serve the more complex needs of the population poorly.

The history of the decline in smoking prevalence illustrates this dilemma.

The prevalence of smoking is now declining in the United Kingdom and most other developed countries. In retrospect, many steps can be identified in the chain of causation for this trend. The start can be traced to the original research that demonstrated the association between smoking and lung cancer. This was followed by the acceptance of smoking as a health hazard among key subsections of the population (doctors for example), then the wider social acceptance of the ill effects of smoking. The process of dissemination involved the media, activists, health education campaigns and opportunistic advice to stop smoking in the primary care setting among many other processes. Evidence of changing attitudes to smoking was then seen in the adoption of workplace smoking policies and other policies that created smoke free environments in public places. During this time health education campaigns continued and a health lobby encouraged government to increase tax and regulate the advertising of tobacco. In essence, a highly complex, interactive but somewhat unpredictable set of activities led over a period of decades to a significant change in the population's attitudes and behaviour.

It is clear that a narrow, scientific evaluation of the short term impact of component parts of the complex processes described above would provide a very partial picture of the whole process. At the time, individuals taking a narrow viewpoint could have claimed, with justification, that the value of each intervention had not been demonstrated. Yet, with the benefit of hindsight, it is difficult to see how the real and long term contribution of any single influence on smoking decline could have been isolated and measured. It is not simply that an empirically based methodology to isolate and measure the effect of any single activity would be difficult to devise but that it is arguably inappropriate to the analysis of complex interactive processes like the decline in smoking prevalence.

However, if all the actors involved in promoting the decline in cigarette smoking had waited until evidence from placebo controlled trials had been available to justify their action, the health outcome might have been very different. Eastern Europe provides ample evidence that smoking and health trends can go in very different directions.

This is not to argue that, for example, new drugs or technologies should be accepted without conclusive evidence of efficacy and effectiveness based on randomised controlled trials. Rather, this argument states that the creation of health in defined populations is dependent on such a complex and interacting set of influences, that a rigorous, holistic perspective, that includes but is not confined to narrow reductionist methodologies, may produce greater health benefits for the population.

2. CONFRONTING AIM 1

Aim 1:	**To decrease sufficiently the rate of progress of pathology in whole populations so that, for the majority, the disease never becomes symptomatic.**

The three highlighted points are necessary to confront aim 1.

- Social and economic circumstances conducive to an accelerating decline in CHD.
- Social policies to facilitate health related behaviours that reduce the risk of CHD.
- Interventions at the level of the whole population to reduce the population risk of CHD
- Interventions in those with established risk factors to reduce their risk of developing symptomatic CHD.
- Appropriate management of CHD at the primary, secondary and tertiary levels of care.
- Appropriate 'surgical' interventions of those with established disease.
- Effective rehabilitation and secondary prevention for those with established disease.
- Monitoring, audit and outcome measurement of all relevant activities.
- Research and evaluation.

2.1. Social and economic circumstances conducive to an accelerating decline in CHD.

A recent comparison of Glasgow's (relatively deprived) and Edinburgh's (less deprived) populations led to an important and counterintuitive conclusion[14]. The people of Glasgow do not die earlier because they have more heart disease. Rather, CHD, cancer, stroke and the other major causes of death are found in the same proportion in both communities. The people of Glasgow have a general vulnerability to all the major causes of death and CHD is just the leading final common pathway to death for this vulnerable population. The most fundamental task, therefore, is to reduce vulnerability to a range of chronic diseases by improving general levels of health rather than targeting specific diseases.

This insight has been expanded considerably through an important analysis of the factors that give rise to vulnerability. Wilkinson, for example, draws attention to the steepness of the social gradient in society and concludes that psycho-social factors must compound the more direct effects of the physical and social environment associated with relative deprivation[15]. He draws attention to the importance of chronic stress and his conclusions are strengthened by a recent study which demonstrates that a lack of hope is an independent risk factor for heart disease in men[16].

The conclusion from these and many other sources is clear. The single most important strategy for confronting heart disease in Scotland will be an integrated national and local initiative to confront relative deprivation with all its associated manifestations in the physical environment, social environment, health related behaviours and the human spirit.

The Government is taking the lead by reviewing strategies to combat 'social exclusion'. The new Scottish Parliament will doubtless adopt this issue as one of its priorities. The Faculty of Public Health Medicine's Scottish Affairs Committee has begun work to feed into this process. However, health boards, trusts and individual health care professionals have crucial roles as advocates for change and by adopting a style of practice that is empowering. If the NHS continues to focus almost exclusively on issues of cure and care, advocacy for changes in the fundamental determinants of health will be diluted.

Health boards, professional bodies and concerned individuals should combine in advocacy for social and economic circumstances conducive to an accelerating decline in CHD and work towards this goal in their daily practice.

The second step that can be taken at health board level is the creation of 'healthy alliances' that genuinely confront the local determinants of health. Many such alliances exist and some have achieved real, if modest, success. The problem is that partners tend to marginalise the activities of the alliance and do not allow a 'health for all' emphasis to direct the whole organisation's work. If local authorities, health boards, the academic sector, the voluntary sector, the business sector and local communities genuinely reoriented their thinking and activities to confront the determinants of health, the impact could be considerable.

Health boards should take the lead in creating or further developing healthy alliances so that they genuinely confront the local determinants of health.

2.2 Social policies to facilitate health related behaviours that reduce the risk of CHD.

2.2.1 Policies to reduce smoking

Higher taxes on cigarettes and curbs (or bans) on cigarette advertising help reduce smoking prevalence. Also the harmful effects of 'passive smoking' suggest the need for policies to ensure that all public and working spaces are smoke free.

2.2.2 Polices to promote healthy eating

The Scottish Diet[17] makes a convincing case for a policy framework for healthy eating that extends from production, manufacture, distribution, marketing to consumption. *Its major recommendations should be implemented.*

2.2.3 Policies to promote physical activity

The policy agenda is less clear in this area. The evidence suggests that individuals should accumulate physical activity that they enjoy and can become part of their daily lifestyle (walking or cycling to work is a good example). Therefore, transport policy, the use and cost of local authority leisure facilities and many other issues are relevant to this debate.

Policies should be developed at the national and local level to confront smoking, diet and exercise. These should be integrated into comprehensive national and local health improvement programmes.

2.3 Interventions at the level of the whole population to reduce the population risk of CHD

2.3.1 Population based CHD prevention programmes

Community based CHD prevention programmes are longer term programmes (usually lasting several years) targeted at whole populations and employing a variety of methodologies (e.g. health checks, social marketing, local community action etc.) The concept was first developed in the 1970s. Early successful programmes were associated with a reduction in CHD rates after three years but in cancer after a decade. The rationale for these interventions arose from cohort study findings that the majority of coronary events occurred in individuals in the middle range of cholesterol and blood pressure risk. Consequently, it was concluded that only a shift in the whole population risk profile would have a large effect on CHD morbidity and mortality. This population based approach has been contrasted with the, so called, high risk strategy where individuals at high risk are identified and treated. Seven community based CHD programmes that also had a comparison area (to allow evaluations) were started in the 1970s. The most famous of these was the North Karelia Project[18] in Finland. Five of the seven projects had positive effects on smoking, five on cholesterol and five on blood pressure. In the 1980s three major community based programmes were started in the US and one in Germany. In all of these, differences between the intervention and comparison areas (in terms of modification in major risk factors) were either small or non significant. The effect these studies had on end points like mortality has also been disappointing[19].

One way of interpreting these findings is to consider how learning about CHD risk diffuses through a population. In the 1970s the prevention concept was new and larger differences were detected between the intervention and comparison areas. By the 1980s most of the activities developed in the community CHD programmes were already being used (at least in part) by national programmes. Such an analysis does not provide a complete explanation for the disappointing results shown by some large scale community based interventions. The failure to show consistent and statistically significant changes in mortality even when risk factors have changed is the source of continuing debate.

It is likely that the success of the North Karelia project comes from the way it was constructed. Key factors appear to be a comprehensive, theory based, community action approach aimed at risk factor reduction which achieved sustainability. Also the people of North Karelia were involved in the changes from the 'bottom up' and this would seem to be fundamental.

The lesson for the 1990s is that the community based CHD programme of the style developed in North Karelia and replicated elsewhere may provide a model for Scotland. However, lessons should also be learned from less successful interventions that often took a much more 'top down' approach with little true community involvement. Also, given the interaction between health related behaviours and a wide variety of disease and health outcomes (e.g. diet and exercise influence many diseases and well being), careful thought should be given to whether the focus should be CHD prevention (as the main issue) as a more holistic approach might be more successful.

2.3.2 Screening for CHD risk factors in 'healthy' populations (health checks)

Despite their frequent utilisation (in primary care, workplaces and other settings) health checks have been criticised for several reasons.

1. It has been argued that health checks preferentially attract individuals from the middle classes who are at relatively low risk of ill health; the so called “worried well”.

2. Health checks do not have a large effect on measurable coronary risk. This has now been demonstrated by recent primary care based and workplace studies[20].

3. Health checks may impair well-being by provoking anxiety.

Doubt has been cast on the future of health checks as a consequence of these criticisms and economic analysis has led to the conclusion that the effects of health checks must be shown to last for at least ten years if they are to be cost effective[21]. Others take a more positive view of workplace health promotion. In North America rigorous evaluations of workplace health promotion are becoming more common and the case is now being made that workplace health promotion can be shown to improve key health indices[22]. In the meantime, health promotion practice has been changing. Other studies have shown that work site interventions that use more sophisticated behavioural approaches can produce lasting changes in some cardiovascular risk factors and are more effective than simple risk assessment or risk education. For example, work on stages of behaviour change[23] suggests that an intervention may result in a movement towards a health related behaviour change which, at that point in the individual's career of decision making, is not yet manifested in behaviour change but is instrumental in changing the individual’s thinking. *The weight of opinion is now against employing health checks as a means of multiphasic screening for CHD risk factors in healthy populations (whether in primary care, the workplace or elsewhere).* Nonetheless, if rational decisions about the future of health checks are to be made, more information is required on the drivers of changes in health related behaviour.

2.3.3 Social marketing

Social marketing involves the creation of programmes designed to influence the acceptability of social ideas and practices in target groups.[24] It is a potentially powerful tool but its limitation must also be realised. Social marketing can raise awareness and alter perceptions but will seldom, in itself, lead to behaviour change. A successful example (perhaps because it was backed up by strong enforcement and deterrence) is the drink drive campaigns that have changed the social acceptability of drinking and driving.

Analysis of the changes in drinking and driving indicate that the positive effects cannot be explained by one social behavioural theory alone. Among the explanations are innovation diffusion theory, behavioural modification, community support and environmental modification. It is clear, however, that the hallmarks of successful social marketing are consumer orientation, clear objective setting and market segmentation (followed by targeting of the chosen segments). There is, therefore, an opportunity to apply these principles and theories to CHD prevention.

2.3.4 'Settings based' health promotion methodologies

A brief description of a health promotion school will illustrate the approach. If children are taught about healthy eating but the school lunches provide no 'healthy options' the contradiction is obvious. This idea of consistency can be carried much further. A health promoting school should consider the whole school environment (issues of safety and aesthetics), the formal curriculum, the informal or extra school curriculum (opportunities for sport and personal development), the ethos of the school and so on. This approach seeks to involve parents, teachers, pupils and the wider community in the creation of a school in which all aspects of school life work together to promote health. A similar approach can be taken in many settings including hospitals, workplaces and housing schemes. *Many boards have adopted a settings based approach but it remains poorly understood beyond the health promotion community.*

2.3.5 Policies to promote the acquisition of 'life skills' among young people

As a child matures, he or she acquires a variety of 'life skills' that are necessary for a healthy life. These include assertiveness, the ability to estimate risk, negotiation skills, the desire and ability to delay gratification and so on. Children who fail to acquire these skills, or who acquire a distorted manifestation of them, are at a severe disadvantage. *Interventions to enhance the 'life skills' of children will have important long term benefits.*

This approach can be part of an integrated programme of CHD prevention. For example Finland has used prizes for smoke free classes, teaching healthy cooking to boys and girls and the provision of healthy school food as part of their national programme.

The principle can be extended to other age groups, for example teaching food label reading and promoting healthy shopping bargains.

In summary, a wide variety of health promotion methodologies have been shown to be effective but the challenge is to co-ordinate their implementation and ensure the effects are large enough to impact on CHD rates.

3. CONFRONTING AIM 2

Aim 2:	**To delay the onset and progression of symptomatic disease in those at higher risk**

The highlighted bullet point is necessary to confront aim 2.

- Social and economic circumstances conducive to an accelerating decline in CHD.
- Social policies to facilitate health related behaviours that reduce the risk of CHD.
- Interventions at the level of the whole population to reduce the population risk of CHD.
- Interventions in those with established risk factors to reduce their risk of developing symptomatic CHD.
- Appropriate management of CHD at the primary, secondary and tertiary levels of care.
- Appropriate 'surgical' interventions of those with established disease.
- Effective rehabilitation and secondary prevention for those with established disease.
- Monitoring, audit and outcome measurement of all relevant activities.
- Research and evaluation.

3.1 Interventions in those with established risk factors to reduce their risk of developing symptomatic CHD.

As discussed above, there is equivocal or disappointing evidence to support routine screening for CHD risk factors in healthy populations (traditional health checks for CHD prevention). However, the evidence for personalised health education is stronger. For example, the evidence for confronting smoking[25] as a discrete problem in the primary care setting using opportunistic screening is convincing.

3.2 Personalised health education

Personalised health education can be worthwhile. Well-tested theories of behaviour change emphasise the range of attitudinal, motivational, cognitive and environmental factors that can support or inhibit an individual's ability to change behaviour. The challenge is to find the health education intervention that best addresses these diverse factors. However, policies are also needed to establish environments that support the maintenance of health-enhancing behaviours (making the healthy choices the easy choices).

3.3 Smoking interventions (in particular in primary care)

The majority of those who succeed in stopping smoking do so unaided. Nonetheless, in the primary care setting, several trials have shown that simple smoking cessation advice, given in the context of a patient initiated consultation, achieves about 5% cessation, sustained for at least one year. Higher success rates have been achieved in selected populations of smokers highly motivated to stop and with more intensive interventions (e.g. nicotine substitutes, smoking cessation groups)[26].

3.4 Detecting and treating high blood pressure

In broad terms, a quarter of the population has a blood pressure level defined as hypertensive and a third of CHD deaths may be attributable to high blood pressure. A combination of opportunistic and more formal screening of general practice populations can result in the detection, effective treatment and follow up of patients with raised blood pressure. *This is now established as part of the primary care role. The challenge is to turn best practice into universal practice.*

3.5 Giving advice on diet and exercise

It is difficult to change people's eating habits and there is little convincing evidence of widespread dietary change following advice. Some well constructed interventions are successful, but health education has failed to prevent, let alone reverse, the trend in Scotland and the UK towards increasing obesity. Dietary interventions can cause weight loss. However, the pattern seems to be that the weight is gained quickly after the intervention stops. The 'Scottish Diet'[27] provides a set of integrated policies to confront this problem.

In a similar way, the promotion of physical activity requires interventions at many levels in society. Advice from GPs (and exercise prescription schemes) has equivocal outcomes and can only be part of a broader strategy.

3.6 Prescribing cholesterol lowering agents

In this section, primary prevention (prevention among individuals who do not yet have symptomatic disease) through cholesterol lower agents will be discussed. The role of cholesterol lowering drugs in secondary prevention will be discussed in chapter 4.

Cholesterol is an important risk factor for CHD. Recent RCTs have changed ideas about the benefits of treating raised lipids with drugs. The West of Scotland Coronary Prevention Study (WOSCOPS)[28] and the more recent AFCAPS/TexCAPS study[29] have shown a benefit in primary prevention. A relative risk reduction of around 30% is seen in those across the range of starting cholesterol levels and starting overall risk. However, absolute benefit is greatest in those at highest risk. Thus pharmacological lipid lowering should be considered in the context of all the established risk factors and not only on the basis of the cholesterol (or other lipid fraction) level. For the WOSCOPS study population (middle aged men with moderately raised cholesterol levels) it has been suggested that the cost per life saved is around £500,000. However, for the higher risk groups in the study population, this figure falls to a much lower figure[30]. Thus when deciding whom to treat in primary prevention, the absolute risk should be calculated e.g. using the Sheffield risk tables[31], the New Zealand risk tables[32] or some other method. The recent SMAC guidance for England and Wales[33] suggests an annual level of risk of 3% of a major coronary event as a suitable starting point. Moving the threshold up or down will affect the cost of treatment in a population. The numbers involved in any population at a particular risk level, and therefore the cost of the treatment, will depend also on the prevalence of the disease. The SIGN guideline on Lipids and the Primary Prevention of Coronary Heart Disease are currently in draft and will give a Scottish consensus on whom to treat.

Apart from cost and the question as for whom the pharmacological intervention is effective, there is also the ethical issue of whether doctors should medicalise a problem (the diet that leads to high cholesterol) that arises from established environmental and behavioural causes? The answer to that question requires a debate that involves the wider community.

For these reasons, prevention using statins in those with no symptomatic CHD should be confined to individuals with high overall CHD risk as defined by an agreed local protocol or, in its absence, the advice of the Standing Medical Advisory Committee.

4. CONFRONTING AIM 3

Aim 3:	**To intervene after the onset of symptoms to prevent death in the acute phase, slow the progress of pathology, prolong survival and improve the quality of life.**

The highlighted needs should be addressed to confront aim 3.

- Social and economic circumstances conducive to an accelerating decline in CHD.
- Social policies to facilitate health related behaviours that reduce the risk of CHD.
- Interventions at the level of the whole population to reduce the population risk of CHD.
- Interventions in those with established risk factors to reduce their risk of developing symptomatic CHD.
- Appropriate management of CHD at the primary, secondary and tertiary levels of care.
- Appropriate 'surgical' interventions of those with established disease.
- Effective rehabilitation and secondary prevention for those with established disease.
- Monitoring, audit and outcome measurement of all relevant activities.
- Research and evaluation.

4.1 Appropriate management of CHD at the primary, secondary and tertiary levels of care.

Mortality rates are high in individuals with symptomatic CHD. A 60 year old man's annual chances of death are about 5% with angina, 10% following a heart attack and 50% with severe heart failure. Secondary prevention and rehabilitation are currently organised between primary and secondary care but there is large variability in practice and availability.

4.2 CHD in primary care

Most patients with symptomatic CHD are treated in a primary care setting. After debate and controversy over the role of health promotion in primary care there is now a consensus arising that priority should be given to implementing preventive measures in patients with established CHD (i.e. secondary prevention and rehabilitation). These tasks should be accomplished in the context of planned co-operation between primary and secondary care.

There are an estimated half a million Scots with underlying CHD pathology, with around 180,000 being treated for symptomatic disease. Also, there is some evidence that a proportion of those at risk are unrecognised or being treated suboptimally. Desirable changes in lifestyle for this group include stopping smoking, exercise and dietary modification. The evaluation of formal cardiac rehabilitation programmes has been difficult because of variability in components and protocols but a recent overview of 22 trials concluded that the risk of CHD mortality can be reduced by 22% and reinfarction by 25%.[34]

Pharmacological interventions that have been tested in patients with a history of myocardial infarction include antiplatelet therapy (principally aspirin), beta blockade, angiotensin converting enzyme inhibitors and lipid lowering drugs. The benefits of

antiplatelet therapy have been established for patients after a myocardial infarction and extend to those with angina and those who have undergone revascularisation procedures[35]. Beta blockade can reduce the risk of reinfarction and death after myocardial infarction[36] and angiotensin converting enzyme inhibitors reduce the risk of death and coronary events in patients who have compromised left ventricular function after myocardial infarction.

The effectiveness of each of the above is now well established. More recently, the Scandinavian Simvastatin survival (4S) study[37] of patients with angina or a history of myocardial infarction showed in patients with a total cholesterol concentration of 5.5 - 8.0 mmols/l, a 30% reduction in total mortality and 42% reduction in coronary mortality over a five year follow-up. Even more recently the CARE study[38] demonstrated equivalent benefits in patients with a lower range of cholesterol (less than 6.2 mmol/l). Secondary prevention, using statins, also seems to be relatively cost effective. *Consequently, the highest level of evidence now supports the use of lipid lowering agents in secondary prevention* (as discussed earlier their role in primary prevention is more open to debate).

There is no doubt, however, that general practice faces a formidable task in implementing all of the above tested interventions in daily practice. A practice of 10,000 will have between 300 and 500 individuals with established CHD but many fewer with MIs.

4.3 CHD in secondary care (acute phase)

One quarter of patients die within an hour of symptom onset (sudden death) and are thus inaccessible to health services. Community initiatives to extend skills in cardiopulmonary resuscitation are part of the response to this problem.

Most patients surviving for longer are admitted to hospital where they receive aspirin (the majority), clot-busting thrombolysis (about a third) and cardiopulmonary resuscitation if required (about one tenth). *Even although the evidence is not robust, the current clinical consensus within Scotland is that all patients suspected of having an acute myocardial infarction should be considered for admission to a Coronary Care Unit.* While this consensus begs a number of questions, SNAP supports this view and would seek to encourage the trend towards protocols of care that ensure that secondary prevention and rehabilitation begin immediately. In more rural areas CCU admission may not be an option.

4.4 Angina pectoris

Angina is a recurrent discomfort or pain which is precipitated by exertion or emotion and is relieved by rest and/or nitrates. Up to half of patients with angina are referred to a hospital specialist (cardiologist). Management options then include increased medication, intensive investigation, or revascularisation. Revascularisation involves widening the narrowed coronary arteries by balloon angioplasty (opening up of the narrowed artery by a balloon passed into the artery on a wire) or by Coronary Artery Bypass Graft (CABG - surgery to bypass each narrowed artery). These treatments relieve symptoms but do not cure. Debates over growing CABG waiting lists highlight an increased readiness to refer and investigate such patients. This conflicts with limited NHS resources and raises awkward questions about cost-effectiveness. In Scotland this debate came to a head in the contrasting approaches taken in the PHPU report 'Coronary Heart Disease in Scotland'[2] and the Intercollegiate review produced in response to that document.[3]

Patients with stable angina may live for many years provided that they can adapt their lifestyle and receive effective drug treatment to control their symptoms but many have moderately or severely restricting symptoms.

The severity of symptoms does not reflect the severity of the disease in the arteries and a normal ECG does not preclude the presence of coronary heart disease. Thus, it is important that all patients who are diagnosed in primary care as having angina should have the prognosis assessed and a management strategy planned based on objective evidence such as exercise testing and, if necessary, angiography (an X-ray of the arteries round the heart taken using an injected dye).

New angina (where the pain is not controlled by maximal medical treatment), anginal pain at rest or during sleep, or angina which is becoming increasingly frequent or severe is called "unstable angina". It often heralds an impending myocardial infarction or death and requires urgent hospitalisation for assessment and treatment which may include surgery or an equivalent "unblocking" procedure of the affected artery.

Incidence estimates for angina vary between 1 and 5 per 1,000 population. These estimates vary by the age and sex group studied and the method of case finding. It is generally more common in older groups and among men. Since the disease is often only detected when symptoms (or death) occur, there is much undetected disease in the community.

Prevalence estimates are usually up to 10% for middle aged men and less for women. The prevalence rises with age and is greater for men than women. Prevalence varies by socio-economic group as outlined in the section for CHD. In the year following diagnosis of angina, 4% of patients die and 7% have a non-fatal heart attack. Other studies of angina have shown a 1-2% annual mortality over 25 years and double that rate for infarction.

4.5 Service use by angina patients

Patients coded as having ischaemic heart disease but excluding those admitted with myocardial infarction are heavy users of hospital services. The diagnosis is associated with use of 166,000 bed days, 2.1% of all acute bed days and a crude rate of 3230 bed days per year per 100,000 population. The rate of admission is rising steeply. A general practice with 10,000 patients would expect around 500 consultations each year with patients complaining of angina pectoris. No reliable data are available for the number of exercise tests or echocardiography studies carried out on this group of patients. Probably less than 10% have had an exercise test[39] indicating a requirement for increased resources to provide this service for all new angina cases.

There is some evidence to support the effectiveness of surgical interventions[40]. CABG does improve survival rates (at least for the first 10 years after surgery) and there are real benefits in terms of quality of life. Also, the majority of patients with proximal narrowing in one or two coronary arteries initially experience symptomatic benefit and improved quality of life following angioplasty. Nonetheless, angioplasty and CABG rates vary widely between Health Boards (Figure 4).

Figure 4 Rate per 100,000 population by health board of residence 1993-1995

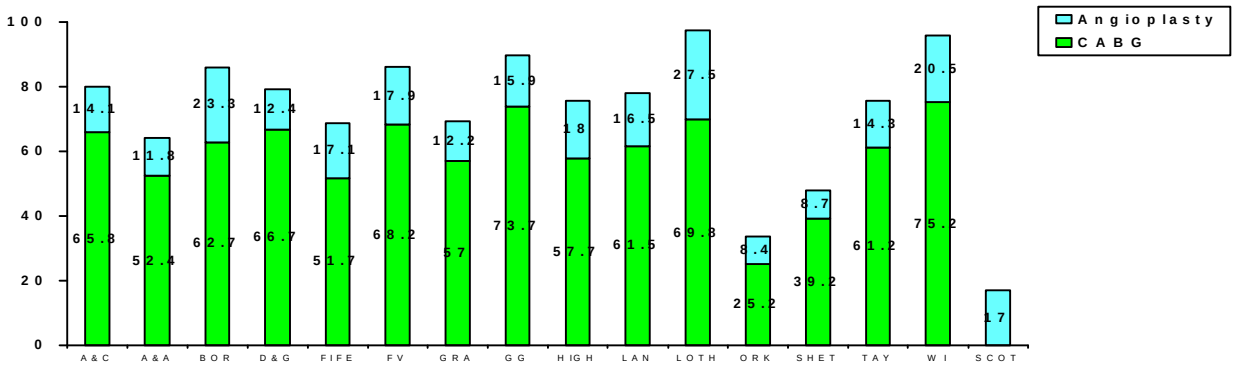
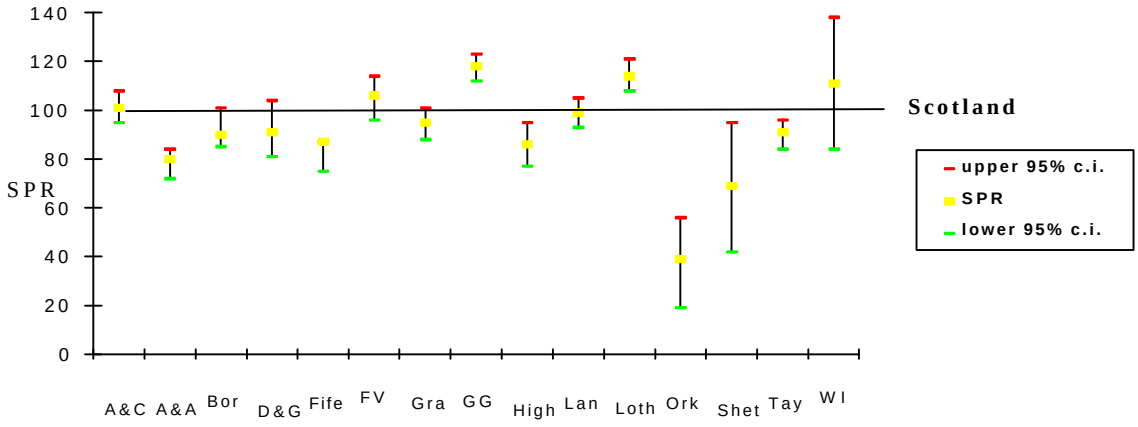


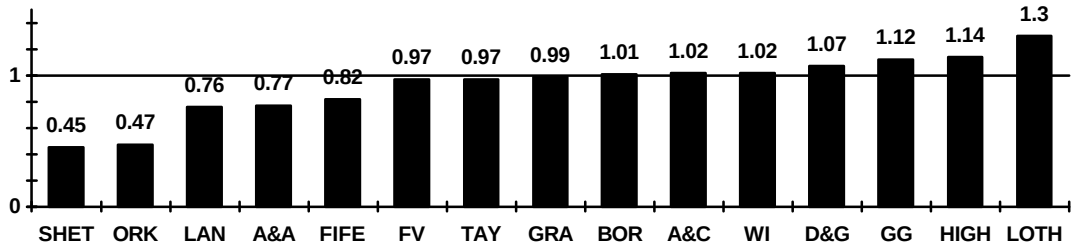
Figure 5 shows the standardised episode ratio with 95% confidence intervals for the use of revascularisation procedures by health board of residence. These data confirm that there is a significant variation in revascularisation rate between health boards with the population of some boards having significantly less than the Scottish average.

Figure 5 Standardised procedure ratios, both sexes, CABG, angioplasty, Scotland 1993-4



When the mortality from CHD is taken into account (as a proxy measure for the prevalence of CHD in each area), it can be argued that people in different areas of Scotland have different chances of receiving CABG or angioplasty. (Figure 6)

Figure 6. Ratio of age/sex standardised CABG rate, for residents of health board areas, to age/sex standardised mortality ratio (1994 data)



Those areas with a value above 1 provide more CABG interventions than the Scottish "norm" and those with a value below 1 provide less. However, it cannot be assumed that Scotland as a whole has an appropriate rate of provision as it is much lower than many other developed countries with a lower CHD mortality than Scotland. Furthermore, the number of angioplasties carried out on each health board's population varies and apparent shortfalls in CABGs might be made up by

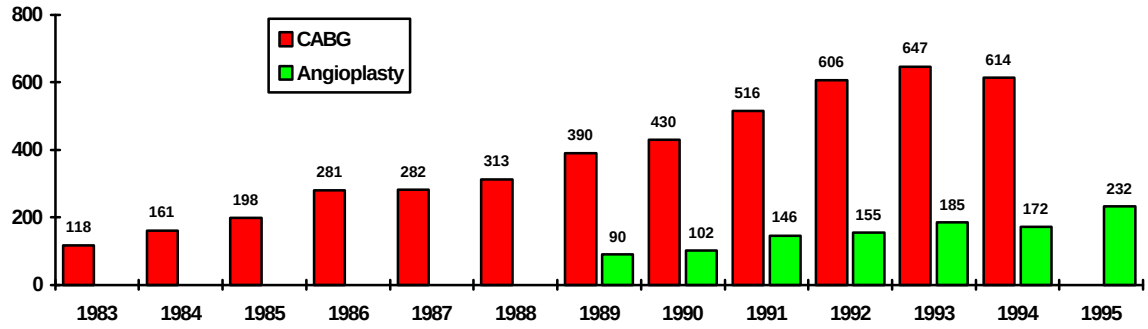
angioplasty. It is difficult to be certain about the correct balance between procedure rates. In addition, year to year variations occur in the number of procedures by health board so the rank order of boards will vary from one year to the next. The interesting feature of this data is the three fold variation between the ratios of the boards at either end of the graph.

Numbers of CABGs and angioplasties carried out in Scotland have been increasing steeply over time (Figure 7).

Figure 7.

Trends In CABG And Angioplasty Rates:

Age Standardised Rates Per Million Population



There were very few angioplasties before 1989 as it was a new technique.
CABG standardised for age and sex (1983 based); angioplasty rates standardised for age

The fundamental question for service planners is whether or not this level of intervention is adequate to deal with the avoidable mortality and morbidity associated with ischaemic heart disease and, particularly, angina. *At present, no firm conclusion can be reached as to the appropriate level of revascularisation that should be provided for the Scottish population.* To have any robust calculation of this figure, one would need to know, for each Health Board area, the prevalence of remediable coronary occlusive disease in the population. It is unlikely that such a survey would ever be undertaken. A possible proxy would be the prevalence of angina in each area.

However, there is some evidence that patients from poorer areas are less likely to be investigated with a view to revascularisation and, as a result, the need for surgery might be underestimated in these areas. Similarly, women appear to be under-represented in their provision of surgical interventions. However, a significant pointer to the need for surgery can be deduced from data collected as part of the Cardiac Surgery audit funded by the three Scottish purchasing consortia. This shows clearly that, in Scotland, patients undergoing CABG tend to have more advanced disease than is commonly reported in series from other countries. *There is no evidence that patients in Scotland are being operated on inappropriately. This observation raises the possibility that some who might benefit from surgery may not be receiving it. Until more information is available on the prevalence of treatable lesions, it is impossible*

to say with certainty that all patients who might benefit from surgery have access to such care.

In the light of this uncertainty, health service planners will have to resolve the issues of inequity and discover which categories of patients should be referred because evidence supports a cost effective outcome.

4.6 Acute Myocardial Infarction (Heart Attack)

Myocardial infarction can be the most dramatic manifestation of CHD, often causing sudden, severe crushing chest pain or sudden death with little or no warning symptoms. It is usually the result of a clot (thrombus - hence "coronary thrombosis") attaching to the diseased wall of a major artery to the heart. In those under 65 years of age, about 50% of acute myocardial infarctions occur in people previously known to have CHD - either a previous infarction or angina. This proportion rises with age because more victims will be having a second or subsequent attack.

Acute treatment should include pain relief, aspirin (to prevent further clot formation), thrombolysis (to dissolve the clot and restore blood supply thus reducing the muscle damage), beta-blockers to reduce sudden death due to rhythm disturbance and ACE inhibitors for heart failure. Thrombolysis is most effective the earlier in the attack it is given. Most deaths occur early in the attack and the availability of resuscitation facilities (including defibrillators) early in the attack is important.

Following a heart attack, patients should be assessed using exercise testing to see whether there is extensive coronary heart disease which should be treated by surgery to the coronary arteries; echocardiography is also indicated to diagnose heart failure. As discussed in chapter 3, rehabilitation (exercise, education and psychological counselling) reduces subsequent mortality and improves quality of life.

Studies show a wide geographical variation in incidence e.g. 8.4 per 1,000 for men less than 70 years in Edinburgh in 1972 and, in 1973 in Oxford, a rate for the same group of 4.5 per 1,000. Incidence in North Glasgow is shown in Table 1.

Table 1
Annual age-specific incident coronary event rate/1,000 population
Glasgow North MONICA Population
1985-1991

	MEN	WOMEN
25-34	0.1	0.02
35-44	1.5	0.4
45-54	5.4	2.0
55-64	10.8	4.5
Age standardised rate	3.9	1.4

There is variation by social class, greater for women than men. Other studies show higher rates for those from the Indian sub-continent. Fatality during myocardial infarction is around 50% and two thirds of the deaths occur outside hospital. *Community strategies to reduce the delay in getting to hospital and in minimising the delay between the onset of symptoms and the presence of resuscitation facilities and thrombolysis are vital if mortality is to be reduced.* These strategies will differ from area to area, particularly between urban and rural settings.

Acute myocardial infarction accounts for 192,500 bed days, 2.4% of all acute bed days, a crude rate of 3740 bed days per year per 100,000 population. The rate of admission is falling.

4.7 Heart Failure

The single most common cause of heart failure in Scotland is CHD. Heart failure occurs when the heart does not pump properly. This produces breathlessness, lethargy and ankle swelling. Diagnosis should not be made solely on physical examination which can be unreliable. It should include ECG and echocardiography or some other imaging technique. Drug treatment is directed at reducing the heart's work (ACE inhibition), or improving the heart's pumping efficiency (digoxin), and reducing retained fluid which cause breathlessness and swelling (diuretics). No surgical treatment, except heart transplantation in exceptional cases, is available. Careful control of drug therapy, education of the patient and modification of risk factors can produce benefit in terms of quality of life and reducing hospital admissions.

At any one time, at least 1% of the population has heart failure. The incidence is around 0.3%. Heart failure carries a high mortality - in-hospital case fatality is 30%. Before the ACE inhibitor era the condition had a mortality rate of 50% at 5 years after diagnosis, and for severe heart failure a 50% survival at one year.

The problem is not only mortality but also morbidity - death comes after a period of ill-health. The patient suffers from debilitating fatigue and breathlessness which affect functional capacity and quality of life. The syndrome affects quality of life more than hypertension, diabetes, angina and chronic lung disease.

The extent to which heart failure patients use hospital resource is not easily defined but is estimated at 14,000 admissions per year with a cost to the Scottish Health Service of £20m. Hospital admissions are rising steeply world-wide and also in Scotland. In 1990 admissions for heart failure accounted 3.6% of general medical

and 4.3% of geriatric assessment discharges as a first diagnosis. Thirty percent of patients with a hospital admission for heart failure are re-admitted within 1 year.

4.8 Secondary prevention and rehabilitation

Significant benefits can come from effective secondary prevention activities. In brief, the risk of death post heart attack will be halved by stopping smoking, reduced by a third by cholesterol reduction and by a quarter by medications (aspirin, betablockers, ACE inhibitors or a combination) or a comprehensive rehabilitation programme (including stress management, exercise, and dietary advice). See the section above on primary care for more details.

5. COST EFFECTIVENESS

One approach to addressing benefits of CHD interventions can usefully be summarised by the "NNT" approach (the Number of patients Needed to Treat for one year to prevent one death). If the number needed to treat is high, two disadvantages follow. The first is the potential for high costs and the second is the large number of individuals who will receive the intervention with all the attendant risks of side effects.

Figure 8. Number of patients needed to be treated for one year to prevent one death

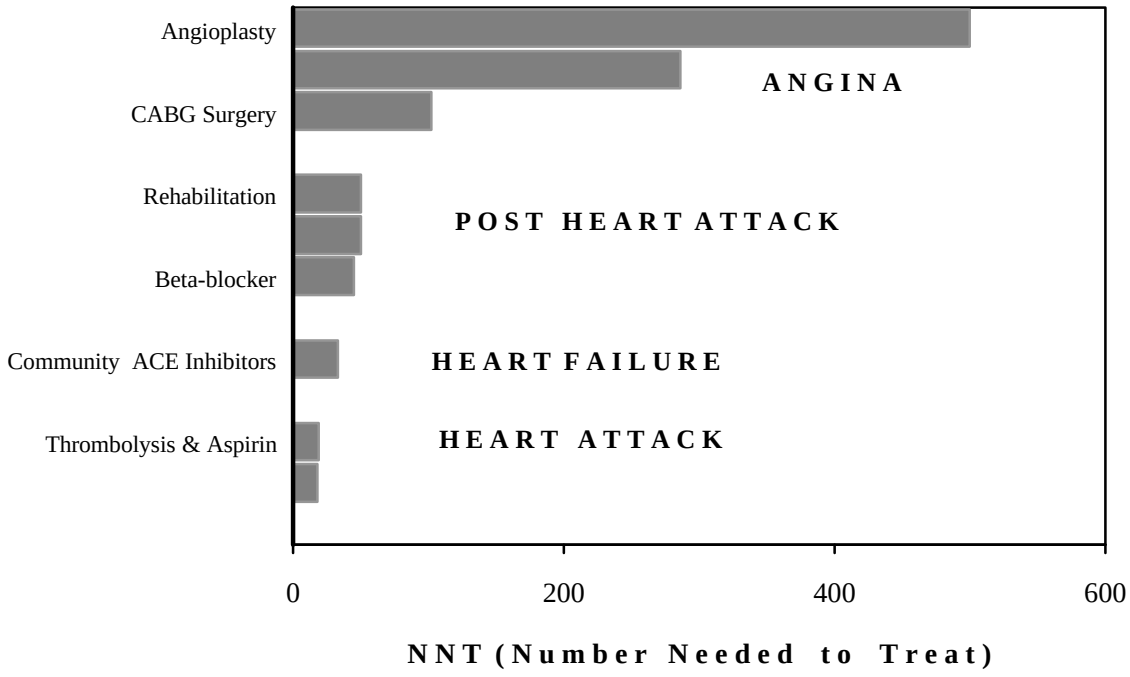
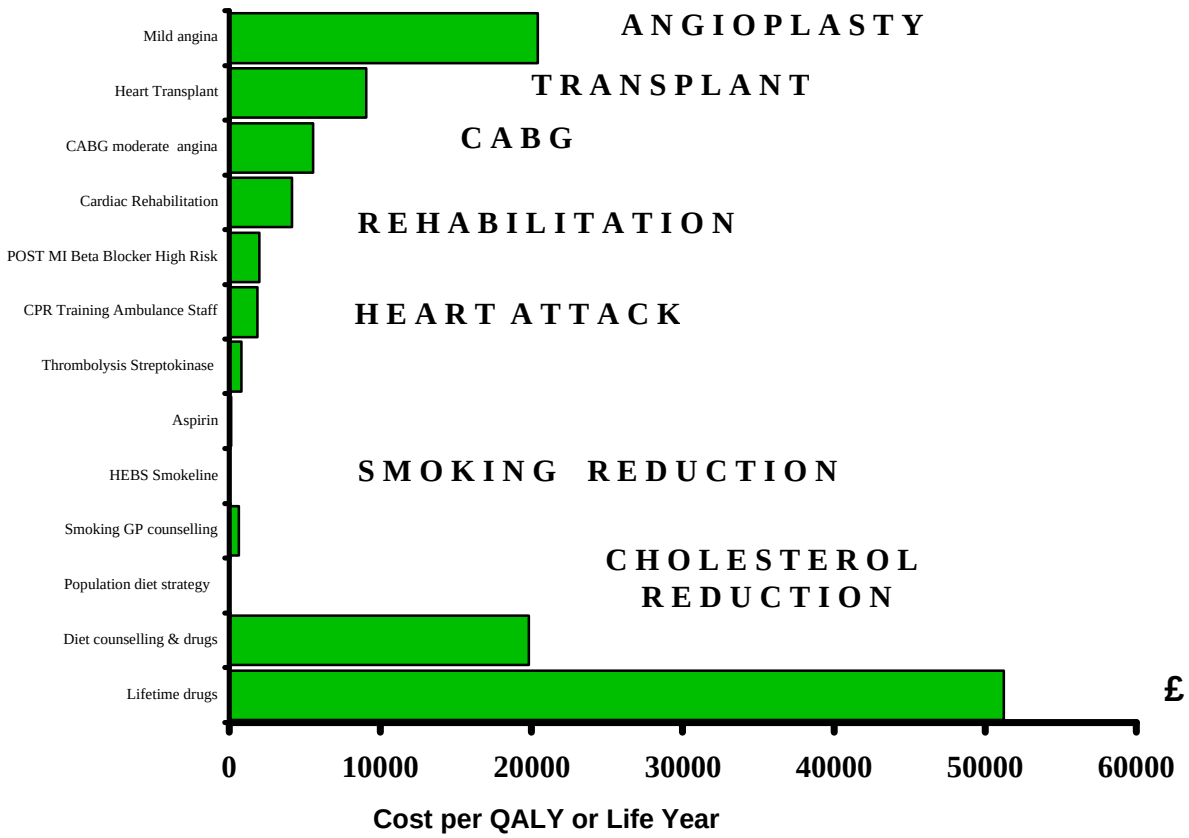


Figure 8 shows that where mortality is highest (e.g. following a heart attack) the benefit in terms of the number of people needed to treat for one year to prevent one death is much lower than when mortality rates are lower (e.g. in patients with angina).

A patient's quality of life can also be severely reduced by heart disease. Treatment effectiveness can, therefore, also be measured using quality adjusted life years (QALYs). These can be combined with cost data to calculate the cost per QALY for different interventions (Figure 9). Acrimonious debates about detailed methodology and precision can obscure the remarkably consistent findings. In general, there is a gradient in cost-effectiveness: low costs and high effectiveness for national schemes and, moving from community to individual initiatives, progressively more expensive and less effect (Figure 8). Primary prevention, particularly in populations, is generally cheap. Secondary prevention is effective but at a cost, whereas high tech interventions in tertiary care hospitals for established disease are generally expensive with least benefit.

Figure 9 Summary Table Of Cost-Effectiveness



Such cost per QALY tables always attract legitimate criticism. Also, new data constantly causes costing ratios to be revised. For example, the cost per QALY of lifetime drugs is currently the source of much debate. Therefore, both the estimations of cost and effectiveness for each entry are open to criticism. Nonetheless, the general pattern of the figure is unambiguous and should be a factor in health service planning.

Conclusions

This report argues that while there are some ongoing areas of uncertainty, there are many actions that can be taken to improve CHD in Scotland. An assault on inequalities in wealth and health is probably the most important but many other interventions (public policy, settings based health promotion, secondary prevention in primary care, cardiac rehabilitation - to name but a few) can be effective. All are needed but the balance of expenditure on each remains controversial.

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PART 2.

1. INTRODUCTION

This report focuses upon coronary heart disease for the following reasons:

> Coronary heart disease in **Scotland has a high incidence** compared with the rest of the United Kingdom and internationally, and the need to address CHD has been expressed nationally by many groups and individuals.[1234]
>
> The latest Annual Report of the Scottish Chief Medical Officer[5] highlighted coronary heart disease (CHD) as the **major cause of premature mortality and morbidity.**
>
> The SOHHD has set a target in line with Health For All 2000 to reduce deaths from CHD in the under 65's by 40% between 1990 and the year 2000.[6]
>
> Increasing availability of evidence about effectiveness of preventive and treatment measures which affords the **opportunity substantially to improve the overall health** of the people of Scotland.

The main cause of heart disease is **inadequate blood flow to heart muscle** because of disorders of the arteries supplying it (the coronary arteries). Coronary heart disease causes around 90% of deaths from heart disease which is why it is the focus of this needs assessment.

This report addresses the issues underlying the genesis of coronary heart disease, and the patterns of its occurrence and treatment within the community (its epidemiology). Also, it reviews aspects of the delivery and effectiveness of preventive and treatment services and outlines appropriate actions for commissioners of care.

2. DEFINITION OF CORONARY HEART DISEASE (CHD)

2.1 Coronary heart disease (Synonym - Ischaemic Heart Disease)

This is a collective **term given to symptomatic manifestations of reduced blood flow in narrowed coronary arteries (those which supply the heart muscle).** The underlying disease process starts in childhood with development of fatty deposits (atheroma) in the internal lining of the arteries. With the passing years such deposits increase in size and can change the nature of the lining of the artery so that components of the blood stick to it. The net result of these processes is a progressive narrowing of the artery. When it occurs in the coronary arteries, this narrowing can result in reduced blood flow to the heart muscle (myocardium) which can give pain when increased demands are placed on it as in exertion (anginal pain). If there is a sudden excessive demand made of the heart, or the blood vessel finally becomes suddenly blocked, then death of heart muscle can occur rapidly - an acute myocardial infarction or heart attack. The heart can also stop suddenly in such an attack because of electrical disturbances in the muscle.

Therefore, **the probability of death following myocardial infarction is high** and those who survive may have permanent disability. This disability can arise from inability of the heart to perform as a pump driving the circulation of blood throughout the body (heart failure).

3. PATTERNS OF OCCURRENCE OF HEART DISEASE

A commissioning strategy for coronary heart disease must take account of how common it is and how this frequency of occurrence differs between different groups and areas and over time - **its epidemiology.**

Dramatic events such as heart attacks are easiest to detect and diagnose. Therefore the numbers of new cases occurring over a period of time (the incidence of heart attacks) is reasonably accurately known. For chronic conditions it may be difficult to tell when they start, therefore it is necessary to estimate how many patients are suffering from, for example angina or heart failure, within a community at a given point in time (the prevalence of the condition).

Frequently **death rates from heart disease are used as the parameter by which groups are compared** because death is universally reported and cause of death given. Most international comparisons are of death rates from heart disease.

It should be noted that errors can occur in diagnosis and in attributing causes of death, since the underlying causes of disease exert their influence throughout a lifetime. In the elderly, in particular, some may have myocardial infarction recorded on the death certificate as the cause of death, even when this was not certain.

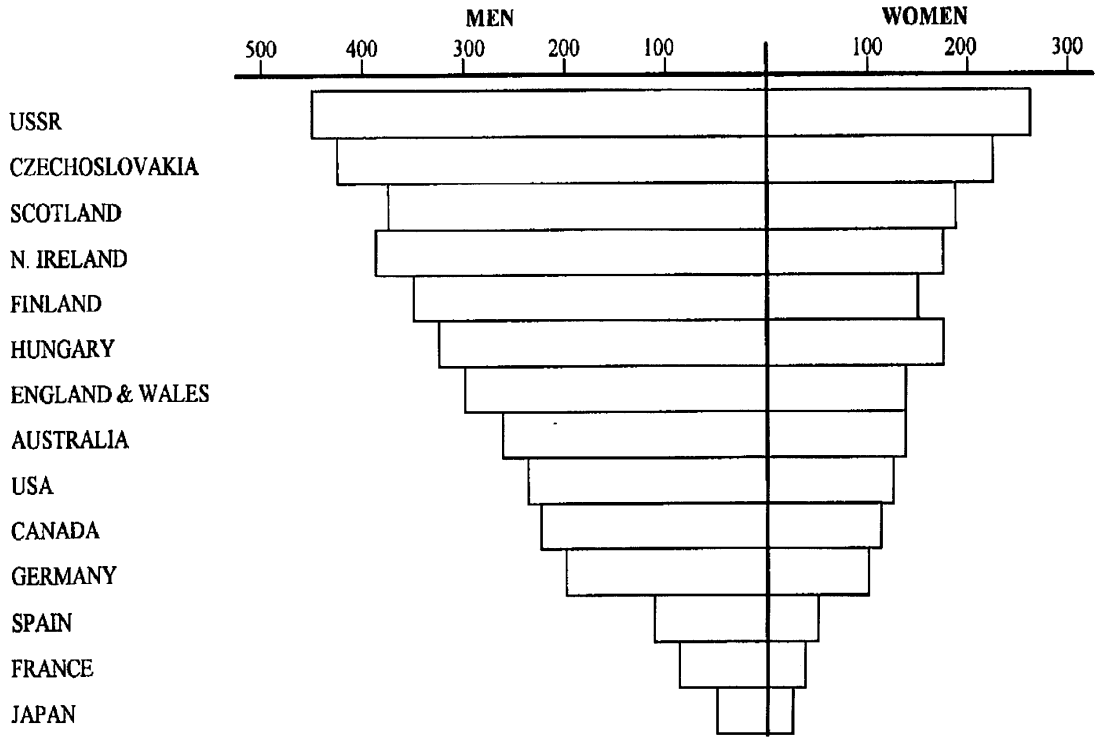
However, because most of the epidemiological studies include large numbers of patients, levels of diagnostic accuracy can be considered adequate to allow comparisons between groups.

The following section reviews differences between groups and over time based upon death rates and then estimates are given of the prevalence of disease based upon statistics obtained from hospital admissions and primary care services.

3.1 Mortality from CHD

Internationally **Scotland has among the highest death rates** from coronary heart disease in the world, being surpassed only by some Eastern European nations. **(Figure 1)**

Figure 1 **International Comparisons of Age Standardised Death Rates from Coronary Heart Disease Per 100,000 by Sex**



Source: From "Coronary Heart Disease in Scotland" - Health Policy & Public Health Directorate, SOHHD, 1995

Around **20,000 persons a year in Scotland die from cardiac disease** accounting for 34% and 30% of male and female deaths respectively in 1992. They were almost entirely due to CHD (89% and 82% respectively) with the other main cardiac diseases distributed as shown in **Table 1 (overleaf)**

Table 1 Deaths from Cardiac Disease by Sex and Type of Disease, Scotland 1996

Description	Number of Male	Female	All	% of all deaths
Chronic Rheumatic Heart Disease	28	126	154	0.8
Hypertension	119	162	281	1.5
Coronary Heart Disease	7888	6762	14650	80.7
Acute	5167	4449	9616	
Chronic	2721	2313	5034	
Pulmonary*	232	363	595	3.3
Other Forms of Heart Disease	956	1512	2468	13.6
Inflammation	15	30		
Other Valve	121	169		
Cardiomyopathy	95	37		
Rhythm Disorder	140	259		
*Heart Failure**	423	834		
Ill-defined	162	183		
All Heart Disease	9223	8925	18148	100.0

*Includes an element of coronary heart disease
Data Source: GRO Scotland ISU/LHB (Ref. F009_A)

3.1.1 Age & Gender Differences

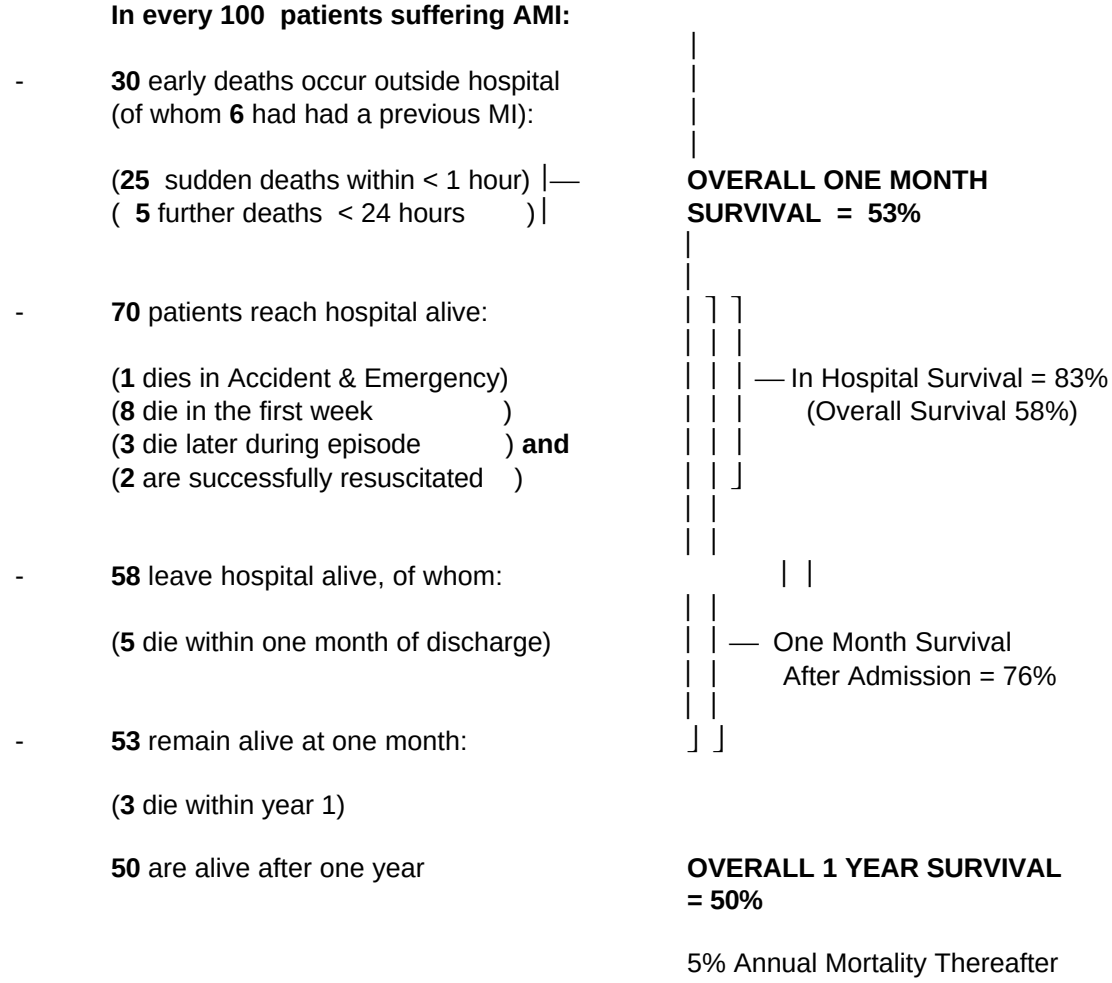
In 1996 CHD was responsible for 18,148 (30%) of the total 60,671 deaths in Scotland. **It was the most common single cause of death in both men and women** and is the major cause in Scotland of years of life lost prematurely[7].

The likelihood of CHD increases steadily with age **males tend to develop the disease around 10 years earlier than women**. While the sexes are converging in overall death rates for CHD, the men who die are much more likely than women to be young. Approximately one in four deaths of men with CHD occurred in those aged under 65 years compared with one in ten for women. Of all deaths under the age of 65 years in 1996, 27% in men and 17% in women were due to CHD.

It is very uncommon under the age of 45 years, except in countries with a high incidence such as Scotland.

The Glasgow MONICA***** study of the North Glasgow population aged under 65 years has shown that in 1990, **46% of M.I. deaths occurred before the person even reached hospital**. Furthermore, almost **one quarter (23%) of all deaths occur within 1 hour** of first symptoms and **60% are within 24 hours**. The Scottish position overall is shown in **Figure 2** which indicates that **50% of those having a heart attack die within a year** and most of these at the time of the attack.

Figure 2 Model of Proportionate Survival of Persons with a principal diagnosis of Acute Myocardial Infarction in Scotland within a year of diagnosed event (1988 - 91 : Provisional Figures for a total of some 58,000 AMIs)



Source: From "Coronary Heart Disease in Scotland" - Health Policy & Public Health Directorate, SOHHD, 1995

*** WHO Monitoring Cardiac Disease Project which is an international study monitoring 42 centres and has been investigating cardiac disease over a decade.**

3.1.2 Trends in mortality

CHD mortality in Scotland doubled from the early 1940s to the early 1970s and tripled in men under 65. However **since the mid 1970s CHD has declined generally**, falling by over 30% in men and 20% in women in the past 10 years in Scotland **(Figures 3 & 4).**

Figure 3 **Mortality Trends by Age and Sex - Age <65 years, Scotland, 1940 - 42 to 1990 - 92**

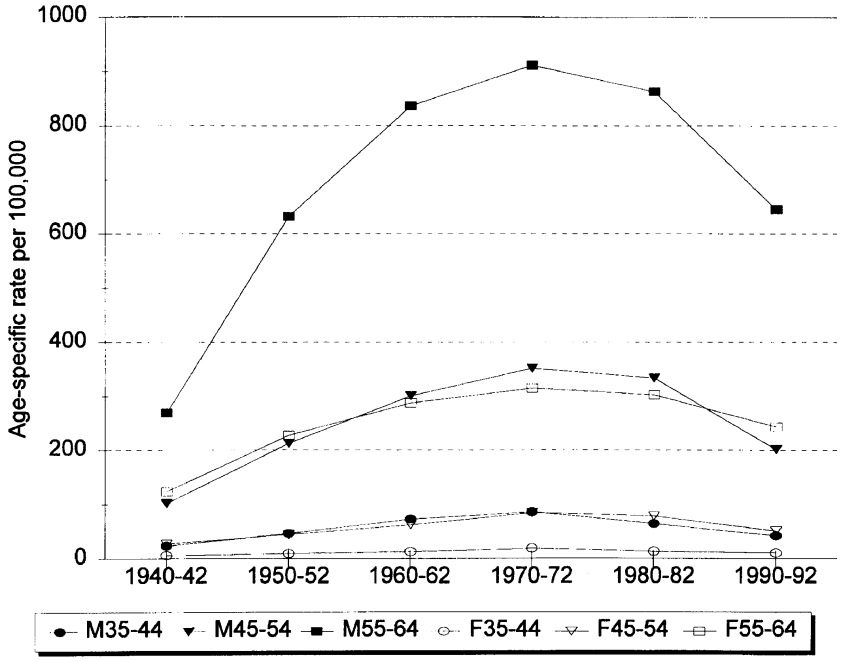
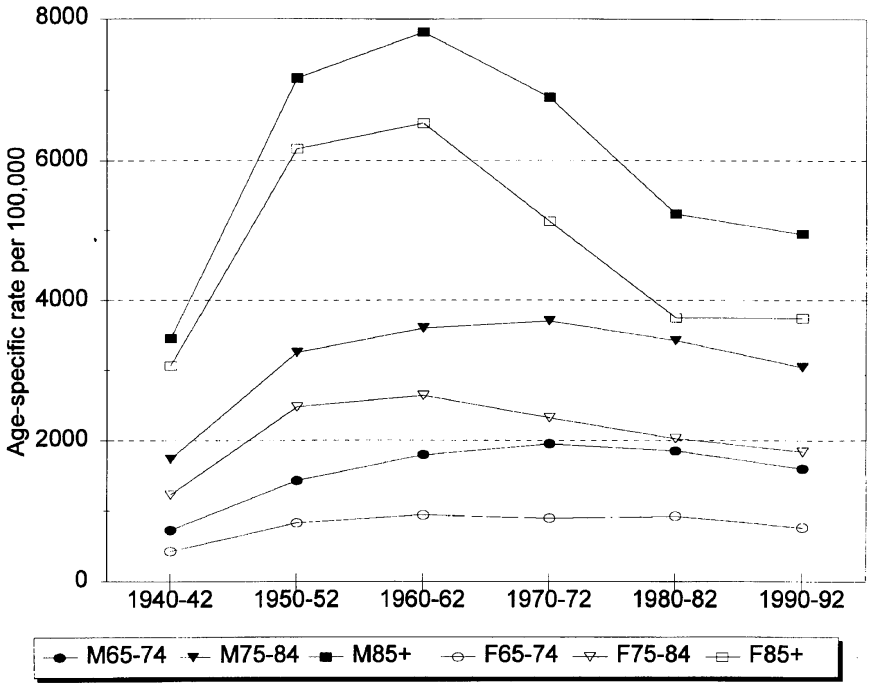


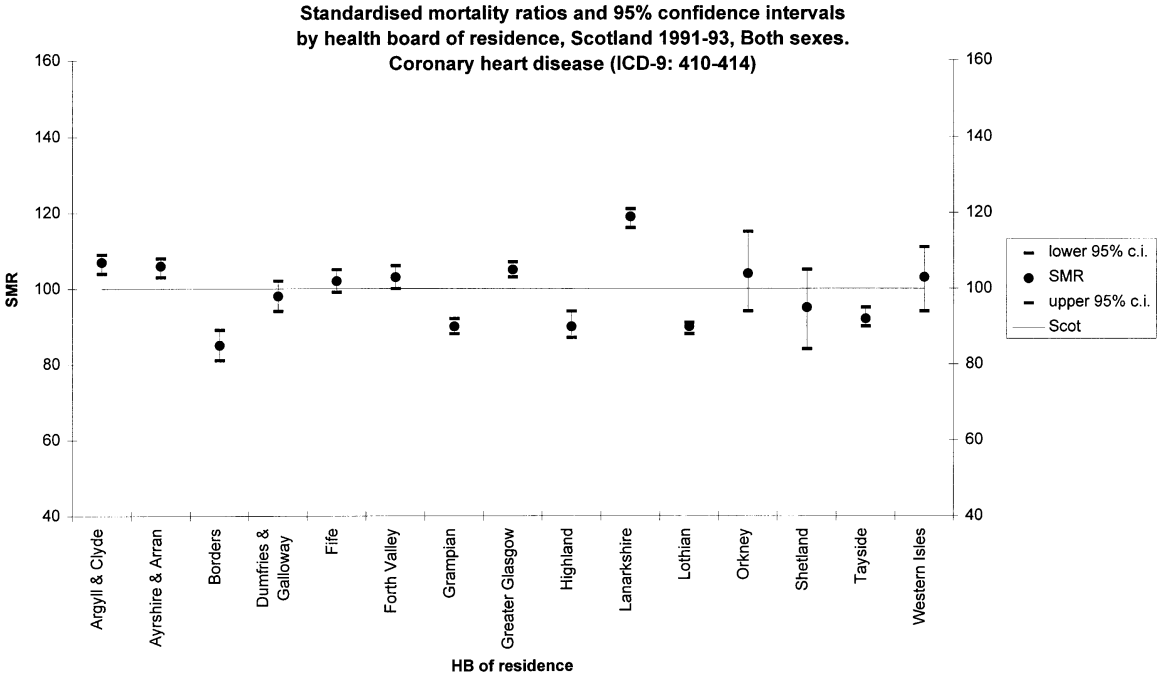
Figure 4 **Mortality Trends by Age and Sex - Age 65+, Scotland, 1940**



3.1.3 Geographical Differences in Scotland

The Scottish average CHD mortality masks substantial differences between Health Board populations. Deaths by Health Board of residence for 1988 to 1992 were examined. Except for Fife, there is an **apparent split between the East and West of Scotland** in CHD mortality. Lanarkshire Health Board has the highest standardised mortality ratio and Borders the lowest. **(Figure 5)**

Figure 5 Health Boards Standardised CHD Mortality (SMR* for ICD 410-414, Persons, 1991-1993)



* **The standardised mortality ratio is the ratio of deaths in the Board area in relation to that of Scotland overall (which is set at 100) and corrected for differences in the age and sex structure of the populations of Boards.**
(Source ISD of CSA)

3.1.4 Socio-economic differences

At the level of local authority district using the scores calculated by Carstairs and Morris[8], it is clear that living in an area of high **social deprivation is associated with higher mortality from CHD**. The correlation between deprivation and SMR for the period 1988-1992 was high at 0.68.

Both **men and women in deprived areas are more likely to experience heart disease** than those in the most affluent and are more likely to die from it when they do. The indication is that the differential **excess is greater for women than men** (50% compared with 40%) and that **the gap in incidence widened** between social groups by 10% between 1985 and 1991.[9]

3.2 Morbidity from Coronary Heart Disease

3.2.1 Coronary Heart Disease in the Community

Degenerative changes in coronary arteries are progressive throughout life but disease is only diagnosed once significant symptoms are experienced or myocardial damage is detected (whether or not it is symptomatic). Consequently, **there is a substantial amount of undiagnosed disease** in the community.

Various surveys throughout the United Kingdom and in Scotland[10,11] specifically have been undertaken, seeking to determine the extent of detectable pathological myocardial changes and relevant symptomatology. These provide estimates of **up to 30% of Scottish, middle aged and elderly men** having either symptomatic heart disease or changes in their electrocardiograms (ECG) indicative of heart disease. **Women experience an equivalent prevalence around ten years later than men.**

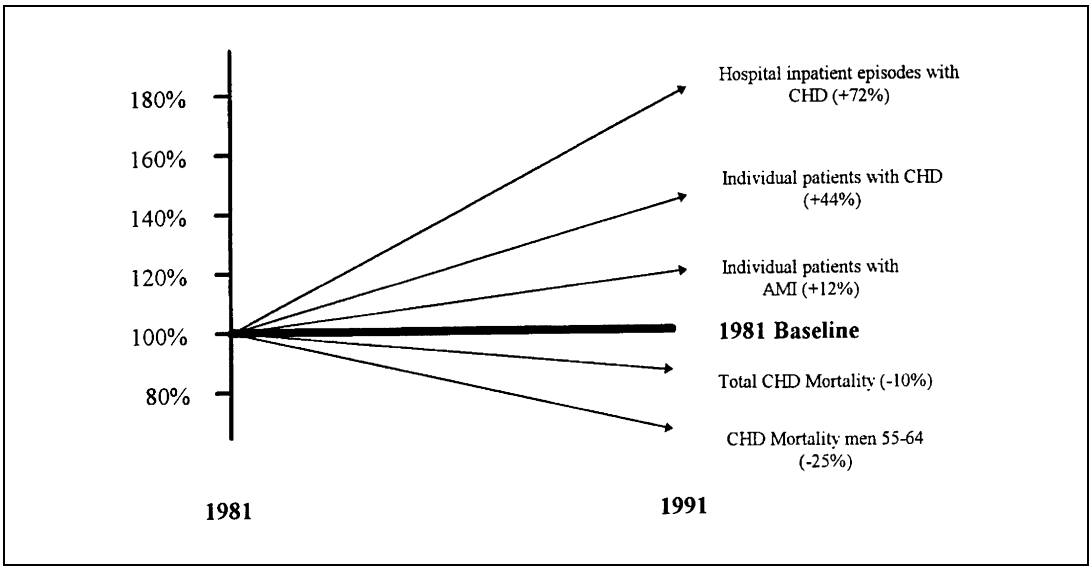
These findings indicate that around **500,000 Scots are afflicted by heart disease**, the majority being aged over 65 years. Of that 500,000, approximately **182,000 are being treated for CHD** in its various manifestations by their family doctors according to analyses obtained from the General Practitioners Administration Support System (G.PASS).

Variation in the overall morbidity from heart disease mirrors that of mortality between Board areas, with the highest levels being found in the West, particularly in areas of deprivation.

3.2.2 Coronary Heart Disease in the Hospital

Different levels of access to hospitals and referral practices have a perceptible impact upon discharge rates for heart disease and are likely to contribute to the variation observed between Boards in episodes of admission for heart disease. Analysis of the respective contributions each might make is a difficult exercise of doubtful value. Whatever they might be, **the inexorable trend is upward (Figure 6)**[12], so that by 1992 over **70,000 episodes of care were provided** for patients with coronary heart disease as their main diagnosis.

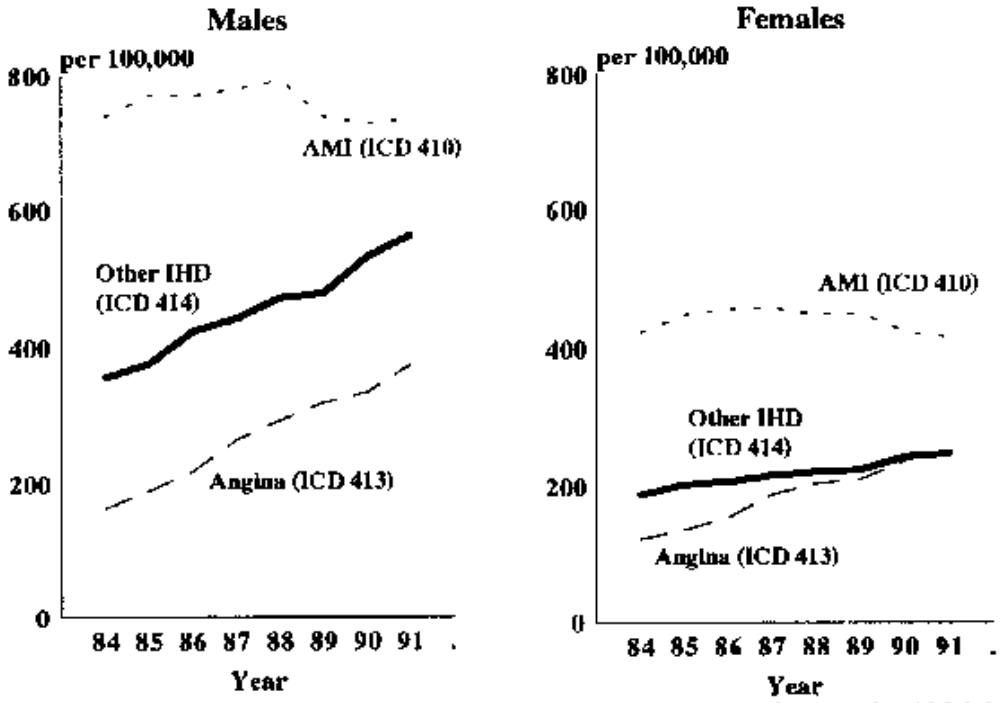
Figure 6 **Graph of percentage changes in Hospital activity and CHD mortality between 1981 and 1991 in Scotland**



Source: From "Coronary Heart Disease in Scotland" - Health Policy & Public Health Directorate, SOHHD, 1995

Within that increase differences are observable in that the rate of admission for **myocardial infarction appears to be falling slightly (though still the commonest single cause) and those for angina and other heart disease are rising (Figure 7).**

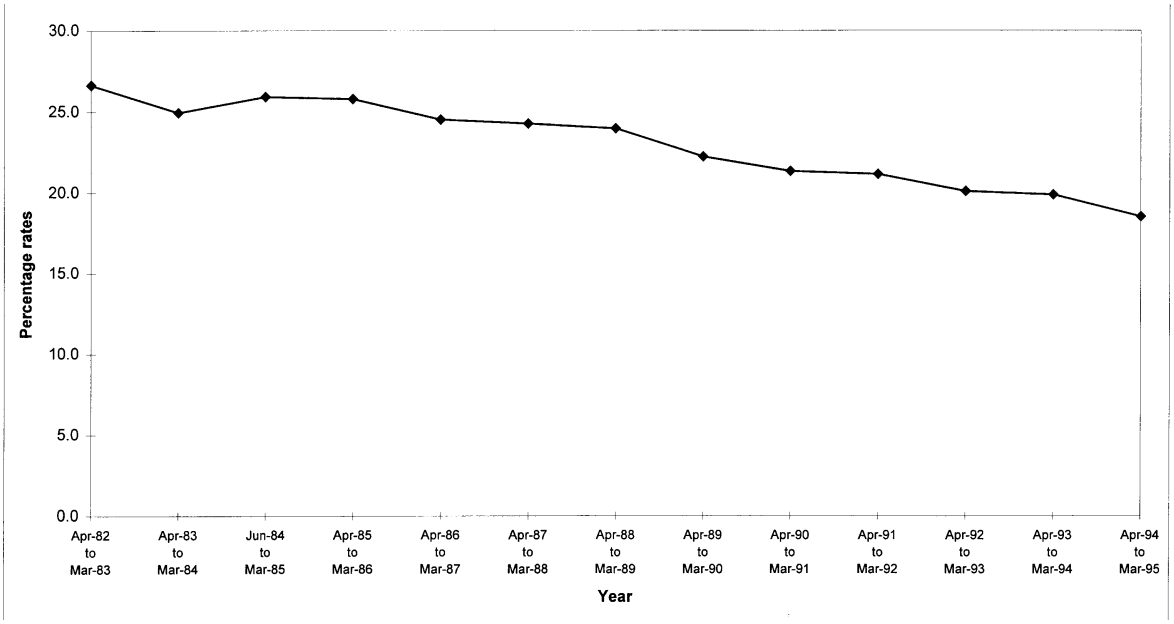
Figure 7 **Age Standardised Rates of patients admitted to Scottish Hospitals 1984 - 91**



Source:McGeechan, K., McLoone P., Boddy, A: 1994. Occasional Paper "Increasing hospital admissions for Ischaemic heart disease in Scotland : are more people being treated?", from the Public Health Research Unit

Improved survival of patients with myocardial infarction (Figure 8) and their subsequent re-admission is likely to have contributed to this overall increase.[13]

Figure 8 **Percentage of patients with AMI reaching Hospital and dying during admission or within one month of admission for the years 1982 to 1995 in Scotland**



Source: Information & Statistics Division of the NHS in Scotland Common Services Agency

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